The assessment of animal welfare in tropical livestock production: ethical and scientific issues

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Kurzfassung

Die Untersuchung zur Beurteilung von *animal welfare* in Nutztierhaltungen am tropischen und subtropischen Standort ist vor allem getragen von der Idee einer dualistischen Betrachtung, die beides, Aspekte der Ethik und der Naturwissenschaft, umfasst. Bereits in der einleitenden Frage, warum wir uns um Tiere kümmern sollen, wird dieser Dualismus deutlich sichtbar, denn die mentalen Fähigkeiten, die Tieren zuzusprechen ist, sollten den Umgang mit ihnen bestimmen. Der französische Philosoph und Mathematiker René Descartes beispielsweise erkannte im tierischen Organismus vor allem ein mechanistisches Prinzip und meinte deshalb, dass Tiere im Hinblick auf moralische Erwägungen keine Bedeutung haben und sie nach Belieben behandelt werden könnten. Dieser Auffassung widersprach der britische Utilitarist Jeremy Bentham energisch und forderte eine Gerechtigkeit für Tiere, da es egal sei, ob Tiere denken oder sprechen könnten, wichtig sei lediglich die Tatsache, dass sie leiden könnten.

Naturwissenschaftler haben eine Anzahl von Ideen entwickelt, um das Wohlbefinden von Nutztieren in ihren Haltungssystemen zu beurteilen und wissenschaftlich messbar zu machen. Wesentlich dabei ist, die subjektive emotionale Erfahrung des Tieres als einen wichtigen Bestandteil des Wohlbefindens zu erfassen, was jedoch erhebliche Schwierigkeiten bereitet. Den unterschiedlichen Denkmodellen zur Beurteilung des Wohlbefindens von Tieren sind verschiedene Messindikatoren, wie physiologische, ethologische, pathologische und Produktionsparameter, zugeordnet. In allen Denkmodellen und Messverfahren werden Limitationen sichtbar. Gleichzeitig hat sich ein ethischer Diskurs zum Tierschutz etabliert, der auf die Frage wie Tiere behandelt werden sollen gerichtet ist. Ansätze aus der Vergangenheit zeigen, dass in der Ableitung des moralischen Status' von Tieren ihr Fähigkeiten zu denken, Vernunft zu zeigen, Schmerz empfinden zu können, leiden zu können und auch ihr sprachliches Vermögen eine wichtige Rolle gespielt haben. Heute ist dominiert die Auffassung, dass Tiere in ethischer Hinsicht relevant sind wegen ihrer Interessen und ihres Bewusstseins zu Dingen, die um sie geschehen. In der fachlichen Diskussion hat sich weitgehend durchgesetzt, dass *animal welfare* keine Vorstellung ist, die nur naturwissenschaftlich zu erfassen ist. Ebenso gehört dazu die Erkenntnis, dass die naturwissenschaftliche Untersuchung nicht wertfrei ist. Aus den vorliegenden Ergebnissen muss die Verknüpfung der unterschiedlichen Betrachtungsebenen (Dualismus) als wesentlich betrachtet werden für eine positive Entwicklung des Tierschutzgedankens.

Vor dem Hintergrund dieser Erkenntnisse wird die weitgehend auf die westliche Welt beschränkte Diskussion zu animal welfare, in Bezug gesetzt zu den Besonderheiten der Nutztierhaltungen in tropischen und subtropischen Umwelten und Kulturen. Am Beispiel unterschiedlicher und repräsentativer Tierhaltungssyteme werden die besonderen agro-ökologischen, sozio-kulturellen und ökonomischen Voraussetzung der tropischen Tierhaltung dargestellt und prioritäre systembezogene Stressfaktoren in ihren Auswirkungen auf das Tier diskutiert. Diese umfassen Hunger, Durst, Thermoregulation, Krankheit, Schmerz, Nicht-Ausübung natürlichen Verhaltens und Angst. Die systembezogene Diskussion der Streßfaktoren verdeutlicht beachtliche Unterschiede bezüglich der Vermeidungsmöglichkeiten durch die Tierhalter und der damit verbundenen Verantwortlichkeit für Beeinträchtigungen des tierischen Wohlbefindens. Die Betrachtung der Tierethik in unterschiedlichen Kulturen zeigt, dass der Umgang mit dem Tier beachtlichen Unterschieden in Handlungsnormen unterliegt, die in das jeweilige Weltbild der betrachteten geographischen Region eingebettet sind. Auch rituelle Handlungen an Tieren können einerseits von der Sorge um das Wohl der Nutztierherde und andererseits besonders bei rituellen Schlachtungen von der Schuld am Tod des Tieres geprägt sein - eine Position die in modernen Kulturen verloren gegangen ist. In diesem Zusammenhang stellt sich klar die Frage nach der Relativität ethischer Normen. Die Untersuchung des Spielraums für Veränderungen macht deutlich, dass innovative Neuerun-

gen den technischen Bereich und moralische Normen betreffend vor dem Hintergrund der bestehenden ökologischen, ökonomischen und kultur-religiösen Rahmenbedingungen zu sehen sind. Moralische Forderungen im Sinne des Tierschutzes sind besonders bei geringer menschlicher Beeinflussung oder der vorherrschenden ethischen Maxime nicht umsetzbar im Sinne des europäischen Verständnisses.

Die vorangestellte Analyse der gegenwärtigen Tierschutzdiskussion kommt zu dem Ergebnis, dass eine Vielzahl verschiedener Ideen und Ansätze für die Beurteilung von *animal welfare* vorliegt, was die Komplexität des Begriffs hervorhebt. Gleichzeitig wird deutlich, dass der traditionelle epistemologische Ansatz der Naturwissenschaft, der im Positivismus begründet liegt, für die Untersuchung von Phänomenen unzureichend ist, die stark von mentalen Zuständen geprägt sind und nicht allein auf Fakten beruhen. Es wird deutlich, dass die traditionelle naturwissenschaftliche Methodik hier auf ihre Grenzen stößt, woraus sich die Forderung nach einem holistischeren epistemologischen Ansatz ableitet.

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Preface

The human-animal relationship was a matter of concern in the past time and again. In the 1960s renewed social interest in animal welfare arose, when industrialized livestock agriculture made an entrance in Europe. Modern animal production systems were blamed to reduce the well-being of farm animals, though they were proved to be economically efficient. This retrospective view shows the ambivalence of the discussion. At the same time it challenges the scientific reflection on and the development of conceptual frames for the assessment of the welfare of farm animals. In this study such theoretical/conceptual considerations will be continued. Emphasis is placed on the dualism science – ethics, which highlights the necessity of a discussion of values.

Although the concern for farm animals has global relevance, at present its scientific interest is rather limited to industrialized countries in the Western world. However, in view of (increasing) activities to incorporate animal welfare concerns in international trade agreements, the issue of animal welfare is given more and more importance in agrarian countries, too. It is doubted that an unsophisticated adoption of norms in agrarian communities in other regions of the world is appropriate, because animal ethics and technical standards in the West may sharply be in contrast with the conditions elsewhere. Thus, information is required about the human attitude towards farm animals and livestock environments from different perspectives in order to possibly meet the concerns of every society.

From the point of view of technical collaboration policy the approach underlying this study consciously will not provide recommendations for conduct or the use of new technologies. It is rather based on the idea to offer information about basic features of the human-animal relationship in different cultures and empirical data about animal awareness and the state of well-being in animals. Providing facts, figures and interrelations may have an impact on local discussions, the decision-making process of those affected. In this regard, the study is intended to result in a culturally adequate and self-determined resolution of problems.

Animal production systems in the tropics often greatly differ from those in the temperate zone. Major constraints of tropical livestock husbandry are the impact of agro-ecological conditions (e.g. seasonal availability of fodder, water scarcity, contagious diseases and parasites) and limited modification of natural conditions through improved production systems. As a rule, smallholdings are prevalent where farmers permit their animals to range free or to scavenge, although large-scale animal units are increasingly established. Thus, this analysis places emphasis on the specific environmental and economic situation inherent to tropical livestock production.

In consequence of the socio-economic demand for animal welfare, scientific studies on the assessment of the well-being of animals have increasingly been carried out. It is widely accepted that the assessment of animal welfare implies both moral standards and scientific concepts. When considering tropical livestock production, the particularities of the natural environment and cultural influences are to be involved. Thus, a concept for the assessment of animal welfare in tropical livestock production must necessarily be grounded at a very basic level, namely, at epistemology or scientific theory.

Against this background, the striving for a suitable method for the assessment of animal welfare - a theme that is traditionally embedded in science – must result in the insight that the methodological approaches commonly used are not entirely satisfactory to generate meaningful statements about the well-being of farm animals. Hence, a more appropriate conceptualization on an epistemological level is to be developed, which can integrate the variety of

influencing factors deriving from ethics, science and the specific natural and cultural features of tropical livestock agriculture.

Research topics cannot be chosen from the point of view what is measurable by the available scientific tools, which in general rely on quantitative traits. In agricultural and biological research increasingly research questions emerge (e.g. the issue of animal welfare) that include qualitative traits as well and cannot be answered by the regular instruments provided by science. Since it becomes more and more apparent that present-day research questions, particularly those related to life or living things, cannot be resolved adequately with an epistemological approach that is solely based on mathematics, new paths have to be followed.

Similarly to the turn of the world-view in the 17th century induced by the findings of such important figures as Copernicus, Kepler, Newton and Descartes who prepared the ground for Cartesian science, it may be predicted that in the near future the principal view in terms of the study of natural phenomena will change again. An era in which the diversity of nature will be not ignored and limited to chemical composition and matter, but will be perceived and investigated with multifaceted reflection. In this context, the assessment of animal welfare has an important role to play not only within the boundaries of the disciplines of agrarian science, veterinary science or biology but also for science in general.

A concept of animal welfare, which includes scientific as well as ethical issues, is believed to exceed the borders of the subject and is also relevant for novel technical developments, for example, in biotechnology or nanotechnology. The rapid progressing of technologies requires taking into account ethical aspects in order to make novel techniques acceptable and open to experience for human beings or to reject it. Indeed, ethical questions are going to receive an increasing importance in science, especially in life science. Therefore, the study is also intended to give impulses for and to encourage the involvement of ethical issues in other technical disciplines and to affect technological innovations.

At the very beginning of this study the question will be raised: Why should we care about animals? The first chapter will briefly explain the moral status of animals and their mental capacities. It analyses how the possession of mind, the capability to feel or having interests and awareness have an impact on the animal being an object of moral concern or how people think animals should be treated. At the same time these ideas about the animal's mental-emotional potential and its moral relevance wonderfully expound the relation between ethics and science being a key element of the thesis.

In the second chapter, the present-day debate about animal welfare led in Europe and America will be illuminated. Major components of the discussion are the scientific assessment of animal welfare including definitions, concepts and measures as well as ethical approaches for the treatment of animals. The scientific study of the well-being of animals is inextricably connected with *the five freedoms*, which provide minimum standards for the welfare of farm animals. In addition, a number of concepts addressing aspects, such as suffering, health, stress, coping, animal needs and feelings have been developed in order to create a theoretical framework for the scientific measurement of animal welfare. Although a variety of measurable criteria have been attributed to these concepts, such as behaviour, neuroendocrinology, productivity, preferences etc., the results have remained unsatisfactory due to the subjective connotation of welfare. In general a combination of measures is recommended. Alike, in Western moral philosophy over the centuries many ideas have arisen about how animals ought to be treated. Early Judaeo-Christian notions claimed human dominion over animals, although recent interpretations differ from this view. In the modern age the French philosopher René Descartes drew the picture of *animal machines* and denied that animals are morally pertinent. Since animals lack rationality, Kantian theory poses that animals are not themselves objects of moral concern. Humans have only indirect duties to animals, because brutality to animals would incline human beings to be cruel to each other. On the other hand, the

18th century utilitarian Jeremy Bentham attributed unqualified moral relevance to animals owing to their ability to suffer and Arthur Schopenhauer in his *Mitleidsmoral* made compassion a criterion for the ethical significance of animals. Influential contemporary concepts have been developed by Peter Singer and Tom Regan. While Singer has aimed at the equal consideration of human and animal interests, Regan has formulated the animal rights view, which was vigorously debated. Finally, this analysis will draw attention to the point that the concept of animal welfare is a dualistic one incorporating both ethical and scientific elements. Thus, dealing with farm animals or conducting an animal experiment always involves values and moral questions.

In the third chapter animal welfare concerns in tropical livestock production will be discussed. After a brief introduction to animal production systems in the tropics, exemplary systems will be selected for the subsequent analysis and animal welfare-related issues be identified. The following situations will be portrayed:

1. Fulbe pastoralism in northern Nigeria
2. The llama and alpaca breeding system in the Andean highland
3. Draught oxen in the smallholder crop-livestock system in India
4. Large-scale commercial swine and poultry production in Thailand

In a subsection of the third chapter, stress factors affecting animal welfare in tropical environments will be considered from a scientific perspective. This analysis will be directed to the problems of hunger and thirst, thermal stress, effects of disease, the impact of pain, behavioural deprivation and fear in animals. Hunger will be discussed in terms of animal metabolism and feed intake control with reference to animal welfare under pastoral conditions. Alike, thirst physiology and psychological effects of thirst will be related to the well-being of animals. Thermal stress will be regarded with respect to thermoregulatory response and control and its measurement. Furthermore, within the Andean pastoral system disease processes will be illuminated in relation to animal welfare. Effects of pain can be measured by behavioural changes, neuro-endocrine responses and by cerebro-cortical activity. In this context, functional magnetic resonance imaging (fMRI) technique will be introduced as a promising tool to assess subjective experiences in individuals. Behavioural parameters have an immense importance for the assessment of animal welfare. In this study the normal and abnormal behaviour of pigs and its effects on their well-being will be delineated. Finally, the impact and assessment of fear in poultry will be examined under intensive production. Additionally, in the third subsection of this chapter it will be referred to animal ethics in a global context or which elements constitute the moral status of animals in different cultures. The ethical reflection will aim at *cattle values* and Muslim morality in the Fulbe pastoral system and engages in a discussion about the cattle complex and animal protection in the Qu'ran and the Schari'a. Secondly, the religious ethic in the Andes will illuminate Andean cosmology, moral codes for the treatment of llama and alpaca and ritual ceremonies. Then, the traditional Indian ethic with respect to the treatment of cattle will be discussed focusing on the principles of *karma*, *dharma* and *ahimsa*. The last point is concerned with Buddhist ethics in Thailand, which primarily addresses the notions of reincarnation and *dukkha* and aspects of non-injury and compassion. Finally, essential features of the moral treatment of farm animals will be summarized emphasizing on moral concern for and duties to animals as well as the killing of animals for food and for ritual ceremonies. The third chapter will be concluded by a reflection on the scope for changes in the different exemplary situations.

Chapter four will provide a prospect for the assessment of animal welfare involving a critical reflection on methodological traditions in science and novel aspects of animal welfare assessment, such as functional magnetic resonance imaging (fMRI), a model to assess subjective states in animals and epistemology in different cultures.

0 Introduction

During the last few decades animal welfare has aroused considerable public interest. In Europe first concern arose in the 1960s, when livestock farmers gradually intensified their husbandry systems and adopted mass production. These technological innovations induced detrimental effects: high producing farm animals increasingly showed health problems including metabolic disorders, system-related injuries and performance of abnormal behaviour as well as reduced life spans. Thus, intensive animal production was blamed to be inadequate to sustain the well-being of farm animals. Recently, the societal debate has brought about a reform of the animal welfare legislation in the European Union.

The widespread public concern for intensively housed farm animals has challenged livestock agriculture to raise their animals under more favourable conditions. For the implementation of these claims it was essential to engage in elaborate scientific reflection on the issue of animal well-being and the formulation of research strategies. Although a variety of scientific approaches for the assessment of animal welfare have been developed yet, there is an ongoing debate about this complex subject. A main constraint in this regard is the fact that the welfare of farm animals involves subjective affective states that are not amenable to traditional scientific methodology. As a consequence, the application of established research tools cannot generate entirely satisfactory results.

Additional questions are posed, because recently initiatives have been made to incorporate animal welfare concerns into international trade agreements. In fact, in a global world with multifaceted trade relations, animal welfare can be expected to attain world-wide importance. However, the interests of animal agriculture in agrarian countries in the South may be severely impaired by the acceptance of regulations that have been developed in industrial countries. Various cultures possess their particular attitudes towards and symbolic meanings of animals. It is doubtful whether the unsophisticated adoption of ethical and technical norms that are implied in international trade agreements is appropriate, because the Western view of things may sharply be in contrast with the people's view in Southern agrarian communities.

Thus, information is required about the human attitude towards farm animals from different perspectives in order to possibly meet the concerns of every society. Until now very little is discussed about own concepts of animal welfare in societies of the Southern hemisphere and the fitting of Western technical standards into tropical settings. The objective of this study therefore is to place the present debate about animal welfare in an international context and attempting to develop a dialogue between the cultures and disciplines. This is intended to be accomplished by three sub-goals:

1. reviewing of recent developments in the animal welfare debate and pointing out inconsistencies and gaps

2. developing a broader perspective on animal welfare concerns with special reference to tropical livestock husbandry

3. outlining of new approaches for the assessment of animal welfare in relation to a wider concept of animal welfare

1 Why should we care about animals? - The moral status of animals and their mental capacities

When studying animal welfare first of all the question arises: why are we concerned about animals? In the recent discussion about the issue contrary positions have evolved. While some social groups advocate caring for animals without qualification, others deny moral worth of animals and may approve the use of animals for any human end. Open queries are addressed to the animals' moral status and their mental capacities. Are animals' objects of moral concern? Which, if any, among the apparent dissimilarities between humans and animals are morally relevant? What is clear, however, is that the mental-cognitive capacities we credit to animals, be it thinking, feeling or having interests, "have a great deal to do with how we think animals should be treated" (DeGrazia 1996, p. 1). It is further important to know: which human duties, if any, arise from the animal's moral status? In order to receive deeper insight into this complex subject, a brief introductory examination of the animals' nature and their moral status, if any, is provided.

1.1 The moral relevance of animal minds

Although it is generally accepted that animals possess minds, there is little consensus about the extent of their cognitive processes and about the moral importance of the mental activity of animals. Looking back at history the 17th century philosopher René Descartes denied that animals have mental capacities. In Descartes' view animals cannot think (e.g. Orlans *et al*. 1998, pp. 8-9; Dolan 1999, pp. 126, 152), he regarded them as machines who "act naturally and mechanically, like a clock" (Descartes 1989 cited by Orlans *et al*. 1998, p. 9). As a result, Descartes held that humans have no moral duties to animals and can treat them as they like (Orlans *et al*. 1998, p. 9). Though, Guerrini (2002, p. 58) pointed out that it was the first time that mechanics and clockworks attracted the attention of the public, when Descartes ideas have arisen.

According to Immanuel Kant, who lived a century later than Descartes, "animals do not lack minds, but they do lack reason". Animals do not fall within the scope of moral concern, because they are incapable of rationality (Rollin 1981, p. 19; Wolf 1990, p. 33; Orlans *et al*. 1998, p. 9). Rollin (1981, pp. 19, 22) deduced from his work *critique of pure reason* that Kant ties reason to the possession of speech and denied that animals have the capacity to speak. For Kant language is necessary to understand and articulate universal judgements – a prerequisite of rationality. Since animals do lack language and only respond to stimuli, they cannot be rational.

Kant's moral theory (Categorical Imperative) considered human beings as "ends in themselves". He claimed: "So act that you treat any human being, whether yourself or any other, always as an end and never merely as a means" (Kant 1948, p. 429 cited by Rollin 1981, p. 17). In contrast, for Kant animals are mere human's instruments: "Animals are ... merely as means to an end. That end is man" (Kant 1963, p. 239 cited by Rollin 1981, p. 19 and Orlans *et al*. 1998, p. 25). According to Kant human-beings have no direct obligations to animals. However, although animals not themselves deserve moral consideration, it is not morally justifiable to treat animals in any way. Kant's ethic prohibits unnecessary cruelty to animals, because it predisposes humans to be cruel to each other (Rollin 1981, p. 9; Orlans *et al*. 1998, p. 26).

In the 19th century the scientist Charles Darwin developed his theory of evolution, which implies that animals and humans in both physical constitution and mental ability have evolved from common ancestors (Davis and Cheeke 1998, p. 2072; Orlans *et al*. 1998, pp. 12-13). Darwin in his work *the descent of man* alleged that "[a]nimal minds differ from human minds only in degree, not in kind" (Rachels 1990 cited by Davis and Cheeke 1998, p. 2072). In contrast to Descartes and Kant, who emphasized the dissimilarities between humans and animals in language and reason, Darwin believed that there is empirical evidence that animals possess properties like, thought, memory and decision making. For Darwin animals too have emotions, such as sympathy for members of their social group. He maintained that all human properties be it physical, mental or in terms of reason have developed in the evolutionary process and also emerge elsewhere in nature (Orlans *et al*. 1998, pp. 12-15).

Davis and Cheeke (1998, p. 2072) pointed out that at present Darwin's theory of evolution is widely accepted in society, insofar that physical aspects are concerned. However, they have doubt whether this is also true for mental aspects. Do people really agree with the notion that animals have mental capacities very similar to humans with its implicit consequences for the moral status of animals? Allen (1998, pp. 42-43) emphasized the importance of studying cognition in animals, which he defined as "the synthesis of information from diverse sensory and memory sources to produce appropriate responses", because notions about mental and cognitive states and awareness in animals have an impact on how people treat animals.

1.2 Pain, pleasure and moral concern for animals

The utilitarian Jeremy Bentham (1748-1832) offered an influential ethical concept for the protection of animals, which is based on the animals' capacity to feel pain and pleasure. In his writing *introduction to the principles of morals and legislation* he argued that animals ought to be protected by law and expressed his moral principle in the well-known passage (Sandoe *et al*. 1997, p. 4; Orlans *et al*. 1998, pp. 22-23): "The question is not, Can they reason? Nor, Can they talk? But, Can they suffer?" (Bentham 1789, p. 283 cited by Sandoe *et al*. 1997, p. 4). Thus, for Bentham the ability to suffer is the decisive factor that makes them fall into the sphere of moral concern (Rollin 1981, p. 29; Orlans *et al*. 1998, pp. 22-23). It is further important to note that lack of reason and language did not for Bentham imply a lack of moral relevance. According to Bentham's morality humans "have moral obligations to animals not to cause them pain and suffering, and these duties are independent of any duties we may have to the owners of the animals" (Orlans *et al*. 1998, pp. 22-23).

The school of behaviourism about a century ago and logical positivism in the mid-twentieth century denied thinking and feeling in animals and excluded emotional states from scientific inquiry (Rollin 1987 cited by Benson 2004, p. 62). Orlans *et al*. (1998, p. 19) maintained that the study of animal emotions has long been avoided, since subjective states have been criticized as not amenable to scientific measurement and distorted by anthropomorphism. Though, the ethologists Konrad Lorenz and Niko Tinbergen were occupied to apply the Darwinian evolutionary continuity in animals including humans to behavioural patterns (Allen 1998, p. 43). According to van Rooijen (1997, pp. 115-116) for Lorenz (1963) the supposition that other human beings experience emotional states similar to oneself "is a genuine a priori necessity of thought" or even an axiom. In the light of this assumption Lorenz (1980) maintained that looking at some photographs of hens in battery cages is sufficient to recognize that these animals suffer.

According to Bermond (2001, p. 51) pain is an emotion not a sensorial experience as often erroneously believed. This is evident from the observation that "all sensorial experiences, except pain, can be induced by electrical stimulation of sensorial cortex (Libet 1982 cited by Bermond 2001, p. 51). Bermond (p. 52) further explained that suffering, unlike pain, involves reflection, imagination and understanding of past and future. Rollin (1981, p. 31) reported

that in an experiment pain-alleviating substances, namely, beta-endorphins and enkephalins have been detected in earthworms. The occurrence of these analgesic substances in "lower" animals is an indication that they feel pain.

Similarity of animal and human anatomy and neurophysiologic processes involved in pain perception (Bonica 1990 cited by Benson 2004, pp. 62-63), the animals learning of avoidance behaviour, crying in response to pain and displaying of signs of distress are in favour of the argument that animals consciously experience pain (Benson 2004, p. 63). However, Fraser and Duncan (1998, pp. 383-384) alleged that animals are not supposed to experience only negative affective states, such as pain, fear or thirst but also positive states or pleasures, such as exploring or playing. Bentham (1823) cited by Fraser and Duncan (1998, p. 384) maintained that animals experience pleasure, when they gratify hunger, thirst, sexual desire or curiosity.

1.3 The ethical significance of animal interests and consciousness

According to Bernard Rollin's contemporary philosophy (1981, p. 35) it is the presence of interests including needs and desires what makes an animal fall within the sphere of moral concern. *Interest* indicates that it matters to the animal, if certain needs are not satisfied. Therefore, having interests suggests some sort of conscious awareness. Rollin claimed that

[…] rationality and the ability to suffer are not in themselves what make the creatures who have them fall within the scope of moral concern – it is rather the fact that rationality and the feeling of pleasure and pain are interests for those beings that can be helped or hindered by those of us who act.

Tannenbaum (1995, p. 125) maintained that self-awareness allows animals to anticipate in the experience of pleasure or pain. Animals can feel further pleasure by anticipating in the experience of pleasure or feel fear at the prospect that harm will be inflicted on them. "Self-awareness is also related to autonomy, the capacity to decide on one's own that one will make decisions and long-term plans and to work to put these decisions into effect". According to Rollin (1981, p. 41) there are several empirical sources that strongly suggest that animals possess awareness: Firstly, it can be deduced from the argument of analogy that the neural systems in animals and humans function similar, because these systems are homolog. Secondly, biochemical pathways guiding the secretion and feedback control of hormones are similar in animals and humans. Thirdly, it is evident from their behaviour that animals experience conscious states. For example, the animal's avoidance of a painful stimulus that also harms humans supports the premise of animal consciousness.

Evidence of consciousness is provided by the flexibility with which many animals adapt their behaviour to changing environments (Griffin 2001, pp. 12-13). Wemelsfelder (1993) cited by Meijsing (1997, p. 58) reported that Zebra's place themselves in a position so that their own shadow as extension of their body protects their young from the sun. According to Griffin (2001, pp. 12-13) also communicative behaviour in animals supposes that they consciousness is involved in thinking and feeling. A signal of a dominant animal that intends to attack a subordinate animal can result in various responses. Thus, the communication between predators and prey supports the view that conscious thoughts are very likely in animals. Douglas-Hamilton and Douglas-Hamilton (1975) cited by Tannenbaum (1995, p. 125) observed elaborate grieving behaviours in elephants, when other herd members died. Tannenbaum (1995, p. 125) maintained that this behaviour suggests some extent of self-consciousness. Therefore, empirical study in animal neuro-anatomy, neuro-physiology and behaviour give much credibility to the view that animals are not only capable of thinking and feeling, but are also conscious about it.

According to Vorstenbosch (1997, p. 32) it is a widely held argument that this evidence accounts for the view that at least vertebrates are conscious beings and, therefore, deserve moral consideration. Kirkwood and Hubrecht (2001, p. 7) alleged that “endeavours for animal welfare rest on the belief that the animals whose welfare we are concerned about have the capacity for consciousness”. Making decisions in animals, as described, reflects the possession of interests and the conscious reflection about their situation. Although presently the majority of people believe that animals are objects of moral concern, there is little agreement in terms of the weighing of animal and human interests. In general, human interests are given greater weight than animal interests (Tannenbaum 1995, p. 127). In this context, DeGrazia (1996, pp. 258-274) provided some guiding principles about how animals ought to be treated including *inter alia*:

(1) Not to cause animals’ unnecessary harm and suffering, because animals possess interests and it matters to them, if their interests are thwarted.
(2) To provide for the animal’s basic physical and psychological needs, as a consequence of the human-animal relationship.
(3) Not to confine sentient animals unnecessarily, because freedom is essential to sentient animals to live a harmonious life according to their nature.
(4) Not to kill animals unnecessarily, since sentient beings are being harmed by death.

2 The current animal welfare debate

Studies of animal welfare were initiated to identify the specific strains of farm in intensive environments, which are unacceptable both in biological and ethical terms. Research has been carried out in this respect in form of scientific experiments and philosophical reflections. While animal welfare science is concerned with the empirical study of natural phenomena related to animal biology, animal ethics is "the study of arguments about what things are good and bad, and which actions are right and wrong, in the use of animals for food and fibre" (Comstock 2000, p. 103). The widespread concern for farm animals has evoked new moral theories about their treatment. Additionally, „there has been a growing effort to develop rigorous and clearly interpretable scientific criteria for assessing animal welfare" (Mench 1993, p. 68). The objective of this chapter is to provide a comprehensive analytic review of the previous work on animal welfare. Information will be given about the scientific inquiry on farm animals' well-being, on the one hand, and ethical considerations about the treatment of animals, on the other hand.

2.1 The scientific study of animal welfare: definitions, concepts and assessment

A major difficulty the study of animal welfare is being faced with is the huge variety of definitions and concepts that have evolved in relation to *animal welfare*. The way of defining *animal welfare* is clearly interconnected with the type of measures applied to assess animal welfare (Mason and Mendl 1993, p. 302). In this section the diversity of definitions, concepts and measures of *animal welfare* and their interconnectedness will be analysed.

2.1.1 Attempts to „define" animal welfare

Initial point of every scientific work is a precise definition of the study object, which describes its scope and delimits it towards related objects. Technical terms are generally defined by a short phrase or even by a formula. Gravity, for example, denotes the property of masses to attract each other and is described in Newton's law of gravity. When entering the field of biology and agrarian science and attempting to define phenomena of life, one may recognize that, for example, emotional states are not amenable to brief and mathematical description. Similar difficulties arise in the terminology of *welfare*. Thus, many attempts have been made to "define" animal welfare.

2.1.1.1 The literal meaning of "welfare"

From an etymological point of view *welfare* is defined as a "condition of being or doing well". It is developed from Old English *wel faran*, which consists of *wel* well (adverb) and *faran* get along, fare (verb) (Figure 2.1). A corresponding formation is found in Middle High German *wolvarn* (The Barnhart Dictionary of Etymology). According to The Oxford Dictionary of English Etymology the German word *Wohlfahrt* from Middle High German wol varn means "live happily". This dictionary assigns to welfare good fortune, well-being. "The modern sense of social concern or provision for the well-being of children, unemployed workers, etc., is first

recorded in 1904, originally in such phrases as welfare work, welfare committee, welfare policy" (The Barnhart Dictionary of Etymology).

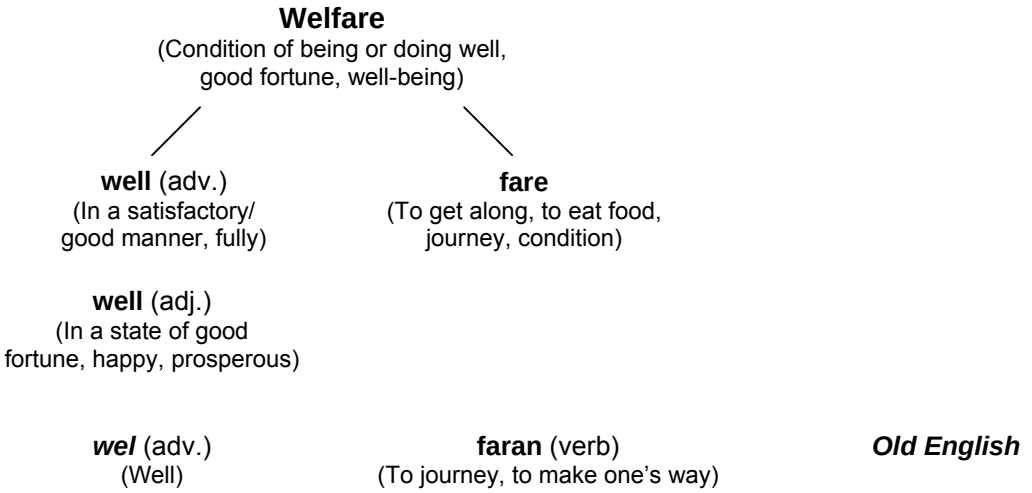
The evident divergence in the meanings "being or doing well" and "good fortune" requires a more detailed analysis. The term *welfare* comprises the syllables *well* (adverb) and *fare* (verb). Well in the adverbial form (as in everything is going well) means in a satisfactory manner, satisfactory. "The Old English *wel* is cognate with Old Frisian, Old Saxon, Middle Dutch, and modern Dutch *wel* well, Old High German *wela*, *wola* (modern German wohl)" (The Barnhart Dictionary of Etymology). In The Oxford Dictionary of English Etymology *wel* is defined as in a good manner, to a good extent, fully.

Since many uses of the adjective may be classified as adverbs (The Barnhart Dictionary of Etymology), the adjective well is also important to interpret welfare. The adjective well, Old English wel, (as in all was not well) means in a state of good fortune, welfare, or happiness. Additionally, the meaning of in good health is recorded (The Barnhart Dictionary of Etymology). The Oxford Dictionary of English Etymology provides the meanings happy, fortunate, prosperous, and in sound health for the adjectival form of well. Interestingly, the meaning of the adjective "well" shows parallels to the assignment of the meaning "good fortune" in the term "welfare" given by the Oxford Dictionary of English Etymology. This may explain the different denotations "being or doing well" and "good fortune".

The verb *fare* in the second syllable of welfare means to get along, to eat food. It is developed from Old English *faran* to journey, to make one's way. It is cognate with Old Saxon, Old High German, and Gothic *faran* to journey (The Barnhart Dictionary of Etymology). According to The Oxford Dictionary of English Etymology *fare* denotes journey, passage money, passenger, procedure, condition, and (supply of) food. Putting the syllables *wel* and *faran* together the result could in colloquial words be interpreted as: To travel through the world happily or to live a satisfactory life.

In The Oxford Universal Dictionary Illustrated both of the meanings of welfare mentioned above appear. This dictionary assigns a state of being or doing well, good fortune, happiness, or well-being (of a person, community, or thing), and prosperity to the word welfare. The Chambers Encyclopaedic English Dictionary introduces the term health: Welfare denotes the health, comfort and happiness, and general wellbeing of a person, group, etc. as well as social work and financial support for those in need.

Figure 2.1 The literal meaning of welfare



In addition, the explanation of the origin of the word *animal* in the Barnhart Dictionary of Ethymology is worth to be noted. This term is likely borrowed from Latin *animal*. “The Latin word was originally the neuter form of *animālis* having the breath of life, animate, from *anima* life, breath, which is related to *animus* mind, spirit. Latin animus is cognate with Greek *ánemos* wind, breath, and with Sanskrit *ániti* he breathes”. In this regard, it is important to recognize that the Latin term is related to mind and spirit. Therefore, the view that animals possess mind which was discussed in the first chapter is also rooted linguistically.

2.1.1.2 Differentiating welfare and well-being

Apart from the term *animal welfare* the term *well-being* has an important role to play in the debate about animal welfare. In the Chambers Encyclopaedic English Dictionary well-being is equated with welfare. Likewise, in the scientific discussion welfare and well-being are widely regarded as synonyms (e.g. Duncan and Dawkins 1983, p. 14; Fraser and Broom 1990, p. 258; Appleby and Hughes 1997, p. XI). In contrast, Andrew Fraser (1992, p. 227) claimed that *welfare* refers to the human treatment of animals and its effects on animals, while well-being denotes an endogenous state of the animal. According to Smith (1998, p. 217) this distinction is not widely accepted.

However, in the German-speaking debate parallels to Fraser’s approach can be found. Common dictionaries translate animal welfare into the German word *Tierschutz*. The Brockhaus encyclopaedia interprets *Tierschutz* as all activities that are orientated towards protecting the life and well-being of animals, preserve them from the infliction of pain, suffering, and fear or from damages and if they are in human care, to enable them to lead a species appropriate life as well as to provide them a painless death (own translation). Thus, the denotation of *Tierschutz* clearly embraces human action and responsibility with respect to the well-being of animals, as pointed out by Andrew Fraser.

Broom (1993, p. 17) maintained that welfare is equivalent to *Wohlbefinden* in German. In fact, the term *Wohlbefinden* is commonly used by scientists and legislators, but according to ordinary dictionaries (e.g. Pons dictionary) the literal meaning of welfare (and also well-being) is *Wohl* or *Wohlergehen*. As a result, Knierim (1998a, p. 31) stated that the term welfare has no direct equivalent in German language. In his comment on the German animal welfare act Lorz (1987, p. 84) defined *Wohlbefinden* as a state of physical and psychological harmony in the animal itself and of the animal with its environment. Lorz’ definition indicates that *Wohlbefinden* refers to an endogenous state of the animal, not to human activities and is therefore identical with the definition of *welfare* used in the scientific discussion about animal welfare.

Gonyou (1993, pp. 38, 42) suggested to apply the subtle deviation between *welfare* and *well-being* in order to differentiate between short-term and long-term considerations of animal welfare. While *well-being* is employed to refer to the short-term or present state of an animal, *welfare* is adopted to the long-term status as well as past and future implications for the animal’s well-being. For example, the administration of a vaccine to an animal including capture and restraint has an influence on its current well-being. As far as welfare is concerned, vaccination can be expected to decrease the probability of illness and therefore to maintain well-being in the future. On the other hand, Broom (1993, p. 17) proposed that *well-being* can be understood as how an individual feels about its state and *welfare* as the animal‘s state itself feelings being an integral part of it. Accordingly, *welfare* is the broader concept.

It can be concluded that the scientific study of animal welfare is almost exclusively concerned with the animal’s endogenous state; this is expressed either by the term welfare or well-being. The connotation of animal welfare in relation to the human accountability in the use of

animals has minor importance. Though, it may point to an ethical component incorporated in the term may be relevant for ethical reflections on the human treatment of animals.

2.1.1.3 The variety of „definitions“ of animal welfare

According to Gonyou (1993, p. 37) there is different terminology in common use by different societal groups. Scientists' views about how to define animal welfare vary to a large extent. Mason and Mendl (1993, p. 302) emphasized that „the exact way in which scientists define welfare will clearly influence the types of measure they use to attempt to assess welfare objectively“. On the other hand, Moberg (1993, p. 1) stated that how animal welfare is defined will have an influence on the type of guidelines established for the regulation of the care and use of farm animals. Thus, definitions of animal welfare address such different aspects as physical and mental states of animals, physical and psychological harmony, animal needs, negative feelings, human responsibility for animals etc.

> “Welfare is a wide term that embraces both the physical and mental well-being of the animal” (Report of the Technical Committee 1965, p. 9)
>
> The welfare of an animal must be defined therefore not only by how it feels within a spectrum that ranges from suffering to pleasure but also by its ability to sustain physical and mental fitness and so preserve not only its future quality of life but also the survival of its genes.
>
> (Webster 1994, p. 11)
>
> [Welfare (Wohlbefinden) is] a state of physical and psychological harmony in the animal itself and of the animal with its environment which is in particular characterized by freedom from pain and suffering. The indications of well-being are good health and normal behaviour. Both presuppose undisturbed, species-specific and for the behaviour adequate life functions.
>
> (Lorz 1987, p. 84)
>
> In order to overcome differences and biases in the definition of *harmony*, Hurnik (1993, p. 30) suggests a guiding moral principle that „*every sentient, living organism subjected to full, direct human control should have an opportunity to experience an environment for which its own genotype is predisposed, in order to develop into a physically and psychologically healthy organism*“.
>
> “Welfare is reduced when animals suffer, i.e. when they have negative feelings” (Duncan 1993, p. 12).
>
> “Welfare is not health [...] it is not being ill that reduces welfare but feeling ill” (Duncan 1993, p. 11).
>
> An animal's welfare is “its state as regards its attempts to cope with its environment“ (Broom 1986, p. 524). Coping implies having “control of mental and bodily stability” (Fraser and Broom 1990, p. 386).
>
> “[…] but for the present animal stress offers us the first reasonable step in defining animal welfare” (Moberg 1996, p. 47).
>
> “[A]n animal is in a state of poor welfare only when physiological systems are disturbed to the point that survival or reproduction are impaired” (McGlone 1993, p. 28).
>
> A dictionary definition of well-being [referring to a state of being happy, healthy or prosperous] is too vague for understanding the nature of a particular animal and its needs and wants. Well-being as a dynamic state, varied in its manifestations and enormously complex.
>
> (Curtis 1985, p. 2)

> "Animal welfare consists of the animals' positive and negative experiences. Important negative experiences are pain and frustration and important positive experiences are expressed in play, performance of appetitive behaviour and consummatory acts […]" (Simonsen 1996, p. 92).
>
> "'Animal welfare is a human responsibility that encompasses all aspects of animal well-being, including proper housing, management, nutrition, disease prevention and treatment, responsible care, humane handling, and, when necessary, humane euthanasia'" (The American Veterinary Medical Association 1990 cited by Tannenbaum 1995, pp. 150-151).

Many scientists came to the conclusion that defining animal welfare is a very difficult even if impossible task. According to Dawkins and Duncan (1983, p. 14) it is highly problematic to create an exact and unambiguous definition of welfare. Moberg (1985, p. 27) pointed out that

> [i]t is doubtful that animal well-being will ever be defined to everyone's satisfaction. Such a definition inevitably incorporates subjective feelings derived from personal experiences and views of life. Nevertheless, it is essential that objective information about well-being be included in any debate on animal welfare as well as in the development of guidelines for animal care and use.

Similarly, Rushen and de Passillé (1992, p. 722) asserted that a number of one-sentence definitions of animal welfare are "vague, often contradictory, and do little more than generate semantic disputes and hide the complexity of the issues involved" and predicted a continuing dispute about what constitutes welfare in animals.

An important question arising in this regard is why so many different definitions have evolved. Tannenbaum (1995, p. 162) drew attention to the point that

> [s]ome of the differences among the various definitions of "animal welfare" may derive from different views about what animals actually experience or about what it is possible to measure in them. Nevertheless, it is clear that all the definitions have an ethical component. Someone who believes that welfare is the absence of suffering takes the position that what constitutes an acceptable kind of life for an animal is one without suffering. Someone who believes that this is not sufficient for welfare believes that animals are owed more. […] [S]omeone who defines welfare in terms of the satisfaction of needs may insist that one start with the animals' needs first and adapt environments to them - on the grounds that this is the morally correct approach.

Thus, the great number of distinct definitions appears to derive from ethical considerations that are inextricably implicated in the scientific study of animal welfare.

Another issue to be raised is why so many additional definitions have been developed, although the denotation of the term welfare is given by the dictionary. Are other natural phenomena, for example gravity, also defined in a literal and a scientific way? Are lexical definitions too vague to understand the nature of an animal, as stated by Curtis (1985, p. 2)? *Definition* denotes the meaning of a term and this meaning is determined linguistically. If a definition is *per definitionem* laid down in linguistic terms, definitions that deviate from the literal meaning cannot be definitions either. Therefore, it is suggested to refer to definitions only, when the literal meaning of a term is concerned. "Definitions" developed by scientists or legal advocates to establish a theoretical basis for the assessment of animal welfare might be better referred to as concepts.

In order to gain overview of the confusing diversity, several categories of definitions were introduced. Gonyou (1993, pp. 38-39) identified legal, public and technical or *animal* definitions of welfare that reflect different viewpoints and affect each other. Legal definitions are based on legislation and refer to socially accepted minimum standards which determine what practices are permitted or what norms must be met. For example, the German animal protection act permits dehorning of calves only up to 6 weeks of age (Bundesministerium für Ver-

braucherschutz, Ernährung und Landwirtschaft 2001, p. 16). Gonyou (p. 39) further alleged that public definitions generally mirror peoples' interests and experiences with animals and technical definitions are characterized by variables used for the measurement of animal welfare. He called into question whether these types of definitions reflect the general concept or actual welfare of an animal.

Accordingly, McGlone (1993, pp. 26-27) introduced the category of dictionary definitions, which refers to the common usage of the word. In relation to public definitions, McGlone stated that the public generally applies the concept of welfare to human-beings in need. In the light of the fact that human welfare programmes provide housing, health care, food and clothing, but not any form of entertainment, he asked „why then should we provide for the happiness of animals, if we do not provide for the same among our less fortunate human populations?"

When considering the adoption of the term *welfare* in the context of social support for those in need, it is worth to recapitulate the literal meaning of the term, as pointed out above. According to the Barnhart Dictionary of Etymology the modern sense of welfare, namely, the provision for the poor, arose at the beginning of the 20th century. The original meaning of welfare, however, which dates from the 14th century, is „a condition of being or doing well". Since the etymological later meaning differs significantly from the original and since it is related to a restricted temporal and local framework, its relevance for the assessment of animal welfare has to be questioned.

Stafleu *et al.* (1996, pp. 225-226) suggested an alternative categorization, namely, lexical definitions, explanatory definitions and operational definitions. For them lexical (or dictionary) definitions describe the common denotation of a term, for example, by a synonym or a phrase. Some words denote a concept, i.e., a basic notion with related aspects. Stafleu *et al.* alleged that different interpretations of these aspects can be expected, because *animal welfare* is a fairly new and abstract concept.

The differentiation of *definition* and *concept* by Stafleu *et al.* is regarded not to be entirely satisfactorily. A definition is a phrase or sentence that denotes exactly what a word, phrase, or idea means, while a concept is someone's idea of how something is, or should be done (Longman Dictionary of Contemporary English). This distinction is relevant for further reflections on the assessment of animal well-being. Definitions of welfare precisely describe the denotation or meaning of the word. On the other hand, scientists have developed different ideas or concepts of animal welfare with respect to its assessment.

Definitions are a product of linguistics and therefore a result of long-term developments in a language; they can be influenced by public opinion. The *flood* of *definitions* for animal welfare may have evolved, because the *translation* of the linguistic terms of the definition into terms of scientific measurement failed. Hence, a variety of ideas or concepts have arisen about what animal welfare is, to make the term suitable for the particular issues to be dealt with in the study of animal well-being.

Stafleu *et al.* (1996, p. 227) further expounded explanatory and operational definitions:

> The explanatory definition relates one or more aspects of the concept to certain other (scientific) concepts. [...] By 'translating' lexical definitions into scientific terms the concept can be fitted into a certain scientific theory and so be 'opened up' for scientific research. Aspects of the concept which do not fit in the scientific theory, for instance moral aspects or feelings, are excluded in the explanatory definition. [...] Operational definitions describe what concrete parameters should be used and how they should be measured in order to make a verifiable quantitative statement about a concept.

At the same time Stafleu *et al.* (p. 232) warned against the implicit reduction of the broad idea of animal welfare in lexical definitions by making them accessible to scientific research, since this goes hand in hand with a loss of ethical characteristics of the term.

Bracke *et al*. (1999, p. 281) claimed that

[a] distinction has been made between subjective and objective definitions of welfare. [...] Objective definitions relate welfare directly to measurable parameters [...]. They tend to emphasise the importance of biological functioning and seem 'inspired' by the question how welfare can be measured in a scientific, objective way. By contrast, subjective definitions define welfare in terms of subjective emotional states of animals, i.e. as what matters to the animals from their point of view [...]. Subjective definitions are more prevalent in the philosophical literature [...] and seem 'inspired' by the question how animals ought to be treated ethically [...].

Although it is very valuable to systematize the seemingly endless variety of interpretations of the term "animal welfare", which is difficult to oversee, it is not the *definitions* themselves that are subjective or objective. When talking about a *subjective definition* it implies that welfare refers to a subjective state of the animal, however, the definition itself is not subjective. Similarly, *objective definitions* aim at the sort of measurement of animal welfare that may be objective and, therefore, objective is related to epistemology and not to the meaning of *animal welfare*. In this regard, Michael Meredith in the applied ethology network stated that the

welfare of an animal is a human construct - a concept or judgement in our own minds. We could usefully, I suggest, distinguish it in this way, and separate it from purely objective observational data, otherwise we are in constant danger of confusing subject and object - i.e. ignoring our subjectivity - under the illusion of objectivity.

When looking critically at the variety of definitions, it is apparent that legal definitions aim at governing human treatment of animals and technical definitions are made amenable to scientific research rather than determining the term welfare itself. The actual or linguistic definition of welfare neither includes how animals should be treated nor how animal welfare can be measured; it is a state of being or doing well; good fortune, happiness, or well-being […]; prosperity (The Oxford Universal Dictionary Illustrated). This also supports the view that the basic meaning of welfare should be initial point for further considerations about the assessment of animal welfare. Additional explanations might be called a concept of animal welfare. In this regard, it is useful to articulate what the underlying assumptions are. Is it someone's intention to define animal welfare or is someone primarily concerned with something else, e.g., how animal welfare can be measured, how farm animals should be housed, or how animals ought to be treated?

2.1.2 Scientific concepts of animal welfare

Research has developed a number of concepts of animal welfare. These concepts are closely related to the assessment of animal welfare. A way to make animal welfare amenable to scientific inquiry is to create a link between the novel concept, namely welfare, and an established concept (e.g. health, stress). Most influential and at the same time most contrasting are the concepts of coping and of animal feelings, which will be addressed in this section.

2.1.2.1 In retrospect: „The five freedoms"

In 1964 Ruth Harrison in her book *Animal Machines: The New Factory Farming Industry* (Harrison 1964) first drew attention to the welfare of intensively managed farm animals (Webster 2005, p. 12) subsequent to rapidly arising large scale livestock production systems in industrial countries (Report of the Technical Committee 1965, p. 4). Owing to the increasing public concern for farm animals living under intensive conditions, the British government initiated the formation of the Brambell Committee, which was one of the earliest commissions

that reviewed the welfare of intensively housed farm animals (Webster 1994, p. 11; 2005, p. 12).

The Brambell Committee proposed that all farm animals should, at least, have the freedom to „stand up, lie down, turn around, groom themselves and stretch their limbs“ (Report of the Technical Committee, 1965; p. 13). These minimal standards, which were pioneering for the animal welfare debate in Europe, were denoted as the *five freedoms* (Webster 1994, p. 11; 2005, p. 12). According to Webster (1994, p. 11) the concept of the *five freedoms* has been revised by the British Farm Animal Welfare Council (FAWC) in 1993 and provisions have been formulated. In the modified form the *five freedoms* require:

(1) Freedom from thirst, hunger and malnutrition - by ready access to fresh water and a diet to maintain full health and vigour.
(2) Freedom from discomfort - by providing a suitable environment including shelter and a comfortable resting area.
(3) Freedom from pain, injury and disease - by prevention or rapid diagnosis and treatment.
(4) Freedom to express normal behaviour - by providing sufficient space, proper facilities and company of the animal's own kind.
(5) Freedom from fear and distress - by ensuring conditions which avoid mental suffering.

The *five freedoms* are widely accepted rules concerning a stockperson's obligations toward animals (Knierim 1998a, p. 36). They serve as a practical guideline to farmers, extension workers, policy-makers, and scientists (Fraser and Broom 1990, p. 264) and are appropriate to identify risk factors for poor welfare (Webster 2005, p. 15). However, it will be impossible to fully implement the *five freedoms*, because at least on the short-term in no life pain, disease and anxiety is entirely avoidable. Thus, the needs of animals and the tolerable degree of deprivation and stress are disputed (Knierim 1998a, p. 37).

Webster (1994, pp. 11-12; 2005, p. 13) presented a practical approach to a comparative evaluation of the welfare of laying hens in alternative husbandry systems based on the concept of the *five freedoms* (Table 2.1). In a matrix in which the rows define the freedoms and the columns define the housing facilities (battery cage, enriched cage and free range). The verbal notes in the boxes of the matrix evaluate the welfare status of animals in the respective system.

Table 2.1 Comparison of the welfare of laying hens in different husbandry systems

	Conventional cage	Enriched cage	Free range
Hunger and thirst	Adequate	Adequate	Adequate
Comfort			
thermal	Good	Good	Variable
physical	Bad	Adequate	Adequate
Fitness			
Disease	Low risk	Low risk	Increased risk
Pain	High risk (feet and legs)	Moderate risk	Variable risk (feather pecking)
Stress	Frustration	Less frustration	Aggression
Fear	Low risk	Low risk	Aggression Agoraphobia
Natural behaviour	Highly restricted	Restricted	Unrestricted

Source: Webster (1995, p. 12 and 2005, p. 13)

The Brambell Committee suggested that "[a]ny attempt to evaluate welfare […] must take into account the scientific evidence available concerning the feelings of animals that can be derived from their structure and functions and also from their behaviour" (Report of the Technical Committee 1965, p. 9).

2.1.2.2 The role of „suffering" in the animal welfare debate

According to Dawkins (1990, p. 1) suffering and the experience of pain were central in the ethical argumentation about the treatment of animals in the 1970s and 1980s. The animal's capacity to suffer occupies a fundamental position in Peter Singer's (1975) view about the human use of animals. The philosopher's utilitarian reflection rests on "a cost/benefit analysis with one of the costs being the degree of suffering caused" (Rushen and de Passillé 1992, p. 723). Dawkins (1990, p. 1) further expounded that the American philosopher B. Rollin (1981) grounded the notion of equal moral consideration of humans and animals and the granting of animal rights on the capacity to suffer and to experience many other conscious subjective states shared by humans and animals. Even those who deny that animals possess rights advocate that "animals should not suffer unnecessarily" (e.g. C. Cohen 1986; M. A. Fox 1986).

The Brambell Committee (Report of the Technical Committee 1965, p. 9) listed various, easily discernible signs of suffering including pain, fright, frustration and exhaustion. Duncan and Dawkins (1983, pp. 14-15) raised the objection that this list may be incomplete. Although states as social isolation may be experienced in a similar way in both humans and animals, there might be states of suffering in animals that are unknown by human beings. For example, people will face difficulty to imagine what a captive migratory bird feels, when it is prevented from migrating at the time of migration (Duncan and Poole 1990, p. 194). In the light of these difficulties Dawkins (1982, p. 31) adopted a broad working definition of suffering, namely, „[s]uffering means a wide range of unpleasant, emotional states". However, there is uncertainty about which intensity or duration of unpleasant emotional states causes suffering in animals.

Dawkins (1990, p. 2) maintained that suffering has evolved in the process of natural selection in order to avoid threats to life and fitness. Wild animals may suffer from hunger, when food is in short supply in their natural habitat, but suffering also assists to restore physiological deficits. Captive animals may particularly suffer under conditions in which they are prevented from performing behavioural patterns that are vital to escape from danger or to correct detrimental effects. Dawkins advocated that only *prolonged or acute* aversive states should be termed *suffering*. A mild itch can normally only termed disagreeable. She concluded that „[s]uffering occurs when unpleasant subjective feelings are acute or continue for a long time because the animal is unable to carry out those actions which would normally reduce risks to life and reproduction in those circumstances".

The philosopher Tom Regan (1983, p. 94) asserted that

> [s]uffering involves prolonged pain of considerable intensity. It is not possible, and neither is it necessary, to give precise quantitative parameters regarding how long or how intense pain must be before it constitutes suffering. Regarding humans, paradigm cases include severe burns, amputations, starvation, paralysis, such diseases as intestinal cancers and emphysema, brutal torture, the death or serious illness of a friend or loved one, loss of self-esteem, public shame of ridicule, severe depression.

Poor bodily condition, disease and injuries are potential causes of suffering in animals. However, the mere consideration of the physical condition is insufficient to assess suffering (Dawkins 1982, pp. 37-38), because suffering may also arise from psychological ill health (Dawkins 1990, p. 3). Dawkins (1982, p. 39) pointed out that relatively short periods of suffer-

ing (e.g. fear during transport) may not result in ill health. However, it may be that intensively raised farm animals are slaughtered before pathological symptoms occur. In general, broilers are sent to the slaughterhouse at the age of 7-8 weeks, pigs at the age of 15-30 weeks. It is also important to note that animals in good health may suffer too (Dawkins 1980 cited by Dawkins 1990, p. 2).

Suffering is associated with animal welfare and an animal's subjective sensations play an important role for its welfare (Dawkins 1982, p. 30; Duncan and Dawkins 1983, pp. 14-15; Dawkins 1990, p. 2; Broom 1991b, p. 118). Unpleasant subjective feelings will clearly have an effect on an individual's state "as regards its attempts to cope with its environment". However, not any animal whose welfare is affected may undergo suffering (Broom 1991a, p. 4168). Broom (p. 4169) argued that it is not useful to equate suffering with poor welfare. For example, when a diseased or injured animal is asleep or narcotised, the welfare of the individual is poor, although suffering is absent (Broom 1991b, pp. 118-119). In this situation welfare is poor, because illness or injury persists, not because the animal suffers (Broom 1991a, p. 4168).

Broom (1991b, p. 121) claimed that

> Suffering is an important aspect of poor welfare but welfare can be poor in the absence of suffering […]. Measures of heart rate, adrenal cortex activity and abnormal behaviour can indicate poor welfare but it is less easy to deduce the subjective feeling of the animal from them. […] Hence it must be concluded that suffering is an aspect of poor welfare rather than being synonymous with it and welfare should not be defined solely in terms of subjective experiences.

In addition, Broom (1988b, pp. 13-16) found animals being confined in a small pen for a prolonged period to respond by lowered activity and unresponsiveness, possibly linked with self-narcotisation through release of endogenous opiates. Broom (1991b, p. 119) argued that such a tremendous response is very likely to entail suffering. Although suffering may be depressed, if self-narcotisation occurs, the welfare of the individual is poor.

According to Ewbank (1999, p. 2) suffering in farm animals is caused by ill-treatment including abuse, neglect and deprivation. Ewbank identified symptoms and signs of suffering and its implications on production in relation to the various forms of ill-treatment (Table 2.2). Abuse and neglect indicates suffering by reduced health, pain and distress and negatively affects the biological efficiency of individual animals (decreasing growth rate, food conversation rate etc). Financial loss is inevitable to the farmer. In addition, deprived environmental conditions in intensive livestock production are inadequate to meet the physiological and/or behavioural needs of animals (e.g. lack of substrate for sand-bathing of hens in battery cages, prevention of suckling by separation of calf and dam). Ewbank further stated that animals in deprived environments sometimes show signs of depressed biological production. Modern livestock breeds "are in danger of over-stretching their physiological and anatomical limits and will start to suffer from the so-called production or over-production diseases".

During the last few decades the occurrence of abnormal behaviour in modern production systems has been accompanied by a steady decline in the productive age of farm animals that at least in parts must be attributed to reduced health and well-being. Simultaneously, pathological states deriving from production conditions, such as lameness of dairy cows kept on slatted floors and metabolic diseases have increased in these systems. All these factors are indicative of lowered production efficiency (see Martens 2005, p. 1). Nevertheless, modern production systems in which animal are kept under deprived conditions, are generally characterized by high productivity and financial return. Owing to high stocking rates, in these systems labour and capital costs for housing facilities can be shared. Though, the biological production of individual animals may be low (Ewbank 1999, p. 3).

Table 2.2 Effects of ill-treatment of animals on animals and production

Type	Symptoms/signs	Effect on production
Abuse (deliberate)	Suffering due to fear, injury, pain, distress etc	Individual biological inefficiency and financial loss
Neglect (through overwork or ignorance)	Suffering due to malnutrition, disease, distress etc	Individual biological inefficiency and financial loss
Deprivation (lack of housing facilities to fulfil behavioural and/or physiological needs)	Likelihood of suffering due to deviations from normal behaviour and "production diseases"	Likelihood of individual biological inefficiency and financial loss

Modified from Ewbank (1999, p. 2)

To conclude, the great interest in animal suffering may have been aroused in the light of ethical concern about the poor state of farm animals in intensive animal production systems. The study of suffering generated human awareness for emotional states in animals and new insights in the psychological life of livestock - a field that was widely unknown and generally neglected before. It highlighted the significance of feelings for the welfare of animals and resulted in the consensus that animal welfare is not only concerned with the physical well-being but also with the mental or psychologically well-being. For a proper understanding of animal welfare and the improvement of housing and management conditions of farm animals the involvement of the animal's feelings is vital.

2.1.2.3 The health concept

Health is regarded as one essential criterion to ensure good welfare in animals (Sainsbury 1998, p. 70). In accordance, animal welfare was defined as "[a] state of complete mental and physical health […] (Hughes 1976a cited by Appleby and Hughes, 1997, p. XI). Freedom from disease and injury is an integral part of the *five freedoms* (see Webster 1994, p. 11). Ewbank (1999, p. 1) described the practical merit of equating *welfare* with *health and well-being*, since those who are familiar with the health concept, namely the stockpersons and veterinary surgeons, will be detecting the signs of health and well-being.

Hurnik (1993, p. 30) considered the relation between health and welfare in terms of well-being as a harmonious state of the animal with its environment, which was expounded by Lorz (1984, p. 84) in his comment to the German animal welfare act (see also 2.1.1.3). Hurnik suggested a moral principle that addresses interests of different groups (society, farmer, welfarist) in relation to the concept of harmony. According to this principle *"every sentient, living organism subjected to full, direct human control should have an opportunity to experience an environment for which its own genotype is predisposed, in order to develop into a physically and psychologically healthy organism"*. In order to maintain physical and mental health, in all farm animals fundamental requirements should be met in terms of environmental conditions and the care of animal keepers:

- adequate air, water and feed supply, according to their biological requirements,
- safe housing and a sufficient amount of space to prevent injuries or atropies,
- an appropriate level of environmental complexity to prevent harmful deprivation and boredom or aversive stimulation and fear,
- regular daily supervision and effective health care to minimize undetected accidents, injuries or illness and initiate prompt assistance, and
- sensible handling in all stages of their life to avoid unnecessary suffering.

Likewise, McGlone (1993, p. 27) identified health, i.e., freedom from disease and being in a normal physiological state, as the critical trait that characterizes well-being. Being aware of the difficulty to interpret the concept of health, Mc Glone related welfare to health and the disturbance of body physiology. He suggested that an animal's welfare is poor only when physiological systems are so seriously disturbed that survival is at risk or reproductive problems occur. In response to the crucial question how to differentiate between normal and poor welfare McGlone (p. 28) stated that „[b]ecause feeling poorly is much like feeling hungry (something we all *normally* experience from time to time), this cannot be the critical measure of well-being. Rather, *only* when animals reach the prepathological state […] can we say that welfare is poor [...]".

An animal exposed to stressful conditions may reach the prepathological state, when regulatory body mechanisms are activated *via* CNS, its endocrine status changes and severe health problems including infertility or reduced immune competence are developed. If the aversive conditions persist for a prolonged period, the animal will either be incapable to reproduce or even die (Rushen and de Passillé 1992, pp. 732-733; McGlone 1993, p. 29). McGlone (p. 29) maintained that the concept of health is very important for the assessment of animal welfare, because the prepathological state clearly indicates that the animal's individual fitness and thus welfare is reduced.

On the other hand, Duncan and Dawkins (1983, p. 16) alleged that „although ill-health denotes suffering, its absence should not be taken as proof of well-being". There may be states in which animals suffer, although they appear to be in good health. For example, during transport physiological disturbances, such as altered hormone levels, may occur. Dawkins (1982, p. 32) further pointed out that the sole consideration of the physical state of an animal as a criterion for suffering is inadequate, regardless of the fact that physical health is an essential precondition for welfare. Physically healthy animals may suffer psychologically. Thus, maintenance of physical health as an animal's proper bodily function is not sufficient to be in a state of welfare. It requires also the absence of mental suffering and of unpleasant subjective states, such as boredom. However, the psychological aspects of suffering and well-being are still a matter of uncertainty.

2.1.2.4 Satisfaction of needs

In modern intensive production systems physical needs are usually properly met (balanced nutrition, pleasant microclimate) and should result in an optimal functioning of the animal body. However, in the recent past health problems have increasingly emerged in domestic animals. These problems were mainly attributed to inadequate housing conditions, such as lack of space to exercise and to perform natural behaviour. Pathologies arising from detrimental environments are assumed to be closely associated with sensations, such as frustration and boredom.

The European Convention for the Protection of Animals Kept for Farming Purposes pointed out that farm animals must be managed according to 'their physiological and ethological needs' (Ewbank 1999, p. 4). A *need* was defined by Hurnik *et al.* (1985, p. 120) as: "Any requirement that is necessary for an organism to develop normally and to maintain its physical and psychological health". Broom (1988a, pp. 384-385) added that the term needs, involves "the expression of a mechanism which exists within the animal, irrespective of its interactions with man or any other species".

Needs were found to arise, when body conditions deviate from the state of homeostasis: Control systems maintain body functions in individuals within a tolerable range (e.g. body temperature, water balance), while environmental conditions change. Homeostatic maladjustment can elicit a need as a result of deficiencies of resources or environmental stimuli

(Broom and Johnson, 1993, p. 21; Broom 1999, p. 135). As a result, a need was defined as "a requirement, which is fundamental in the biology of an animal, to obtain a particular resource or respond to a particular environmental or bodily stimulus". These requirements, for example, involve food and warmth on the one hand and companionship, grooming and nest building on the other hand (Broom and Johnson 1993, p. 21).

Curtis (1985, pp. 2-8) developed a concept of needs for farm animals along the line of Abraham Maslow's hierarchy of human needs. Curtis' concept equates the satisfaction of needs in an organism with the experience of well-being characterized as a dynamic and enormously complex state that „can differ greatly among individuals as well as in the same individual from time to time". According to Curtis the hierarchy of needs established by Maslow is compatible to farm animals. This hierarchy includes most elementary physiological needs for adequate nutrition, a tolerable climatic environment, and health care, which are generally met in intensive production systems. Safety needs have intermediate significance; they involve protection from predators, the rigors of climate, and poorly designed housing facilities and equipment. Behavioural needs are last in the hierarchy occurring under deprived conditions in which domestic animals suffer from frustration, fear, and discomfort (Curtis 1985, pp. 2-3 and 1987, p. 250).

In response to Curtis' order of priority, which classifies physiological needs as more important than behavioural needs, Rushen and de Passillé (1992, p. 723) stated that "[it] is unreasonable to disregard intense pain or panic in animals even if it is of sufficiently short duration to have little effect on their biological functioning". Rushen and de Passillé further raised the objection that practical problems may arise when different aspects of well-being are given different priority. Is it, for example, justified to impose social isolation, restriction of movement and behavioural deprivation on animals by keeping them individually, in order to achieve a minor improvement of the animal's health status? Curtis and Stricklin (1991, p. 5001) alleged that exploring of an animal's needs and the fulfilment of needs is closely associated with the understanding of mental processes in farm animals.

Hurnik (1993, pp. 32-33) distinguished live-sustaining, health-sustaining and comfort-sustaining needs:

(1) In the first category are needs which, if not satisfied, lead to rapid or immediate death of the organism. These needs can be classified as life-sustaining needs which, due to their critical proximity to the death of living organisms, are assumed to have the greatest weight for the animal.
(2) In the second category are needs which, if not satisfied, lead to illness, progressive deterioration and the eventual death of the animal. These needs are called health-sustaining needs and their satisfaction has great weight for the animal since if only one of the needs is not satisfied, the quality of animal life will be relatively poor.
(3) In the third category are needs essential for the comfort of the animal. Failure to satisfy comfort-sustaining needs results in the occurrence of behavioural aberrations (often somewhat inappropriately called non-functional behaviours) and undesirable behaviours, harmful to animal health, normal development or reproduction.

Ewbank (1999, pp. 4-5) suggested a differentiation in physiological and behavioural needs. He maintained that farm animals have a physiological need for quantitatively and qualitatively adequate food. If this need is not met, animals show difficulty in growth and breeding as well as signs of malnutrition. Secondly, Ewbank identified a physiological need for exercise to prevent animals from pathological alterations in their joints, bones and muscles. Moreover, behavioural needs of farm animals which, for example, elicit nest building in domestic fowl are enumerated by Ewbank. The concept of behavioural needs was expounded in a workshop on behavioural needs of farm animals, as follows:

Behavioural needs may be defined as a need to perform: 1, behaviour which is necessary for the maintenance of normal physiological and physical states; 2, behaviour which is necessary for the

maintenance of a normal psychological state, with its emotional and cognitive aspects. Departures from behavioural normality indicate that the animal's control systems are being overstrained. This can be measured scientifically. The full repertoire of behaviour, normal in incidence and patterning, is a manifestation of health.

(Fraser 1988, p. 379)

Friend (1989, p. 151) interpreted behavioural needs as "behaviors that are motivated largely by internal stimuli and, if an animal is prevented from performing these needs for prolonged periods, the individual's welfare may be compromised". Although it is widely accepted that an animal's needs extend the provision of food, water and a mate (Hughes and Duncan 1988, pp. 353-354; Dawkins 1990, p. 1), in intensive husbandry systems these basic resources are often deprived to varying extents. Intensively housed farm animals in general have no opportunity to perform foraging behaviour; social distance and adequate exercise is depressed. These behavioural and physiological restrictions not only affect the animals' mental well-being, but also their life expectancy (Young 1999, pp. 77-79).

Hughes and Duncan (1988, p. 353) provided evidence for behavioural needs in chicken. They observed that "[h]ens in a deep-litter pen without nest boxes construct rudimentary nests before laying each egg. The nest is generally constructed in the same location every day, and often utilises the same materials." This observation refuted the hypothesis that the animal's motivation to construct a nest is solely directed to the functional consequences of the behaviour (the presence of the nest), but is also focussed on nest-building behaviour itself. Young (1999, p. 84) concluded that "[c]ertain behavioural patterns, those which restore homeostatic balance, may appear to be a behavioural need, either because the animal is in physiological deficit, or because the performance of the behaviour is important (self-reinforcing) to the animal".

There is disagreement about the behaviours animals need to display and the importance of specific behaviours for the welfare of an animal (Friend 1989, p. 153).

The behavioural needs that are most relevant to animal welfare are those that most readily exhibit "damming-up" (they are performed at an abnormally high rate when an animal is first allowed to perform them after a period of deprivation), have reinforcing attributes and whose prolonged non-performance is associated with adverse alterations in physiology. Behaviors whose performance is largely dependent on environmental stimuli and whose prolonged non-performance is not associated with behavioral or physiological changes have little impact on welfare.

(Friend p. 156)

Broom (1999, p. 135) drew attention to the point that animal needs can be identified by its effects on the animal's physiology and/or behaviour, such as the rise of glucose levels after feeding (in all farm animals) or the performance of dust-bathing in hens. Broom pointed out that the needs are not physiological or behavioural itself, but are requirements that arise in response to deficiencies the animal is being faced with (Broom and Johnson 1993, pp. 21-22; Broom 1999, p. 135). As an alternative Broom and Johnson (1993, p. 22) suggested the term *biological needs*.

Bodily or environmental deficiencies generating needs may be within a range from life-threatening (e.g. lack of water) to comparatively harmless (e.g. short-term close confinement). This issue was addressed by Broom and Johnson (1993, p. 22) and Broom (1999, p. 136) who alleged that the spectrum of a need is more precisely expressed in German language by the two words *Bedarf* and *Bedürfnis*. While *Bedarf* refers to "a need which must be satisfied if life is to continue", *Bedürfnis* is "a need which the individual wishes to be satisfied". Broom and Johnson maintained that an animal's desires are not all essential for life or even harm the animal.

Alike, Hurnik (1993, pp. 31-32) discussed the dissimilarity of needs and desires in animals. *Desire* denotes the "[m]otivation of an organism to acquire, control, or experience some fea-

ture of its environment" (Hurnik *et al*. 1985 cited by Hurnik 1993, pp. 32), such as water, feed, space, social contact and escape from aversive stimuli, respectively. Desires can indicate underlying needs and are interpreted operationally from the animal's performance of behaviour. While needs were identified as life-, health- and comfort-supporting requirements, an animal's desires may result in harming health or endangering life (e.g. drinking of contaminated water, overeating with highly palatable feed) (Hurnik 1993, p. 32).

In contrast, Duncan (1996, p. 31) argued that although essential for the animal's survival and reproduction it is not the needs, but the desires or wants or emotional states in relation to needs that are primarily important to welfare. His argumentation derives from the postulate that welfare is first and foremost concerned "with the satisfaction of wants and desires rather than the satisfaction of needs". For example, if pigs want straw and are deprived of it, welfare will be impaired independent of the animal's thermoregulatory need of straw. Though, needs are not necessarily identical with wants. In gestating sows, for example, the amounts of food provided to the animals are obviously insufficient to reduce their feeding motivation (Rushen and de Passillé 1992, p. 723). Rushen and de Passillé concluded that it is not the environments themselves that are important for the assessment of animal welfare, but the animals' perception of their environments.

Broom (1999, pp. 135-136) alleged that needs may be directly related to feelings, which are likely to have evolved during natural selection and are likely to alter, when the need is satisfied. "Feelings are part of a mechanism to achieve an end, just as adrenal responses or temperature regulatory behaviour are mechanisms to achieve an end". All these positions strongly support the view that needs and wants or feelings are intimately interwoven and mutually affect each other. Interaction is conceivable between the satisfaction of needs and the presence of wants and desires, while emotional states may affect needs and desires.

According to Hurnik (1993, p. 31) welfare of animals is concerned with the satisfaction of *needs*, which involves acquirement of beneficial and avoidance of aversive events or stimuli (Hurnik *et al.*, 1985 cited by Hurnik 1993, p. 31). Broom and Johnson (1993, p. 22) maintained that non-satisfaction of needs results in poor welfare and the welfare of animals is the poorer the less their needs are being met (Broom 1999, pp. 135-136). The degree of poorness of welfare will fluctuate and this has to be scientifically assessed. At a time, when all needs are satisfied the animal is in a state of good welfare and is likely to experience positive sensations. On the other hand, when needs remain unsatisfied, welfare is poor and the animal's emotional state can be expected to be negative.

Hurnik's concept of animal needs in relation to the animal's quality of life is based on three assumptions (1993, p. 31):

(1) animals can experience either a better or poorer quality of life,
(2) their quality of life is directly related to the satisfaction of their biological needs,
(3) biological needs differ in weight or importance to the animal; that is, satisfaction of some needs has a greater effect on the animal's well-being than does the satisfaction of other needs.

Hurnik (pp. 31-32) emphasized that the satisfaction of needs is not necessarily identical with the satisfaction of animal desires. As mentioned above, some desires may lead to activities that are harmful to the animal. Consequently, Hurnik (p. 32) came to the conclusion that the animal's quality of life is a function of satisfaction of needs and not of desires.

Hurnik and Lehman (1988) cited by Hurnik (1993, p. 33) suggested to apply longevity as an indicator of how well an animal's needs are met. This proposal avoids arbitrary weighing of the individual categories and inaccuracy in interpretation of needs and takes into account cumulative effects of all harmful and beneficial experiences throughout an animal's life. Central is the supposition that an individual's overall well-being and its lifetime or longevity is

positively correlated. The more satisfactorily an individual's needs are met, "the longer it may be expected to live". Thus, longevity is appropriate to indirectly indicate an animal's quality of life. At the same time longevity is an objectively measurable parameter and permits to compare different animal production systems (Hurnik 1993, p. 33).

Hurnik (1993, pp. 33-34) maintained that examinations of longevity are open to monitor aberrations of production measures, animal behaviour and physiology that indicate a reduction of welfare. Inferences about the nature of needs may be drawn from deviations of normal behaviour and physiology in environments that are detrimental in terms of the satisfaction of these needs. Since sensations and feelings influence animal preferences, information about needs can be obtained by experiments testing the choice of animals (Broom and Johnson 1993, p. 22; Broom 1999, p. 136).

The application of *longevity* as an indicator for the satisfaction of needs and thus animal welfare is doubtful in production systems with short production cycles. Clearly, in long-term producing farm animals this approach may generate more meaningful results than in short-term producing animals. When production cycles become very short, as in broiler production, where the birds hardly reach the age of eight weeks, using longevity as an indication of welfare becomes increasingly problematic. Although dairy cows have longer productive lives, they may be culled long before their productive life ends for reasons, such a serious nervousness that aggravates handling and milking.

To summarize, the biological functioning of an organism is based on the fulfilment of needs. Satisfaction of an animal's needs and desires is generally regarded to result in good welfare. However, it is important to note that the satisfaction of desires has not always beneficial effects for the animal. On the contrary, overconsumption of protein-rich diets may give rise to severe health problems and compromised welfare. The assessment of animal needs and thus welfare resulting from the satisfaction of needs is still vague, particularly in relation to emotional states. Since needs vary not only between the species but also in different individuals within a species, there is a necessity to explore and interpret the concept of animal needs and its assessment more fully.

In some modern production systems often animal needs are not satisfied in favour of the production goal. For example, gestating sows are provided with restricted rations not to get in an unfavourable condition for breeding purposes. Under these circumstances clearly the sow's nutritional needs are not being met. Similarly, high-yielding dairy cows may experience *metabolic hunger*, because their nutritional needs exceed their feed intake capacity (e.g. Hurnik 1993, p. 26; Kyriazakis and Savory 1997, pp. 52-53). On the other hand, it is clear that in no life all needs and wants can be fulfilled. In this context, Curtis (1987, p. 250) expounded that "a particular reduction of welfare does not necessarily imply an ethically unacceptable state".

2.1.2.5 The model of stress

Some scientists related animal welfare to the concept of stress (e.g. Moberg 1985, 1996, 2000; Rushen 1986; Dantzer 1993). Stress is inevitable in the life of both wild and domestic animals, because exposure to aversive stimuli or stressors is the rule (Curtis 1987, p. 246; Dantzer 1993, p. 87). At the same time animals are endowed with an excellent array of stress responses (Curtis 1987, p. 246). In science the past conceptualization of stress was always directed to alterations in the body endocrinology, but a clear and generally accepted definition of stress is lacking (Levine 1985, pp. 51-52; Moberg 2000, p. 1). Unlike most diseases stress lacks a definite aetiology or diagnosis. Hence, the use of the term *stress* is widely determined by human intuition and personal experience (Moberg 1985, p. 28; Moberg 2000, p. 1).

Selye (1979, p. 12) defined stress in human beings as "'the non-specific response of the body to any demand made upon it'" Selye further explained that

> [e]ach stressor or stress-producing agent, however, also elicits specific effects, depending upon its specific properties or characteristics, and these specific actions will in turn modify the nonspecific (stress) response of the organism. Furthermore, even the same stressor can exert different effects upon different people, because of their varying inherited and acquired stress susceptibility. The end result will depend, to a large extent, on the condition of the various organ systems, of which the weakest will naturally break down first. Thus, stress accompanies all disease phenomena and, in fact, all activities in life, but when the organism is exposed to any degree of stress incompatible with possibilities of adequate resistance or adaptation, stress can produce disease.

Dantzer (1993, p. 87) claimed that the present concept of stress derived from the concept of homeostasis, i.e., regulatory mechanisms maintain the internal milieu of the animal constant in varying external conditions. In accordance, Moberg (2000, p. 1) interpreted stress as „the biological response elicited when an individual perceives a threat to its homeostasis. The threat is the 'stressor'. When the stress response truly threatens the animal's well-being, then the animal experiences 'distress'". According to Curtis (1987, p. 246) stress is an environmental change (e.g. fall of ambient temperature) that challenges an adaptive response. Curtis alleged that it is no problem to measure a change of physiological, immunological, anatomical, or psychological indicators in an animal, which is exposed to a controlled stressor. However, it is elusive to establish an objective index of stress in terms of animal health and overall welfare.

Terlouw *et al.* (1997, p. 143) maintained that

> [a]lthough originally the term 'stress' was used to refer to the physiological responses involved in adaptation to the environment, nowadays the term describes the animal's state when it is challenged beyond its behavioural and physiological capacity to adapt to its environment.

It is important to note that not every aversive stimulus that threatens homeostasis is bad (Dantzer 1993, p. 87). Selye (1979, p. 13) differentiates between non-threatening stress (eustress) and threatening stress (distress). Distress is bad and can cause diseases. Thus, to maintain good welfare distress is to be avoided. Farm animals experiencing distress, can fall sick and develop difficulty in reproduction and growth (Moberg 2000, p. 1). According to Dantzer (1993, p. 90) "[t]he response to stress is multidimensional, involving different responses in different systems, individuals, and situations".

If a stimulus is identified as threatening by the central nervous system (CNS), the animal may respond to stress either by behaviour, the autonomic nervous system or the neuroendocrine system (Moberg 1985, pp. 30-31; Mormède and Hay 2002, p. 5). The autonomic nervous system not only changes heart rate, but also vascular pressure, contraction in stomach and intestine, exocrine secretion and most notably elicits the secretion of catecholamines. On the other hand, the neuroendocrine reaction to stressors modifies the release of glucocorticosteroids from the pituitary which, in turn, influences immune competence, reproduction, metabolism and behaviour. Additionally, stress affects the secretion of other pituitary hormones, such as, thyroid-stimulation hormone, prolactin, gonadotropins (Moberg 1985, p. 31 and 2000, pp. 3-8; Dantzer 1993, p. 88).

Both autonomic and neuroendocrine responses can influence "the synthesis of glucose at the expense of lipid and protein reserves, to redirect the blood supply to certain organs, to modify digestion, and to modulate numerous other biological systems" (Moberg 1985, pp. 30-31; Mormède and Hay 2002, p. 5). The immune system plays a significant role in the response to stressors. During prolonged stress or when stress is severe, the animal enters a prepathological and pathological state (Moberg 1985, p. 31 and 2000, pp. 3-8). Therefore, Moberg (2000, p. 8) suggested that the incidence of disease or pathological state is appropriate to indicate a threat to welfare.

Gonyou (1993, p. 41) denied that an animal reaches a point of poor welfare only, when it enters a prepathological state. He claimed that it is important to recognize that welfare variables are continuous, not discrete and criticized that

> [a]lthough legal definitions of welfare may require a discrete point of concern, and economic considerations may limit our response to minor challenges to the animal's welfare, we have an ethical obligation to acknowledge that an animal may not be content with its environment long before pathological or even physiological responses are observed.

Fraser and Broom (1990, p. 259) and Broom and Johnson (1993, p. 72) limit the term stress to those levels of activity at which the biological fitness of the individual is reduced including increased mortality or reduced production of offspring and linked stress with the concept of coping (which will be discussed in more detail later on). Thus, according to Broom and Johnson (1993, p. 72),

> stress is an environmental effect on an individual which overtaxes its control systems and reduces its fitness or appears likely to do so. There will normally be a reaction on the part of the individual to such an effect. This is a response to stress, or a stress response, and the immediate and short-term consequences of the stress are strain. The time course of the effect is not specified but, whether it lasts for a short period or for much of the animal's life, the animal is unable to cope with it. [...] failure to cope implies reduced fitness.

Although there is a wide consensus about that increasing plasma cortisol concentration in animals is associated with their unpleasant treatment, Rushen (1986, p. 360) and Dantzer (1993, p. 88) objected that the negative effects of the treatment *per se* cause an increase in plasma levels of corticosteroids. For example, Schlichting *et al.*, (1983) cited by Dantzer (1993, p. 88) detected higher corticosteroid levels in cattle housed in pens with space for extensive exercise than in animals under confinement. Likewise, Barnett *et al.* (1984) cited by Rushen (1986, p. 360) observed that corticocosteroid levels are higher in pigs raised in outdoor paddocks than in pigs raised indoors.

According to Rushen (1986, p. 360) it is doubtful whether swine kept outdoors are actually subjected to more stress and therefore suffer, or whether the increased adrenocortical response is a result of more novelty and exposure to unpredictable events. In addition, there is evidence that concentrations of corticosteroids in the blood do not reliably reflect the intensity of painfulness of treatments. Thus, owing to the complexity of physiological indicators, the sole measuring of blood concentrations of stress hormones is insufficient to assess the welfare of animals properly (Rushen 1986, p. 360; Dantzer 1993, p. 88).

As a consequence, Duncan (1993, p. 11) criticized the equation of the concept of stress and the concept of welfare. For Duncan welfare is not simply a lack of stress, although welfare may be reduced, if the animal is under stress. The fact that sexual activities (Szechtman *et al.*, 1974; Colborn *et al.*, 1991 cited by Duncan 1993, p. 11), regular delivery of feed (Honma *et al.* 1983 cited by Rushen 1986, p. 360), novel environments (Hennessey and Levine 1979 cited by Rushen 1986, p. 360), and when learned expectations are not fulfiled (Coe *et al*. 1983 cited by Rushen 1986, p. 360) give rise to an elevation of glucocorticoid concentrations indicates that stress is not always linked with poor welfare.

2.1.2.6 The concept of coping

Once applied to stress physiology, recently coping has become an influential issue in the assessment of animal welfare (Wechsler 1995, pp. 123-124). According to Fraser and Broom (1990, p. 386) coping means having „control of mental and bodily stability". Failure to maintain a constant internal state results in a reduction of fitness. All animals encounter a variety of problems during life time, but they attempt to counteract adverse environmental conditions

by employing different strategies (Broom 1988, p. 5 and 1993, p. 16; Fraser and Broom 1990, p. 256; Wechsler 1995, p. 124). The animal's perception of and its physiological and behavioural reactions to an aversive environment suggest that both stress response and coping behaviour are mechanisms of adaptation, which have been formed by evolution. Therefore, Broom's concept of coping is placed in the wider context of the concept of stress and the concept of behavioural adaptation (Wechsler 1995, pp. 124-125).

Coping strategies involve, for example, the modification of behaviour to achieve a tolerable state, immunological defences, the activity of the adrenal cortex to mobilize energy resources and the release of opioid peptides in the brain to relieve pain through analgesic effects (Fraser and Broom 1990, p. 256; Broom 1993, p. 16). According to Wechsler (1995, pp. 126-129) behavioural coping strategies involve escaping from or removal of aversive stimuli. If these coping strategies fail, the animal may react by apathy and wait for a spontaneous alteration of the detrimental situation. Lack of stimuli (e.g. food) results in searching for the missing stimuli or appetitive behaviour. In intensive systems the performance of abnormal behaviour is a means to actively cope with aversive conditions.

Broom (1991a, pp. 4167-4168) further explained that

> [i]f an animal has a need, its motivational state is affected so that behavioral and physiological responses that should result in remedying that need can be made. These coping responses allow the animal to control and maintain mental and bodily stability. Coping includes normal regulation of body state and emergency responses, such as high adrenal activity, heart rate, or flight activity, which require more energy expenditure and hence are used only when the animal predicts that normal regulatory actions will be inadequate.

Broom (1986, p. 524) applied the concept of coping to the assessment of animal welfare. „The welfare of an individual is its state as regards its attempts to cope with its environment". Regardless of the regulatory body mechanisms which are activated, animals may succeed, they may be faced with difficulties, or they may fail in its attempts to cope with the environment. Three implications of these coping strategies on the welfare of an animal were described:

(1) When an individual copes successfully with little expenditure of resources, its welfare is good.
(2) Difficulties in coping result in reduced biological fitness and poor welfare, although the animals survive, grow and reproduce.
(3) Animals fail to cope, if problems in their life are so severe that their control systems are overtaxed. Prolonged failure to cope with the environment results in failure to grow and to reproduce or death. The individual's biological fitness is reduced and its welfare is poor.

(e.g. Broom 1991, p. 4168; 1993, p. 16 and 1999, p. 130)

It is implicit in the term *coping* that the welfare of an animal is poor, when it fails to cope. In turn, linearly inferred, welfare must be good, if the animal is able to cope with its environment. However, as Broom (1993, p. 17) revealed, this assumption is wrong, since aversive situations may result in poor welfare. Broom pointed out that under certain circumstances (e.g. when an animal feels pain, fear or frustration) the welfare of this animal is impaired, although its biological fitness is unaffected.

> [I]f two conditions or treatments are compared and individuals in one condition are in slight pain while those in the other condition are in severe pain, then welfare is poorer in the second condition even if the pain or its cause does not result in any long-term consequences such as a reduction in fitness. Pain […] may not affect growth, reproduction, pathology or life expectancy, but they do indicate poor welfare.

As a result, it is important to recognize that suffering of animals can occur long before the ability to cope with the environment ceases and suffering or unpleasant mental states must be regarded as a main source for the depression of welfare in farm animals.

Broom's conceptualization is directed to the measurement of good and poor welfare including indicators of poor welfare, such as the effects of lack of success in the animal's attempts to cope with the environment and the extent of what is done to try to cope (Broom 1986, p. 524; 1988, p. 5) and measures of good welfare (Fraser and Broom 1990, p. 256). According to Broom (1993, pp. 15-16) measurements in general vary over a range rather than following a binary system. Broom assumed that this variation is implicit in the definition of the term welfare, namely, "how well does the individual 'fare' or travel through life". Consequently, "an individual's state as regards its attempts to cope will vary over time and according to conditions". Therefore, the welfare of animals varies over a scale from very good to very poor and measurements of welfare determine the position on the scale at a particular time.

There is some incompatibility: Broom suggested that the welfare of an individual varies over a continuum from good to poor. However, as far as the measurement of welfare is concerned, it is referred to measures of good and poor welfare (e.g. Broom 1999, pp. 130-131), which indicate a distinct character rather than a range. A main problem involved might be that not welfare as such is assessed, but one or several indicators instead of welfare. These indicators are expressed in numeric values that are clearly distinct. The inconsistency arises between the conceptual level and the level of measurement, because the concept for the assessment of animal welfare requires adjustment to the available methodology. Thus, the problem is primarily grounded in scientific methodology.

Moreover, Broom (1989, pp. 82-83 and 1999, p. 130) maintained that the state of the individual animal is objectively measurable by determining how good or poor welfare is, along a continuum. In this context, a few objections will be made. Firstly, alike welfare, *coping* or *having control of mental and bodily stability* cannot be measured by direct parameters, because, as David Fraser (1995, p. 104) pointed out, *welfare* and *coping* do not describe a single attribute, such as temperature, but describe a concept comprising various attributes. What can be measured are physiological and behavioural indicators that are assumed to provide information about an animal's mental and bodily stability or welfare.

Another question that arises is can *welfare* be equated with *having control of mental and bodily stability*. In this regard, Duncan and Fraser (1997, p. 26) claimed that the association between biological functioning and the welfare of the animal is not clear in functioning-based approaches including the concept of coping. Although the exactness of measurements is high, the relation between the parameter measured (e.g. heart rate, stereotypy etc.) and the factor to be measured, namely welfare, is weak. When claiming that the definition of animal welfare „must refer to a characteristic of an individual which is measurable" Broom (1993, p. 15) implies that in his concept the definition is subordinated to the possibility of scientific measurement, i.e., the type of measurement predetermines the definition of the term *welfare*. This raises the question whether in future scientific inquiry should exclusively be based on the instrument of quantitative measurement or whether research concepts should be initial point for the development of new tools for the assessment of scientific problems.

In addition, Broom (1988, pp. 5-6; 1991, p. 4168 and 1999, p. 129) in his extensive concept advocated the separation between scientific measurement and values stating that animal welfare can be assessed in a scientific way without making any ethical considerations. Therefore, ethical decisions about how poor welfare has to be before it is regarded to be intolerable can be made independently of the scientific measurement (Broom 1993, p. 24; Fraser and Broom 1990, p. 256). This approach of "conceptual separability of animal welfare science and ethical judgments, with scientist supplying value-free data and society making ethical judgments" was sharply criticized by Rollin (1996, pp. 6-7). He argued that science is neither value-free nor ethics-free, but that scientific study is closely related to values, when

making choices about what phenomena are studied, how a phenomenon is studied and about underlying assumptions. Tannenbaum (1995, pp. 155-157) confirmed that scientists clearly make moral decisions in terms of the selection of the species to be investigated. For example, welfare studies on rats or tsetse flies will hardly be conducted. Similarly, experiments granting luxury environments to animals that are incompatible with an economic production will be rejected.

To conclude, the concept of coping implies that the welfare of animals is to do with its capability to adapt to the prevailing environmental conditions (see also Wechsler 1995, pp. 124-125). Indeed, in modern animal husbandry systems the animal's degree of adaptation to artificial environments is a key aspect. Adaptation in the current situation must be assumed to approach the biological limit, which is, especially in high-yielding animals, in jeopardy to be exceeded. The various strains imposed on farm animals' result in an overall state of exhaustion and in shorter productive lives. Hence, the animal's capacity to adapt to a given situation is a decisive factor to be focused on. The issue of coping with aversive conditions is also pertinent in tropical livestock production, where farm animals are faced with severe climatic and nutritional stresses.

2.1.2.7 The animal's point of view and the concept of animal feelings

There is a widespread belief that animals experience affective states (feelings) (Duncan and Fraser 1997, p. 21). Many scientists have identified mental activities in animals as a decisive factor for the study of the well-being of animals (e.g. Duncan and Dawkins 1983, p. 13; Dawkins 1990, p. 1; Broom 1999, pp. 136-137). In experiments in animal welfare discrepancies have been detected in results that derived from measuring physiological indicators and from measuring subjective feelings. For example, animals with normal physiological values have displayed signs of distress or even abnormal behaviour (Duncan 2004, p. 86). These findings induced a discussion about which aspect of animal welfare is the more pertinent – the biological functioning or the feelings of animals (Duncan 1996, p. 29 and 2004, p. 86).

While the concept of coping primarily aims at the animal's biology, the contrasting concept of animal feelings is based on the argumentation "that welfare is all to do with what animals feel" (e.g. Dawkins 1990, p. 1; Duncan and Petherick 1991, pp. 5017-5018; Duncan 1996, p. 30). This approach conceptualizes animal welfare in terms of the animal's mental experiences including feelings and emotions. It aims at the minimization of negative feelings and/or the maximization of positive ones (Duncan and Fraser 1997, p. 19). As in the concept of coping, in the concept of animal feelings, the conceptual differentiation of scientific measurement and ethical decisions is advocated (Rollin 1996, pp. 6-7).

The idea that welfare is solely related to an animal's subjective experiences is directed to the animal's perspective on its own welfare (Gonyou 1993, p. 40) or the animal's point of view (Dawkins 1990, p. 2). Gonyou (1993, p. 37) alleged that all definitions of animal welfare should try to reflect the animals' subjective state. Similarly, Webster (1994, p. 10) maintained that proper analysis of animal welfare must be based on welfare as perceived by the animals themselves. The concept of feelings emphasizes that welfare goes beyond the adequate supply of food and health care and focuses on animal subjectivity and the animals' perceptions of their situation rather than the situation itself (Rushen and de Passillé 1992, p. 723).

Duncan and Poole (1990, p. 194) pointed out that

> [a]lthough physical health and freedom from injury are important, ultimately, it is how the animal 'feels' about its bodily state, how it 'perceives' its environment and how 'aware' it is of these feelings and perceptions that are crucial for its welfare. 'Feeling' is sensing bodily events and 'perceiving' is detecting and interpreting signals that normally originate in external events. An animal 'is aware of' (or no-

tices) a stimulus if it feels it (for internal events) or perceives it (for external events). These processes of feeling, perceiving and being aware are the simplest of the cognitive processes and their possession is probably limited to the vertebrates […].

Duncan and Petherick (1991, p. 5017) asserted that animal welfare is solely determined by mental, psychological, and cognitive needs, because the satisfaction of these needs usually will cover the animal's physical needs. According to the concept of animal feelings negative subjective experiences, such as hunger fear, frustration will result in an impairment of welfare, while positive experiences including contentment and comfort will improve the well-being of animals (Duncan and Fraser 1997, p. 22). Duncan (1996, p. 31) explained that

[a]ll organisms have certain basic „needs", that is, the conditions they require to survive, maintain health and reproduce, and they will react adversely if these needs are not met. In the course of evolution, the higher species (i.e. the vertebrates and the higher invertebrates) have evolved cognitive representations of their needs, usually referred to as „wants" or „desires". In more general terms, conscious states (feelings or emotions) have evolved which motivate behaviour in a more flexible way than do reflexes. The positive states are usually called pleasures and the negative states were historically called pains.

Considering the issue of health in relation to the concept of animal feelings Duncan (1993, p. 11) maintained that „it is not being ill itself that reduces welfare but feeling ill". Although generally a diseased animal will also feel ill, there may be instances in which an animal's physical health is impaired, but it feels good. In Duncan's view, in such cases the animal's welfare is all right. Ewbank (1999, p. 1) raised the objection that certain factors are ignored, when stating that an animal's welfare is depressed only, if it experiences an unpleasant psychological state. According to the concept of feelings, the welfare of an animal with a tumour it cannot feel would be regarded as unaffected even if its health is reduced (Mason and Mendl 1993, p. 302; Ewbank 1999, p. 1).

Broom (1991, p. 4168) agreed that unpleasant subjective feelings have an influence on the animal's state, but drew attention to the point that the animal's condition can also be affected without suffering occurring. For example, in an animal that suffers from disease the period of unpleasant subjective experience ends, when it falls asleep. The welfare of the animal remains poor during sleep, since illness persists. Similarly, injury results in poor welfare, even, if the animal is anaesthetized. Broom assumed that welfare can be poor without suffering occurring and should, therefore, not be defined solely in terms of subjective experiences. Though, welfare is also poor, if suffering or unpleasant mental feelings are experienced independent of physical problems (Broom 1993, pp. 21-22).

Applied indicators to assess subjective states in animals include measures of animal preferences and motivations, as well as physiological and behavioural parameters (Duncan and Fraser 1997, p. 19). A critical point in the assessment of animal feelings is that the animal's short-term preferences may diverge from the interest in long-term physical health and welfare (Duncan and Dawkins 1983, p. 21). For example, the overconsumption of very palatable food stuffs may result in serious health problems. As a consequence, Dawkins (1990, p. 2) conceded that "[t]he animals' point of view cannot be considered in isolation from long-term health interests […]".

A major weakness of the concept of animal feelings is that subjective mental experiences cannot be measured scientifically. It is not possible to make direct measurements of an animal's emotional states by Positivist methodology. In this regard, Gonyou (1993, p. 37), suggested that „[a]lthough the ideal means of assessing welfare may lie in determining animals' mental experiences, our ability to do this is limited at this time. A more practical approach is to assess several behavioural, physiological and pathological variables". Since the assessment of mental states in animals is widely incompatible with traditional models of scientific inquiry, animal scientists may be inclined to reject animal feelings as a researchable area or a significant measure (Swanson 1995, p. 2745). Broom (1993, p. 22), who advocated a *us-*

able definition of welfare, alleged that the feelings of animals cannot be measured directly. Currently, information of animals' subjective feelings can be gained only by indirect experimental evidence (Curtis 1987, pp. 250-251).

Duncan and Fraser (1997, p. 23) maintained that

> [t]he idea that behaviour and physiology can help us understand the feelings and emotions of animals was common well into the twentieth century (e.g. Cannon, 1929). […] The feelings and emotions of animals, like the movement of subatomic particles, cannot be observed directly. […] we have to postulate that these unobservable phenomena have certain properties, are affected by certain influences, and in turn have certain effects on other events that we can observe. […] Compared to the simple, empirical study of processes that can be observed directly, developing an understanding of unobservable processes involves additional logical steps and assumptions, all of which are open to questioning and revision.

Duncan and Dawkins (1983, p. 20) emphasized that despite the existing problems in assessing subjective states, it can be expected that advancement in preference testing and operant conditioning techniques will develop indirect evidence of animal feelings. Swanson (1995, p. 2745) maintained that the emerging subject of cognitive ethology is promising to result in new models about the assessment of mental experiences in animals. Difficulty to obtain adequate methodology for determining what an animal may feel, does not justify a general denial of feelings in animals. However, a great deal of investigations will be necessary to achieve a scientifically based understanding of emotional states in animals (Duncan and Fraser 1997, p. 19). Finally, Fraser and Weary (2004, p. 52) alleged that

> The emergence of "affective neuroscience" […] – or the scientific study of emotions in animals and humans – holds great promise for the study of animal welfare, but the field is still in an early stage of development.

2.1.2.8 Comparative overview of major concepts of animal welfare

The previous analysis of *definitions* and concepts of animal welfare revealed that great efforts have been made to discover the peculiarities and particularities in the assessment of animal welfare. All concepts described possess certain strengthens and weaknesses, as summarized in table 2.3. Approaches related to subjective mental experiences in animals or feelings-based approaches (see Duncan and Fraser 1997, p. 25) including the concept of suffering and the concept of feelings emphasize the animal's point of view. Although these feelings-based concepts are closely associated with welfare, they are poorly amenable to scientific measurement. Contrary, the indicators of approaches based on the biological functioning or functioning-based approaches can be perfectly measured on a scale, but the correspondence between the parameters quantified and animal welfare is weak (e.g. concept of coping, concept of stress). The health concept is a well-established one. A state in which all needs are satisfied is assumed to embody a state of complete welfare, as shown in the concept of needs. Though, incompatibilities exist in terms of animal desires and the hierarchy of needs.

2.1.3 Measures of animal welfare

Although animal welfare in a rigid sense is not amenable to scientific measurement, many attempts have been made to characterize and assess this phenomenon and to provide data for ethical decisions about appropriate animal environments. A variety of measures has been applied to assess animal welfare and has also been critically evaluated. There is no linear

assignment between individual indicators and specific concepts. On the contrary, many indicators are employed in various concepts. A compilation of selected concepts of animal welfare and major parameters assigned to these concepts is given in table 2.4. It is important to note that at present there is neither a single measure that is nor a mix of measures that are generally accepted to assess animal welfare satisfactorily. Therefore, this section reviews commonly adopted parameters and discusses their advantages and disadvantages.

Table 2.3 Selected concepts of animal welfare – strengthens and weaknesses

Concepts of animal welfare	Main characteristics	Strengthens	Weaknesses
Concepts of suffering/animal feelings	Emphasis on the emotional state and the animal's point of view	Subjective state covers animal welfare	No direct measurement of subjective experiences
Concept of coping	Aims at homeostatic consideration and the animal's adaptive potential Particularly addresses the possibility of scientific measurement	Sound scientific measurement of parameters	Indicators measured and animal welfare are incompatible
Concept of stress	Measures the effects of aversive stimuli		
Concept of health	Axiomatic relation between health and welfare; disease is a main threat of welfare	Concept of health is widely applied	Suffering may occur even if the animal is in a state of health
Concept of needs	The animal's quality of life is a function of the satisfaction of needs	A condition, in which "Bedarf" and "Bedürfnis" are fulfilled, corresponds perfectly with the state of well-being	Satisfaction of desires may have unfavourable effects on animal well-being Controversy about the hierarchy of needs

Table 2.4 Concepts of animal welfare and indicators mainly applied

Concepts of animal welfare	Measures applied
Concept of suffering/animal feelings	Preferences, aversion, physiological/behavioural indicators
Concept of coping	Physiological/behavioural/pathological parameters, performance
Concept of stress	Plasma levels of corticosteroids and catecholamines
Concept of health	Pathological measures, immune competence, indicators of reproduction
Concept of needs	Preferences, deviations of normal behaviour and physiology, longevity, production

2.1.3.1 Parameters of veterinary epidemiology, pathology and immunology

Health is used to define animal welfare, although the specific nature of the relation between health and welfare is unknown. According to Dawkins (1982, p. 19) the physical condition of an animal serves as a measure to identify suffering. Regular signs of suffering are a poor outer physical state induced by severe impairment of health. Veterinary epidemiology and pathology can identify injuries and diseases that are caused by the conditions in which domestic animals are reared (Duncan and Fraser 1997, p. 25). Pathological indicators include morbidity, mortality as well as injuries and diseases related to the husbandry system (Knierim 1998b, p. 46; Sundrum 1998, p. 67).

Broom (1993, p. 22) claimed that immunosuppression itself has an effect on the animal's welfare, even if the animal is not challenged by pathogens. Not only inadequate environments are discussed to have an effect on the immune system of animals and their susceptibility to disease but also frequent adrenal activity associated with a reduction of fitness (Broom 1988, p. 13; Hughes and Curtis 1997, p. 109). Alterations in the immune system are indirectly measurable by the incidence of disease. The higher the number of disease incidences in a given production system the poorer is the welfare of the animals compared to another system (Broom 1988, p. 13).

According to Duncan and Poole (1990, p. 201) disease and injury can indicate depressed welfare, but their absence cannot provide evidence that welfare is good. Difficulties in the interpretation of pathological results arise, since the prevalence of disease depends on a variety of factors, such as feeding regime, genetic disposition and individual care (Broom 1988, p. 13; Knierim 1998b, pp. 46-47; Sundrum 1998, p. 67). Dawkins (1982, p. 19) maintained that the use of physical health as an indicator for the assessment of suffering is limited, because in some situations healthy animals show physiological and behavioural changes (e.g. increased plasma cortisol secretion, stereotypies) that are assigned to aversive environments and a poor state of welfare.

Hughes and Curtis (1997, p. 124) stated that the pathological state poorly predicts pain and distress. Painful disorders can be detected more reliably by alterations in behaviour and posture. In this context, Broom (1993, p. 24) pointed out that

> […] severe pain is almost universally recognized as meaning poor welfare whether or not there is an effect on fitness. Hence it is not logical to suggest that some pathology or production impairment must always occur before welfare can be considered poor. [...] severe pathology or reproductive inhibition indicate very poor welfare. However some behavioural or physiological changes which do not reduce fitness may also indicate poor welfare.

2.1.3.2 Production and reproduction

Broom (1993, pp. 20-21) maintained that welfare is poor, if growth rate, reproductive success, or duration of productive life are depressed. There is a general consensus that measures of production and reproduction can be used to compare the welfare of farm animals in different production systems (e.g. Rushen and de Passillé 1992, p. 725; Duncan and Fraser 1997, p. 25; Sundrum 1998, p. 68). While effects on production affect parameters, such as milk yield, growth rate and egg number, „[i]mpaired reproductive success is indicated by delayed onset of reproduction during development, lengthened intervals between successive breeding, reduced litter size, and early death" (Broom 1991, p. 4170).

However, similarly to pathological parameters, the interpretation of production parameters must be carried out carefully. While the decline of performance may be judged to indicate reduced welfare, a persisting high performance does not necessarily mean that the welfare

of an animal is good (Duncan and Poole 1990, p. 201; Knierim 1998b, pp. 47-48). Duncan and Fraser (1997, p. 26) stated that "if a dairy cow is producing large quantities of milk, a further increase would not indicate better quality of life in any case". Drops in performance and physical disorders are in general the consequences of a long-term impairment of welfare (Knierim 1998b, p. 48). In addition, Broom (1986, p. 524) advocated to apply measures of individuals instead of herd parameters, since an average growth or reproduction rate of a herd expresses little about the welfare state of an individual.

Lyons *et al.* (1995, p. 265) compared the productivity, behaviour and injuries of growing pigs in four different housing systems including deep-straw, Straw-Flow®, bare-concrete and full-slats (table 5). Due to significantly greater food intake, the pigs, which were kept with straw, grew significantly faster than the pigs raised without straw. Differences in the food-to-gain ratio were insignificant. According to Lyons *et al.*

[p]igs with straw spent a large proportion of their time manipulating it. Pigs without straw were less active and spent more time manipulating the pen hardware and other pigs. Pigs with straw played more than those without straw. Pigs in the pooled treatments with straw had significantly lower injury scores.

Table 2.5 Mean food intake, liveweight gain and food to gain ration in fattening pigs in different environments over a 63-day period

Treatment	Food intake (g/day)	Liveweight gain (g/day)	Food to gain ratio[f]
Deep-straw	2392 ± 133^{ab}	1023 ± 35	2.35 ± 0.13
Straw-Flow	2427 ± 146^{cd}	1016 ± 30	2.39 ± 0.13
Bare-concrete	2269 ± 117^{ac}	959 ± 16	2.37 ± 0.11
Slats	2244 ± 110^{bd}	939 ± 24	2.40 ± 0.13
Pooled			
Straw	2406 ± 96^{e}	1018 ± 22^{a}	2.37 ± 0.09
No-straw	2260 ± 78^{e}	951 ± 14^{a}	2.39 ± 0.08
Overall mean	2333 ± 62	984 ± 14	2.38 ± 0.06

[f]Food to gain ration was calculated from: total food intake/liveweight gain, on raw data before means were taken. Values within columns with the same superscripts are significantly different, $^{a}P<0.05$; $^{b,c}P<0.01$; $^{d,e}P<0.001$

Source: Lyons *et al.* (1995, p. 268)

2.1.3.3 Behaviour

Short-term stress (e.g. by handling, transport) induces a range of behavioural and physiological changes in animals (Broom 1988, pp. 9-10; Fraser and Broom 1997, p. 267). Behavioural responses to unfavourable conditions are diverse and are mostly specific to the stimulus. Initially normal activities are suppressed and "flight, defence or hiding" is carried out. If the aversive conditions persist and homeostasis is disturbed, behavioural regulatory mechanisms, such as suppression of feeding, signalling, seeking shade or alteration of posture, are elicited. Alternatively, apathy is shown (Fraser and Broom 1997, p. 267). „When difficult conditions are encountered for long periods the same responses as those described for short-term problems occur at first. Some of these continue, but others cease to occur after a period of time and may be replaced by different responses". Therefore, different measures have to be used for the assessment of long-term effects of environments in comparison to short-term effects (Broom 1988, pp. 11-12; Fraser and Broom 1997, pp. 266, 273).

Mench and Mason (1997, p. 127) maintained that behaviour denotes what animals do in order to alter and control their environmental conditions and, therefore, provides indirect evi-

dence about their needs, preferences and mental states. According to Broom (1983, p. 81 and 1986, p. 525) an animal's attempts to cope with monotonous environments range from extreme normal regulatory behaviour to abnormal behaviour and self-inflicted injury. In this regard, behaviour may be a malfunction of neural systems or a means of coping with the environment in that the animal modifies its motivational state by increased sensory input or predictability (Broom 1983, p. 81).

Although the causes and functions of normal behaviour in relation to animal welfare are not well understood, there are a number of normal behaviours that can be used to evaluate welfare. These behaviours indicate the animal's response to aversive conditions and are interrelated with states of frustration, conflict, pain, fear etc (Mench and Mason 1997, pp. 128-130). The performance of escape and avoidance, immobility or protective responses and distress signals (Archer 1976, p. 234 cited by Mench and Mason 1997, p. 131) imply at least a short-term impairment of welfare. Their frequency and intensity gives information about the amount of distress experienced (Mench and Mason 1997, p. 131).

A change in behaviour is another relevant factor in the assessment of animal welfare. For example, beak-trimming in domestic fowl results in decreased performance of feeding, drinking and preening behaviour (Duncan *et al.* 1989, pp. 484-486 cited by Mench and Mason 1997, p. 132). Moreover, in stressed female animals often the display of oestrus behaviour is impaired, because disturbances can induce the suppression of this behaviour (Mench and Mason 1997, p. 132). Finally, the expression of normal behaviour out of context or displacement behaviour includes, for instance, preening movements of hungry birds, when they are separated from food that is visible (Duncan and Wood-Gush 1972, p. 68 cited by Mench and Mason 1997, p. 133).

It is widely accepted that the performance of abnormal behaviour is an important measure of poor welfare and negative affective states in animals (e.g. Broom 1989, p. 82; Duncan and Fraser 1997, p. 22; Mench and Mason 1997, p. 135). Abnormal behaviour is a deviation from normal behaviour (Keeling and Jensen 2002, p. 79). Broom (1989, p. 82) drew attention to the point that the more the animal shows abnormal behaviour patterns the worse is its welfare. In this context, mainly stereotypies, "repetitive behaviour patterns with no obvious function", have been studied. (Fraser and Broom 1997, p. 307; Mench and Mason 1997, p. 134).

Wiepkema (1983, p. 73) enumerated a number of categories of abnormal behaviours that indicate disturbed welfare in farm animals:

(1) *Detrimental behaviours* injure the performing animal itself and/or conspecifics (e.g. tail biting, feather pecking and urine drinking)
(2) *Stereotypies* are repetitive behaviours (see previous paragraph), which may derive from previously unsolved conflicts (e.g. pacing behaviour; tongue playing)
(3) *Sham behaviours or vacuum activities* are displayed in the absence of adequate substrate or environmental stimuli (e.g. sham chewing, sham dustbathing)
(4) *Apathetic behaviours* are characterized by inactivity and reduced responsiveness to external stimuli (e.g. motionless sitting)
(5) *Escape behaviour* indicates the intention to leave captivity (e.g. escape of laying hens)
(6) *Redirected activities* include behaviours that are directed to inadequate or abnormal objects and may develop into stereotypies (e.g. bar biting, sucking other calves).

According to Wiepkema (1983 pp. 73-74) these general, though incomplete, categories can provide some broad idea about the quality of particular abnormal behaviours. For example, detrimental behaviours are far more severe than redirected behaviours. Such differences in quality may be relevant, when the well-being of animals in a certain husbandry system is considered. As a result, the tolerated level of abnormal behaviours should be considerably

lower in severe instances than in less severe instances. Broom (1983, pp. 85-86) suggested that the welfare of an animal can be regarded to be poor in an environment in which stereotypies occur for 10 percent of the animal's waking life or cause physical injuries.

According to Mench and Mason (1997, pp. 135-139) the association of abnormal behaviour and welfare can be developed in three different ways: Firstly, abnormal behaviour predominates in housing systems, which are regarded to be poor. Secondly, abnormal behaviour is often a result of frustrated motivation and, thirdly, it was found to correlate with other indicators of poor welfare (e.g. plasma corticosteroid levels). Thus, animals showing no or low frequency of stereotypies would be in a better state of welfare than animals with high frequency of stereotypies.

Mench and Mason (pp. 139-140) emphasized that the level of abnormal behaviour performed may be affected by a variety of interacting factors, such as differences in individual fitness, the specific character of the stressor or the prevalent experiences of the animal. In addition, Cronin *et al.* (1985, p. 530) cited by Mench and Mason (1997, p. 140) claimed that the performance of stereotypies has also beneficial effects on the animal, because its occurrence is linked with the discharge of endorphins, which may calm the animal. In this regard, stereotypies are an important strategy of the animal to cope with difficult conditions (Broom 1988, p. 14). Therefore, abnormal behaviour is a pertinent factor in the study of animal welfare, but the indications are not straightforward (Mench and Mason 1997, p. 141).

2.1.3.4 Neuroendocrine responses

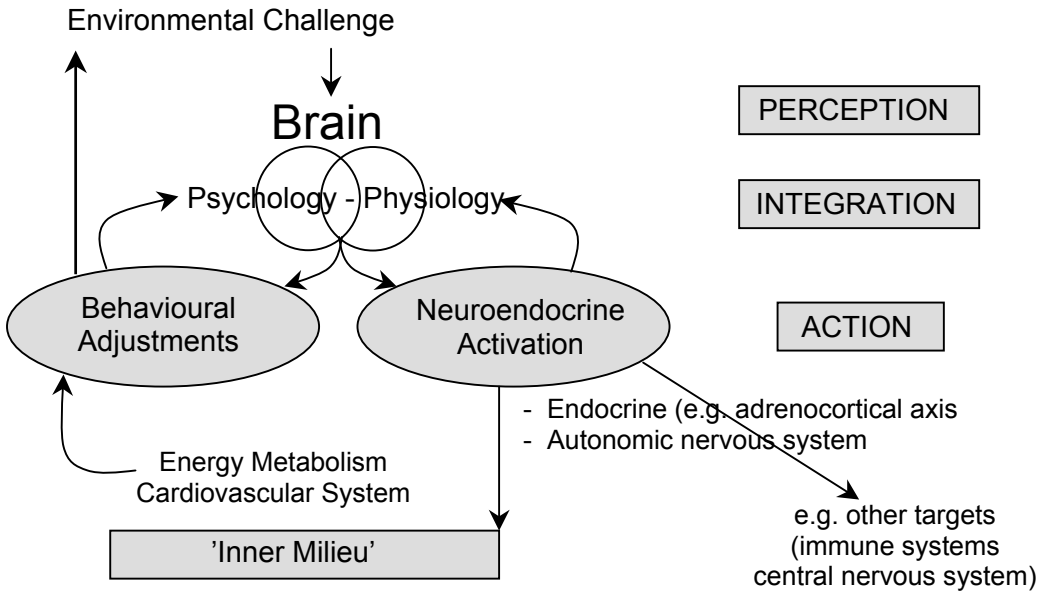
Neuroendocrinology can be defined as the interaction between the central nervous system and endocrine glands. It occupies hypothalamus, pituitary gland and peripheral body systems (Matteri *et al.* 2000, p. 46). Adaptation to aversive environments involves both behavioural and neuroendocrine adjustments. The goal of all regulatory activity in the body is to maintain homeostasis. As shown in figure 2.2, the brain is central in the adaptive response to stressors. The central nervous system monitors the interior state of the body by gathering information from external (*via* sensory organs) and internal sources and it initiates corrective action, when the *Milieu Intérieur* diverges from normal. Changes are directed to behaviour and neuroendocrine activity, which is linked with the hypothalamo-pituitary-adrenal axis and the autonomic nervous system. The control of internal body mechanisms is closely related to the cardiovascular system, immune system and energy metabolism (Terlouw *et al.* 1997, p. 143; Mormède and Hay 2002, p. 5).

Physiological reactions to environmental challenges involve regulatory mechanisms, suppression of the function of certain body systems (e.g. gut) and preparations for escape, fight or immobilization. These responses can affect heart rate, ventilation rate and blood levels of hormones. Alterations in the cardiac system (heart rate, blood pressure) regulate the availability of energy *via* blood circulation. Hormonal changes have an influence on cellular metabolic processes, such as glucose release from the liver (Broom 1986, p. 525; Broom 1988, p. 10; Fraser and Broom 1997, p. 267; Terlouw *et al.* 1997, pp. 143-144). Thus, the energy metabolism is clearly affected, when animals are exposed to stress.

Neuroendocrine activity in animals was investigated in both situations of acute and chronic stress. According to Terlouw *et al.*

> [t]he most frequently monitored physiological responses to acute stress are increased secretion of glucocorticosteroids from the hypothalamo-pituitary-adrenal axis into the blood and increased activity of the sympathetic branch of the autonomic nervous system, resulting in increased plasma levels of adrenaline and noradrenaline and increased cardiac output.

Figure 2.2 Organization of adaptive responses to environmental challenges



Modified from Mormède and Hay (2002, p. 5)

Matteri *et al.* (2000, p. 46) described these mechanisms in a scheme. A stressor activates the sympathetic trunk of the nervous system and stimulates the release of corticotropin-releasing hormone (CRH) and vasopressin (VP) from the hypothalamus. The activation of the sympathetic pathway elicits the secretion of catecholamines from the adrenal medulla, which has an effect on various organs and tissues. CRH and VP initiate the release of adrenocorticotropic hormone (ACTH) from the pituitary, which in turn stimulates the secretion of glucocorticoids from the adrenal cortex. Glucocorticoids act on various body systems. The release of both glucocorticoids and catecholamines (adrenaline, noradrenaline) aims at the maintenance of homeostasis.

Acute stress in calves due to dehorning was found to result in increased plasma cortisol levels (hypothalamo-pituitary-adrenal axis) by Wohlt *et al.* (1994) cited by Terlouw *et al.* (1997, p. 146). In this experiment the extent of response was indicative of the severity of stress (Terlouw *et al.* 1997, p. 147). Lay *et al.* (1992) cited by Terlouw *et al.* (1997, p. 149) examined the effects of hot-iron and freeze branding in calves and observed an increase in heart rate and plasma adrenaline levels (sympatho-adrenal system). Though, heart rate did not differ between treatment and control groups. Controls were only handled and sham-branded.

Alike, neuroendocrine response to long-term aversive effects or chronic stress includes the activation of the hypothalamo-pituitary-adrenal axis and of the sympatho-adrenal system (Rushen and de Passillé 1992, p. 732; Terlouw *et al.* 1997, p. 150). In an experiment by Janssens *et al.* (1995) cited by Terlouw *et al.* (1997, p. 150) pigs, which were tethered on the long-term and fed restrictively for 11 weeks, were restraint by a nosesling. In these animals a higher cortisol response was detected than in previously loose-housed animals of the control group. However, increased adrenal responsiveness was not confirmed in all investigations conducted on this issue (Terlouw *et al.* 1997, p. 150). Schouten *et al.* (1991) cited by Terlouw *et al.* (1997, p. 151) found that chronic stress alters cardiac function. Comparing long-term tethered pigs and loose-housed controls, the scientists found no difference in the basal heart rate, but a significant increase in the heart rate of tethered pigs after food delivery.

Broom (1988, p. 12) evaluated the increase of glucocorticoid levels in relation to long-term coping mechanisms under aversive conditions:

The adrenal system functions when more available energy is required and […] not all adrenal cortex activity occurs when the conditions are adverse. The adrenal medullary responses are very brief and adrenal cortex responses, although considerably more prolonged, decline after a few hours. This leads to problems in the use of measures of adrenal function as indicators of long-term welfare problems. If adverse conditions continue for many hours, however, bursts of glucocorticoid production can be detected.

Since the neuroendocrine system is very sensitive in terms of handling and venous puncture for blood sampling, experimenters take the risk of falsifying neuroendocrine measures by taking a sample (Broom 1986, p. 525; Mormède and Hay 2002, p. 6). Thus, research on non-invasive sampling methods, such as urine sampling, saliva sampling, telemetric monitoring of cardiac function) has increasingly been carried out (Mormède and Hay 2002, p. 6).

Broom (1988, p. 15) described an alternative way for animals to deal with aversive environments for long periods. The utilization of naturally occurring opiate peptides including ß-endorphin and metenkephalin in the brain, which have analgesic effects can mitigate painful states. Poor welfare can be measured by demonstrating that the animal has secreted analgesic peptides in order to cope. The higher the concentration of analgesics the worse is the animal's welfare (Broom 1989, p. 82).

The sole consideration of plasma hormone concentration is regarded to be inadequate to evaluate the well-being of animals (Duncan and Poole 1990, p. 202; Duncan and Fraser 1997, p. 22; Mormède and Hay 2002, p. 7), because behavioural and endocrine responses can be influenced by a number of factors, such as individual variation, genetics, neonatal influences, experience and learning (Mormède and Hay 2002, p. 7). As a result, elevations in plasma corticosteroid levels cannot be equated with an impairment of welfare in a simple way (Rushen and de Passillé 1992, pp. 733-734). Terlouw *et al.* (1997, p. 158) advocated an integrated approach, which combines physiological and behavioural measures, to assess the effects of environmental challenges on animals.

2.1.3.5 Animal preferences, operational conditioning and aversion

In order to gain information about the animal's own perspective measures, such as preferences and aversion play a significant role. Animal preferences can either be measured by choice experiments, which identify an animal's preferences, when offered an array of options or by operant conditioning, which assesses the animal's strength of motivation to obtain or avoid certain consequences by measuring how hard the animal will work (e.g. by pressing a lever) for the preferred event or object (Dawkins 1990, p. 5; Duncan and Fraser 1997, p. 22; Fraser and Broom 1997, p. 277). These methods are based on the assumption that the animal will either choose or work to obtain circumstances that maximize its positive affective states and minimize its negative affective states (Broom 1988, p. 7; Dawkins 1990, pp. 5-7; Duncan and Fraser 1997, p. 22; Fraser and Broom 1997, p. 278).

According to Broom (1988, p. 7) and Fraser and Broom (1997, p. 277) preferences can be detected by watching „the animal in an environment which is rich in the complexity of stimuli and opportunities for activities which it offers. The stimuli which are chosen and the ways in which the animals spend their time provide information about the preferences of the animals". Preference tests can be carried out by giving the animal the choice of two or more situations where it shows its choice by moving from one location to another. In order to compare different animal housing systems, such tests have been conducted to identify preferred pen space, type of flooring, light levels etc.

Nicol (1986, pp. 337-350), for example, investigated the spatial preferences of laying hens in battery cages. Over a period of 2 hours 12 hens were given the opportunity to make a choice

between four cages of different size and shape (A, large; B, small; C, tall; D, short). The amount of time spent in each cage was the indicator of the preference of the animals. Nicol found that the birds spent most time in the largest cage, but also frequently visited the other cages, as shown in table 2.6. The time not spent in any cage was spent in the central location between the cages. Thus, the animals displayed non-exclusive spatial preferences.

Table 2.6 Amount of time spent by hens in the different cages within a 2-h period

Hen	Cage				Total time spent in all cages (min)
	A, large	B, small	C, tall	D, short	
1	43.15	13.45	37.35	17.15	111.50
2	46.05	2.55	54.10	3.55	107.05
3	46.15	31.45	17.00	10.15	105.15
4	78.05	6.50	20.20	0,55	106.10
5	47.30	2.10	39.50	18.45	108.15
6	37.20	20.15	3.30	39.45	100.50
7	14.00	3.30	66.10	20.20	104.00
8	70.55	26.55	10.05	1.30	109.25
9	40.00	4.45	42.35	15.25	102.45
10	17.55	16.25	73.40	6.15	114.15
11	64.25	4.40	16.15	15.55	101.15
12	55.45	5.55	41.10	7.00	109.50
Cage totals	561.30	139.50	422.20	157.15	1280.55

Source: Nicol (1986, p. 340)

A major problem of preference tests is that animals on the short-term not always choose what is best for them on the long-term (Dawkins 1982 pp. 83-87 and 1990, p. 6; Fraser and Matthews 1997, p. 169). Hence, examining the animal's demand over a prolonged period may be useful (Dawkins 1990, p. 6). Furthermore, the animal's choice may be influenced by previous experiences, physiological state or season and therefore not mirror the situation actually preferred by the animal. As a consequence, choice tests have to be controlled and interpreted carefully (Dawkins 1982, pp. 83-87; Broom 1988, p. 7 and 1993, p. 23).

On the other hand, operant responses are appropriate to communicate details of animal preferences and the animals' willingness to work in order to achieve a particular object or condition. They also express how valuable the preferred object or situation is for the animal. Baldwin (1983, pp. 117-121) and Baldwin and Start (1985, pp. 233-243) used operant conditioning techniques in order to investigate illumination preferences in farm animals. Baldwin (pp. 118) found that sheep, who had the opportunity to turn the pen lights on and off with their muzzle, preferred to have the lights on for an average of 77% of each 24h. In pigs and calves the duration of illumination chosen was similar with 72% and 67%, respectively.

Dawkins (1990, pp. 5-7) has linked economic concepts to the strength of an animal's motivation or preferences. If the animal's preference persists, when it must work harder or press a lever more frequently, in order to receive the reward, the animal's behaviour reflects *inelastic demand*. If the animal's demand decreases, i.e., higher input or more work is required, its demand is termed to be elastic. According to Dawkins suffering is most likely to occur, when consequences are not met for which demand is inelastic. Since food is essential to survival and prolonged deprivation leads to clinical symptoms of ill health, a comparison between the slopes of the demand curves for feeding and for other activities can be used as a welfare yardstick. Commodities with demand curves similar to that of food can be regarded as es-

sential to welfare. From the animal's point of view, they are as important as food and should have top priority in the design of animal environments.

However, problems arise with operant conditioning, if experiments are carried out on animals, which have been living in aversive situations for a prolonged period. Those animals „may have adopted coping strategies which make it unlikely that they will learn the task or show sufficient activity to carry out the task" (Broom 1988, p. 7; Fraser and Broom 1997, p. 278). Dawkins (1990, p. 6) pointed out that results of operant responses may be the consequence of inadequate training effects and may therefore more reflect the incompatibility of response and reinforcer than the true demand of the animal. To overcome these constraints, Dawkins suggested to involve additional data about the animal's demand and to make the way to respond compatible with the animal's natural behaviour.

Aversion is another method to indirectly assess mental states in animals. It can be investigated either from „assessing the extent of immediate avoidance" or from „measuring how difficult it is to make the animal return to the place where the aversive event occurred" (Broom 1993, pp. 22-23). The animal's avoidance of an object or event gives an idea of the animal's point of view with respect to the unpleasantness of the object or the previous event. Consequently, the strength of avoidance correlates with the poorness of welfare (Broom 1993, pp. 22-23 and 1999, p. 132). Animals will also work hard to escape from certain unpleasant conditions. Dawkins (1990, p. 8) proposed to quantify the amount of suffering caused by a certain treatment by measuring the amount of food the animal is prepared to forego in order to avoid this treatment. As for preference testing, the assessment of aversion runs into difficulty, if reinforcer and response are incompatible. Low motivation may also falsely be shown by the animal, when the experiment lasts only for a few hours a day or, when the animal is inactive due to disease (Dawkins 1990, p. 8).

To recapitulate, it was assumed that the animal chooses pleasant and avoids unpleasant conditions, when it has the choice. However, in some cases the short-term and the long-term effects of the animal's choice compete. Short-term preferences may have negative consequences on the long-term. Thus, the association between animal preferences and welfare is not unambiguous. Fraser and Matthews (1997, pp. 169-170) highlighted the importance of the biological function of the animal in relation to the animal's choice:

> For an animal of a wild genotype developing and living in an environment similar to that in which the species evolved, we expect natural selection and ontogenic development to produce a set of environmental preferences that promote the health and survival of the individual and its offspring. Exceptions may arise, however, if an artificial environment creates challenges for which the animal's evolution and ontogenic development have failed to prepare it, or if the animal has been genetically altered in relevant ways through selective breeding.

Animals may be faced with hazards or benefits that exceed their sensory and affective capacity. For example, fish who never had the opportunity to develop the ability to identify aquatic pollutants will fail in choosing marine environments that are free of these dangerous substances and thus their preferences. As a result, limitations in employing animal preferences in the assessment of animal welfare may be grounded in the phylogeny and ontogeny of animal species (Fraser and Matthews 1997, p. 170).

2.1.3.6 Vocal and other signals

It is widely accepted that the welfare of animals is not only concerned with physical but also with mental well-being. However, particularly the assessment of mental processes in animals is problematic. According to Dawkins (1982, p. 19) research in subjective states in animals held that some physical states and behavioural patterns can be reliable indicators for the

assessment of feelings in humans and animals. Duncan and Fraser (1997, p. 22) pointed out that vocal and other signals can also indicate subjective mental experiences. Information about an animal's experience is mainly provided by the incidence and intensity of these signals, which indicate states such as distress, disturbance or fear (Mench and Mason 1997, pp. 130-131).

Fraser and Weary (2004, p. 51) maintained that signals form a communication system among animals and mirrors the animals' level of distress.

> If an unweaned piglet is removed to an isolated pen, it gives a characteristic set of calls, beginning with quiet, closed-mouth grunts and progressing to loud, high-pitches squeaks and squeals […]. Experiments have shown that piglets give more calls, especially more of the loud, high-pitched calls, if they have not been fed recently or if they are in a cool environment – both conditions that presumably increase their need to be reunited with their mother. Moreover, sows respond more vigorously to calls given by piglets in conditions of greater need.

In this regard, Grandin (1998, p. 125) found that cattle vocalizations in two slaughterhouses were significantly reduced from 32% of the animals to 13% and from 12% to 3%, respectively, when electric prods were more moderately used.

Marx *et al.* (2000, pp. 57-63) identified vocal signalling of animals as an indication of stress and thus as a depression of welfare. In their experiment male piglets were castrated after restraint with and without local anaesthesia (Table 2.7). The controls were only restraint with and without local anaesthesia. Marx *et al.* observed that the animals treated without anaesthesia responded with a higher intensity of calls. The call energy of the reaction during castration was lowest in animals at an age of 13 days. Therefore, this trial gives evidence that the mean call energy increases, when animals are exposed to stressful situations. Since under extreme stress the call producing organs may be overtaxed, the authors highlighted the importance of analysing the modulation of the basic frequency.

Table 2.7 Mean call energy (dB) of piglets during castration with and without local anaesthesia and fixation (Standard deviation in brackets)

Age	Treatment			
	Castration		Fixation	
	Without LA*	With LA	Without LA*	With LA
7	91,4 (± 0,67) dB	85,8 (± 0,96) dB	83,7 (± 0,89) dB	84,7 (± 0,82) dB
13	88,3 (± 0,73) dB	83,1 (± 1,30) dB	80,2 (± 1,03) dB	81,0 (± 1,52) dB
19	94,4 (± 0,64) dB	90,5 (± 1,50) dB	88,8 (± 1,30) dB	87,4 (± 2,72) dB

*LA = local anaesthesia

Source: Marx *et al.* (2000, p. 62)

While humans can describe their feeling by language, animals cannot tell us directly what they experience, because we share no common language with animals. However, by studying animals' vocalization increasingly an understanding of animal feeling can be achieved (Duncan 2004, p. 94). According to Duncan the study of animal communication is promising in view of exploring new aspects of animal feelings. Mench and Mason (1997, pp. 130-131) claimed that although there are a huge variety of distress signals, vocalization and other behavioural expressions may at least show short-term impairment of welfare.

At present, data about vocal signals in farm animals and its interpretations are sparse. However, the use of signals as indicators for the assessment of the animal's state of well-being is believed to be encouraging, because the communication between individuals would resemble the way in which humans communicate subjective experiences to each other. A main constraint seems to be the decoding of the vocal signals of animals.

2.1.3.7 Combined measures

According to Duncan and Fraser (1997, p. 25) the scientific measurement of animal welfare includes studies of veterinary epidemiology and pathology which identify injuries and diseases caused by environmental conditions. It addresses parameters of productivity, such as growth and reproduction rates, and indicators of disturbed physiology and behaviour. Moreover, preferences and aversion are tested. Broom and Johnson (1993, p. 77) summarized the numerous indicators used in animal welfare science in a table distinguishing between measures of poor and good welfare (Table 2.8):

Table 2.8 Overview of measures of poor and good welfare

Measures of poor welfare	Measures of good welfare
Reduced life expectancy	Variety of normal behaviours shown
Reduced ability to grow or breed	Extent to which strongly preferred behaviours can be shown
Body damage	Physiological indicators of pleasure
Disease	Behavioural indicators of pleasure
Immunosuppression	
Physiological attempts to cope	
Behavioural attempts to cope	
Behaviour pathology	
Self narcotization	
Extent of behavioural aversion shown	
Extent of suppression of normal behaviour	
Extent to which normal physiological processes and anatomical development are prevented	

Modified from Broom and Johnson (1993, p. 77)

An integrated approach using a combination of indicators was discussed by several authors (e.g. Smidt 1983, pp. 201-206; Curtis 1987, p. 251; Broom 1991, p. 4171; Mormède and Hay 2002, p. 5). Broom (1991, p. 4171) stated that „[a]lthough a single measure can indicate that an individual is having severe difficulties in coping with conditions, it is essential that a variety of welfare indicators be used if an adequate assessment of animal housing and management systems is to be obtained". Smidt (1983, pp. 204-205) suggested to combine (1) physiological, biochemical and biophysical measures (2) pathological parameters including morbidity and mortality (3) ethological indicators and (4) production performance for the practical assessment of animal husbandry and management systems.

According to Broom (1999, p. 133) it is necessary to take account of individual variation in attempts to cope with environmental conditions and of the effects of adverse conditions on the animal. Due to differences in the animal's responses to problems, a wide range of indicators should be applied in the assessment of welfare. The various measurements must be combined in an „overall assessment of welfare" (Broom 1991, p. 4171; Broom 1999, p. 134). Duncan and Fraser (1997, p. 22) alleged that

[i]n the future it may be possible to improve our understanding of subjective experiences by studying their physiological correlates in the nervous system. At present, most physiological measures used in

animal welfare research (heart rate, secretion of „stress“ hormones) reflect more general types of arousal, but these may still be useful in comparing different levels of a given affective state.

2.1.4 The animal needs index – an approach to assess animal housing systems

The application of the animal needs index (ANI) has a clear regional emphasis in German-speaking countries. Information based on ethological studies, animal housing technique and human care has been summarized to generate this index. According to Bartussek (1997, p. 77) the ANI is a practicable instrument to carry out on farm assessment of animal husbandry systems.

2.1.4.1 The concept of "tiergerechte Haltungsumwelt" (animal-appropriate environment)

The animal needs index (ANI) is based on the idea of a *tiergerechte Haltungsumwelt* or animal-appropriate environment. The German-speaking discussion about animal welfare and the German animal welfare legislation uses various terms in order to characterize animal housing systems that meet the needs of domestic animals (Sundrum 1998, p. 66). In this respect, the terms *artgemäß* (species-appropriate) and *verhaltensgerecht* (suitable for natural behaviour) which derive from the German animal welfare act, play a substantial role. According to § 2 of the law human beings have a responsibility to keep animals *artgemäß* and *verhaltensgerecht* (Bundesministerium für Verbraucherschutz, Ernährung und Landwirtschaft 2001, p. 8).

Sundrum (1994, pp. 6-7 and 1998, p. 66) maintained that recently the terms *artgerecht* und *verhaltensgerecht* were replaced by the term *tiergerecht*. Though, a clear definition of *tiergerecht* is missing. According to Sundrum husbandry conditions are *tiergerecht*, if they take account of the specific properties of the farm animals kept. *Tiergerechte* housing systems neither impair physical functions of the animals nor overtax their adaptive potential. In addition, *tiergerechte* environments do not restrict or change essential behavioural patterns in animals, which would cause pain, suffering or injuries in the animal itself or in companion animals.

The goal of a *tiergerechte Haltungsumwelt* (animal-appropriate environment) is to satisfy animal needs for maintenance and growth and therefore to ensure the well-being of farm animals (Sundrum 1998, p. 66). Unlike other concepts considered in the previous section, the concept of *tiergerechte Haltungsumwelt* primarily focuses on the assessment of husbandry systems rather than on assessing a state of the animal itself and is thus basically different. The environment is assessed by the response an animal shows under certain housing conditions including pathological, physiological and ethological parameters. These animal-based indicators are along with technical measures and parameters of care summarized in the animal needs index (ANI).

2.1.4.2 The application of the animal needs index (ANI)

The *animal needs index (ANI)* (in German: *Tiergerechtheitsindex, TGI*) is closely related to the term *Tiergerechtheit* (animal appropriateness) which is, as *artgemäß* and *verhaltensgerecht*, part of the German animal welfare legislation. Sundrum (1994, pp. 8-9) alleged that

it is a precondition for the *Tiergerechtheit* of a husbandry system that the infliction of pain, suffering or injury on animals is avoided. Sundrum emphasized that the complex interactions between the domestic animal and its environment can only be taken into account adequately by a multi-factorial approach. Hence, the assessment of *Tiergerechtheit* of animal housing systems involves a number of different aspects.

For the on farm assessment of *Tiergerechtheit* two major versions of the animal needs index (ANI) have been developed (Bartussek 1997, pp. 77-79; van den Weghe, S. 1998, pp. 110). In the TGI-35 L five areas of influence including possibility of movement, social contact, type of floor, light and air as well as intensity of care are assessed by the assignment of scores. In total 35 criteria are evaluated (Bartussek 1997, p. 77). On the other hand, the TGI 200/1994, which assesses 60-70 criteria, involves aspects of locomotion, food intake behaviour, social behaviour, resting behaviour, comfort behaviour, elimination (in pigs), nest building behaviour (in hens), hygiene and care (Anderson 1998, pp. 99-105). While the TGI 35 L primarily aims at housing and management technique, in the TGI 200/1994 emphasis is placed on animal ethology and hygiene (Bartussek 1997, p. 79).

A scoring system that is grounded on literature and expert knowledge, is integral part of the animal needs index. While the TGI 35 L can reach a maximal score of 35, the TGI 200/1994 reaches a maximal score of 200. The higher the score the more the needs of an animal are met in the husbandry system under consideration (Bartussek 1997, pp. 77-79; Anderson 1998, pp. 99). The scores assigned in the individual areas of influence are summarized in an overall score or index. The weighing of all aspects included reflects the experience of the authors, but is not scientifically proved (Anderson 1998, pp. 103).

Anderson and Sundrum (1998, p. 97) explained that in the TGI 200/1994 the evaluation of the animal's response to environmental conditions was left out for practical reasons. Instead, it is focussed on technical indicators and factors related to the management of animals. Ethological and physiological concerns are taken into account by assessing the degree of fulfilment of animal needs and the animals' opportunity to perform natural behaviour in the husbandry system. The TGI 200/1994 is applied for cattle, calves, pigs and laying hens (Anderson, p. 106). The TGI for cattle, for example evaluates animal needs in view of locomotion, food intake behaviour, social behaviour, resting behaviour, comfort behaviour, hygiene and care (Anderson *et al.* 1994, p. 30). The evaluation sheet for social behaviour in cattle is provided in table 2.9.

Van den Weghe, H. (1998, pp. 120-122) claimed that the variety of indicators used in the ANI is appropriate to gain complementary information, although they provide no satisfactory results of the diverse external and internal factors that affect *Tiergerechtheit*. The main problem of the assessment of *Tiergerechtheit* in husbandry systems is the selection and weighing of relevant indicators. The comparison of *Tiergerechtheit* in several housing systems is extremely complex and methodologically diffuse. The assessment of indicators is widely influenced by the subjective view of the evaluating person. However, the ANI systematically records merits and limitations of a given husbandry system and at the same time information about how to improve the system are provided (Anderson 1998, p. 103). The aggregated index is a valuable tool for practice and extension. It is suitable to analyse weaknesses of a given husbandry system and to initiate progress in the quality of animal environments.

In contrast to the previously discussed concepts for the assessment of animal welfare, the animal needs index (ANI) is concerned with the assessment of husbandry systems. It is not the animal itself that is the primary subject of concern, but its environment and indirectly the animal's response to the environment. Thus, this approach attaches minor importance on the animal's point of view that is primarily focused on in the other concepts and emphasizes what humans can do in order to provide animals an appropriate environment. However, it is important to note that both fundamental approaches make an effort to improve the animal's quality of life. The difference detected may be grounded in linguistic terms. In the German-speaking

debate emphasis is more on the human activities to ensure animal well-being, as it is expressed in the term *Tierschutz* and may therefore determined by language. On the other hand, the Anglo-Saxon discussion is mainly directed to the state of the animal itself and is thus in agreement with the denotation of the term *welfare* – a condition of being and doing well.

Table 2.9 Evaluation sheet of the TGI 200/1994 related to the social behaviour in cattle

Area of consideration III: Social behaviour

Date: **Farm:**

Add up the scores of the following columns:

For loose house systems	Column a, b and c
For housing systems in general	Column d
Additionally	
With access to run	Column e
With access to pasture	Column f

	Loose housing stable			Housing system general	Open yard	Pasture
Column	a		b	c	d	e	f
Scores	Area for locomotion in the stable (m²/LU)		Structuring of the husbandry system	Herd structure	Areas for locomotion	Duration of use	Duration of use
	De-horned	Horned					
7							
6	≥ 8	≥ 9					
5	≥ 6	≥ 8	Stables without boxes	Single suckling with bull	Non-slippery		
4	≥ 5	≥ 7		Single suckling		Permanently accessible	
3	≥ 4	≥ 6	≥ 3,3 m Feeding alley and ≥ 2,5 m Walk way			≥ 4 h per day	Total growing season
2	≥ 3	≥ 5		Stable group structure	Medium		≥ 2/3 of growing season
1			≥ 3,3 m Feeding alley and ≥ 2,5 m Walk way			≥ 2 h per day	≥ 1/3 of growing season

LU: Livestock unit

Evaluation:

Column	a	b	c	d	e	f	Sum
Loose housing stable							
Tied stall barn							
Maximum	6	5	5	5	4	3	

Source: Anderson *et al.* (1994, p. 119)

2.2 The treatment of animals in Western moral philosophy – historical background and contemporary concepts

Questions about how to treat animals have always been a matter of interest in human history. Human attitude towards animals, be it dominion over animals, humane treatment or the granting of animal rights, was discussed controversially in all epochs. Nevertheless, in a chronological consideration of moral theories a gradual development of more animal-friendly positions can be recognized. Philosophy critically reflecting on animal concerns can provide a careful, disciplined analysis and form clear, well-founded statements (DeGrazia 1996, pp. 1-2) to advance the issue of animal welfare. Investigating questions regarding the moral status of animals demands some theoretical background. Therefore, first of all the elementary context of ethics and morality will be discussed.

2.2.1 Fundamentals of ethics and morality

Terms, such as *ethics*, *morals*, *morality* and most notable *animal ethics* more and more often emerge at the periphery of the scientific discussion about animal welfare. In addition, the question of the obligatory nature of an ethical decision, which has been made, is another relevant issue to be focused on. Since the Western debate on ethics is commonly centred upon fundamental theories, referred to as moral theories, these underlying theories will briefly be expounded.

2.2.1.1 Ethics, morals and morality

Ethics is concerned "not so much with factual knowledge as it is with values" (The New Encyclopaedia Britannica, Micropaedia). Derived from the Greek word *ethos*, meaning *custom*, *habit* (Des Jardins 1997, p. 16; Mautner's dictionary of philosophy; Pieper 2000, p. 25), ethics refers to the empirical examination, description and explanation of norms, i.e., rules, beliefs, attitudes, and standards that guide human behaviour about what is right and wrong, good and bad (descriptive ethics) (Rollin 1995, p. 3; Tannenbaum 1995, p. 44; Des Jardins 1997, p. 16; Mautner's dictionary of philosophy). These ethical norms, which refer to what *is* done, are specific to any culture and are manifested in religious traditions, codes of professions, laws, and policies (Des Jardins 1997, p. 16; Pieper 2000, p. 32).

On the other hand, ethics is concerned with establishing standards or norms for conduct and is related to general theories. These norms are based on the philosophical study and critique of traditional concepts and beliefs (normative ethics) (Teutsch 1985, p. 10; Rollin 1995, p. 3; Mautner's dictionary of philosophy). In the past time and again philosopher called ordinary beliefs, views, and values into question and reflected upon it. The critical examination resulted in new normative judgements about what *ought to be* done (Des Jardins 1997, pp. 16-17).

The involvement of general theories in ethical reasoning is an integral part of Western ethics (The New Encyclopaedia Britannica, Macropaedia). Normative judgements and their supporting reasons are analysed and evaluated on a higher level of generality and abstraction (Des Jardins 1997, p. 17) and then comprehensive judgements are inferred from the general principles. Such a principle could, for example, demand that one ought to do what generates the greatest happiness for the greatest number (Dolan 1999, pp. 6, 14). As a result, „*ethical theory* refers to any attempt to provide systematic answers to the philosophical question raised by descriptive and normative approaches to ethics" (Des Jardins 1997, p. 17).

The term *moral* (noun), which can be traced back to the Latin word *mos* - a translation of the ancient Greek *ethos*, means custom(s) (Mautner's dictionary of philosophy; Pieper 2000, p. 26). According to Pieper (2000, pp. 26, 46-47) morals denote a generally binding behaviour based on the values of a human community and morality, which refers to the quality of an acting person, is the principle of all moral(s) and it legitimates a moral as a moral. While a moral can only be justified by the principle of morality, the principle of morality becomes effective as an action guiding principle by a moral. Ethics reflects this relation of moral and morality. Pieper (p. 28) concluded that *moral* is concerned with what has to be done in a particular case, while *ethics* examines moral action in a more fundamental way directed to the assessment of acts that claim morality or to conditions in which moral norms are compulsory.

On the other hand, Orlans *et al.* (1998, p. 4) and Dolan (1999, p. 8) designated *morality* as a set of standards of right and wrong conduct that represent the values of a society and form a binding communal consensus. In accordance, for Dolan (1999, p. 5) *morality* is concerned with right and wrong behaviour whereas *ethics* examines why certain conduct is regarded to be right or wrong. Apparently, there is a somewhat different application of the terms in German (Pieper 2000) and English-speaking (Dolan 1999) areas. It is worth mentioning that ethics and morals or morality as well as moral and ethical are widely used interchangeably (Dolan 1999, p. 5; Mautner's dictionary of philosophy; Pieper 2000, p. 27; The Cambridge dictionary of philosophy).

2.2.1.2 Animal ethics

Discussions on the use of animals and thus on animal ethics penetrate the area of *applied ethics* in which "ethical principles [are applied] to real-life situations" (Dolan 1999, p. 113). Animal ethics covers ethical issues about animals. The study of animal ethics is not only an empirical, descriptive task that reviews the variety of moral codes regarding human use of animals but is also the theoretical inquiry of moral arguments and their philosophical justification (DeGrazia 1996, p. 1; Comstock 2000, p. 101). Thus, Comstock (p. 103) defined animal ethics as „the study of arguments about what things are good and bad, and which actions right and wrong, in the use of animals for food and fibre". An animal ethic is „a clear, noncontradictory, comprehensive and generalized set of rules intended to govern human behaviour in the use of animals for food and fibre".

2.2.1.3 Ethical relativism

While Western moral philosophy traditionally maintains that ethical principles are universally valid implying that these principles are right for everyone, everywhere (Harman and Thomson 1996, p. 5; Cook 1999, p. 7), the view of ethical relativism holds that moral standards depend upon, or are relative to, a choice of moral framework or an individual's cultural-religious background. The relativist position denies that one moral framework is objectively privileged as the true moral principle (Fleischacker 1992, p. 1; Harman and Thomson 1996, p. 3; Mautner's dictionary of philosophy; Des Jardin 1997, p. 19; Cook 1999, p. 8). For example, the African philosopher Godfrey Tangwa rejects the view of the universal validity of ethical principles and that things that are right in the West are right at other places in the world, too. What is considered as universally justifiable categories in the West, Tangwa perceives as the Western view of things (Schweitzer 2002, p. 28).

It is a matter of fact that there are different moral standards among the various cultures in the world (Cook 1999, p. 8; Comstock 2000, p. 101). Morals and their legitimate norms constitute the cultural identity of a community and are as diverse as the historical, geographical, eco-

nomic and philosophical-religious conditions under which they emerged (Pieper 2000, pp. 55-56). Harman and Thomson (1996, p. 6) argued that actual moral diversity makes the view of moral relativism very plausible. Herskovits (1972, p. 33), who strongly advocates the view of ethical relativism, stated that cultural relativism must be distinguished from concepts of the relativity of individual behavior. Within a particular society conformity to the code of the group is a requirement for any regularity in life and ensures social controls over conduct. However, this does not imply that everyone can expect the same conformity of persons living in other societies by other ethical codes. Cultural relativism is, therefore, characterized by mutual respect for differences.

However, out of the fact that people in different cultures disagree in moral questions, it cannot be concluded that relativism is true and that value judgements cannot be right (Des Jardins 1997, p. 19; Dolan 1999, p. 100; Comstock 2000, p. 102), because in this regard *right* simply means in agreement with the mores and *wrong* means in disagreement with the mores (Dolan 1999, pp. 100-101). Although the formulation of an universal set of rules is a difficult task and may involve the danger of cultural imperialism, "[e]thics will not […] tell George that it is acceptable to kill a cow in circumstances q, r and s, while telling Jorge that it is unacceptable to kill a cow in exactly the same set of circumstances" (Comstock 2000, p. 102).

Dolan (1999, pp. 100-101) pointed out that the variation in moral standards between the cultures indicates that they are relative in kind. However, these standards cannot be both relative to the societal background and absolute, for to be absolute means to be constant and invariable independent of individual and culture. Concerning the truth of moral judgements Dolan (p. 101) maintained:

> To say that the rightness of an act is relative to the society in which it is performed is not to say that exactly the same act can be both right and wrong. It is because the social context makes the acts different in kind that one can be right while the other is wrong. […] It appears that the grounds for moral evaluation lie outside the moral emotions since it always makes sense to ask someone why he approves or disapproves of an action. If approving or disapproving made its object morally good or bad, there would be no need for such justification. Thus, the fact that moral emotions are culturally relative does not prove that identical acts or persons can be morally good in one society and morally bad in another.

The issue of ethical relativism is disputed vigorously with to the author's opinion no entirely convincing statements of both advocators and opponents. At the same time, due to increasing global interactions there is a need for a minimal moral consensus expressed in universal principles. However, a universal moral or basic norm for all human beings is difficult to apply, mainly, because of different historically grown ways of life that are determined by local climate, economic status, level of technological development, religious belief etc (Pieper 2000, pp. 32-33, 56). Nevertheless, Orlans *et al.* (1998, p. 5) enumerated precepts of morality that are independent of local customs and accepted in all moral communities including (1) tell the truth; (2) respect the privacy of others; (3) protect confidential information; (4) obtain consent before invading another person's body; (5) do not kill; (6) do not cause pain; (7) do not incapacitate; (8) do not deprive of goods; (9) protect and defend the rights of others; (10) prevent harm from occurring to others.

2.2.1.4 Moral theories

Western philosophical ethics is based on general theories in order to justify human action and knowledge about the theoretical background to which an argument is addressed is indispensable to get involved in the ethical debate. In accordance, Comstock (2000, pp. 102-103) stated that „normative arguments require general moral principles as premises, and figuring out whether these principles are justified requires philosophical reflection about our

ethical theories and our shared values“. Des Jardin (1997, p. 18) named four reasons why ethical theories are pertinent for the study of ethical questions. First, ethical theory provides basic concepts for the discussion and makes explicit implicit values involved. Second, ethical theories mirror the society's way of thinking, because theories were traditionally employed. Further, ethical theories can be applied to certain circumstances in which they can provide guidance and assessment. Fourth, knowledge of ethical theories is important, since they may have caused current problems.

Ethical thinking in general and the development of ethical theories in particular are closely connected with the question: „How should one live?" raised by Socrates at the very beginning of Western philosophy (Dolan 1999, p. 39). In the course of time moral philosophy developed a variety of moral theories including theories that are orientated towards moral virtues and character traits, such as honesty, courage, compassion and fairness and are concerned with how people should be. On the other hand, action-oriented moral theories "ask what people ought to *do*". They tend to establish rules for certain moral problems including the concept of duty. Finally, some ethical theories suggest fundamental values or "goods", such as "the liberty to pursue one's goals" or "the fair distribution of wealth" (Tannenbaum 1995, pp. 37-38). Likewise, the question how humans should treat animals is governed by ethical theories. Moral philosophy has produced significant theories relevant for discussing animal ethics. Most important in this field are teleological theories and deontological theories both providing an applicable principle, when trying to resolve an ethical problem.

Both teleological and deontological approaches are action-oriented, in contrast to value-based or virtue-oriented theories (Tannenbaum 1995, pp. 38-39). Teleological theories refer to the consequences of actions in order to determine whether these actions are right or wrong (Mautner's dictionary of philosophy; Routledge Encyclopedia of Philosophy; Tannenbaum 1995, p. 38). The term *teleology* has its origin in the Greek word *telos* meaning *end* or *purpose*. The involvement of the consequences in moral decisions moderates the influence of dogmatic principles, which may be inadequate in certain situations (Dolan 1999, pp. 46-47). An influential teleological theory is utilitarianism. Prominent adherents of the utilitarian view are Jeremy Bentham (1748-1832) and Peter Singer who advocated the moral equality of humans and animals (Sandoe *et al.* 1997, p. 6).

Utilitarianism is commonly based on the principle of utility. According to this principle "an action or practice is right (when compared to any alternative action or practice) if it leads to the greatest possible balance of good consequences or to the least possible balance of bad consequences in the world as a whole for all affected parties". (Tannenbaum 1995, p. 38; Orlans *et al.* 1998, p. 21; Dolan 1999, p. 49; Mautner's dictionary of philosophy). Relevant in this regard is the sum total of the resulting happiness of all individuals affected by the consequences of an act (Tannenbaum 1995, p. 39; Dolan 1999, p. 50).

The term *deontology* is derived from the Greek word *deon* meaning duty (Dolan 1999, p. 46) or *one must* (Routledge Encyclopedia of Philosophy). In contrast to teleological theories, deontological theories relate the rightness of an action not exclusively to the value of its consequences, but deny "that future consequences are the *only* source of moral duties". Deontology holds that the rightness or wrongness of a person's actions and the moral obligations arising from the moral principle are independent of how much good will be produced in the future (Tannenbaum 1995, p. 39; Mautner's dictionary of philosophy; Routledge Encyclopedia of Philosophy). Deontological theory allows altruism and other virtues inherent to human nature (Dolan 1999, p. 46). It is directed to moral duties that may arise from promises, contracts and principles (Tannenbaum 1995, p. 39; Dolan 1999, p. 46) or comply with a divine command (Mautner's dictionary of philosophy). According to Dolan (1999, p. 46) "[d]eontological principles essentially involve the agent and the special relationships between him, what he does and other people affected by his attitudes and actions. It allows for self-reverential altruism and expresses many of the natural tendencies in human nature".

2.2.2 Historical ideas about the treatment of animals in European ethics

European ethics has dealt with the issue how to treat animals both in philosophy and religion. The philosophical study of animal ethics is primarily concerned with the animals' moral status in the light of humanity and justice and the human obligations deriving from this status. Central questions in the debate are about whether animals are morally relevant, and, if they are relevant, how they should be treated. Do animals have moral importance in their own right, i.e., independent of human interests? Which differences between humans and animals, if any, are morally important? And finally, how much weight the interests of animals should be given compared to human interests (DeGrazia 1996, pp. 1-3; Orlans *et al.* 1998, pp. 3, 8)?

2.2.2.1 Human "dominion" over animals? – Judaeo-Christian notions about animals

European philosophical ethic is particularly influenced by Jewish and Christian thought that is based on the scriptures of the Old Testament in the Bible and the Talmud. The view of human dominion over animals has traditionally been justified by interpretations of the Old Testament in which the superior position of humans is articulated. The commandment to have dominion over animals is part of the creation myth in the Old Testament (see also Keel and Schroer 2002, p. 182):

> God said, 'Let the earth bring forth living creatures, according to their various kinds: cattle, creeping things, and wild animals, all according to their various kinds.' So it was; God made wild animals, cattle, and every creeping thing, all according to their various kinds; and he saw that it was good. Then God said, 'Let us make human beings in our image, after our likeness, to have dominion over the fish in the sea, the birds of the air, the cattle, all the wild animals on land, and everything that creeps on the earth.' God created human beings in his own image; in the image of God he created them; male and female he created them. God blessed them and said to them: 'Be fruitful and increase, fill the earth and subdue it, have dominion over the fish in the sea, the birds of the air, and every living thing that moves on the earth.
>
> (Genesis 1,24-28, The Revised English Bible 1989)

According to Davis (1994, p. 33) human domination of animals is a consequence of humans being created in the image of God (Gen. 1: 27,28). Koch (2000, pp. 38-47) cited by Keel and Schroer (2002, pp. 181-182) pointed out that the commandments must be considered in their temporal context. Since in biblical times there was a necessity to create a habitation for human beings, the habitat of (wild) animals had to be restricted. However, this does neither imply the thoughtless destruction of the nature nor the unlimited right to kill animals. Teutsch (1985, p. 14) objected that God demanded animals not only to have dominion over animals, but also to give them names: "So from the earth he formed all the wild animals and all the birds of the air, and brought them to the man to see what he would call them; whatever the man called each living creature, that would be its name. The man gave names to all cattle, […]" (Genesis 2,19-20, The Revised English Bible 1989). Thus, the human-animal relationship can, according to Teutsch, not one of mere despotism.

Keel and Schroer (2002, p. 183) maintained that, alike, in the eighth psalm human dominion over animals is inferred from the superior position of humankind:

> Yet you have made him little less than a god,
> crowning his head with glory and honour.
> You make him master over all that you have made,
> putting everything in subjection under his feet:
> all sheep and oxen, all the wild beasts,
> the birds in the air, the fish in the sea,

and everything that moves along ocean paths.

(Psalms 8,5-8, The Revised English Bible 1989)

Such biblical passages have long been regarded as a justification for the human exploitation of animals. Although there is reason for considering animals as means to a human end, many other perspectives can be found in the Old Testament that advocate animals being ends in themselves and having intrinsic value independent of their utility for humankind (Rollin 1981, pp. 51-52). New biblical interpretations on this issue account for a more symbiotic relation between humans, animals and nature. For example, a close association between animals and humans can be recognized in the fact that both are made of the same matter. The second story of the Creation (Genesis 2,4 sqq) claims that both humans and animals originated from the dust of the earth (Davis 1994, p. 31).

In addition, Keel and Schroer (2002, pp. 146-147) claimed that humans and animals share the spirit of life and the fate of death.

Human beings and beasts share on and the same fate: death comes to both alike. They all draw the same breath. Man has no advantage over beast, for everything is futility. All go to the same place: all came from the dust, and to the dust all return. Who knows whether the spirit of a human being goes upward or whether the spirit of a beast goes downward to the earth?

(Ecclesiastes 3, 19-21, The Revised English Bible 1989)

Gerlitz (1998, pp. 85-87) emphasized that humans should refrain from ruling over other creatures and be accountable for animals, because they are capable to reason and to gain insight into the common origin and the mutual dependence of humans and animals. Similarly, Davis (1994, pp. 31-32) argued that the relation between the natural world and the social life in human communities is linked with the moral imperative for responsibility. Davis concluded:

Men and women cannot regard themselves simply as artists enjoying the world in a dispassionate sense, because the world is a vehicle for divine ends and is not an end in itself. Human beings are living members of a complex world, existing within all sorts of relationships with it and possessing all sorts of responsibilities towards it.

However, another human being was created by God to overcome human loneliness (Genesis 2). Thus, although intimately related, animals, which lack language and reason, are not considered as adequate partners to humans (Gerlitz 1998, p. 93; Keel and Schroer 2002, p. 148).

There are a variety of prescriptions of the Old Testament that are directed to the humane treatment of farm animals. Both livestock keeper and domestic animals are placed under the umbrella of the divine law in that work animals are implicitly involved in the Sabbath regulations (Rollin 1981, pp. 51-52; Teutsch 1985, p. 14; Gerlitz 1998, p. 96): “For six days you may do your work, but on the seventh day abstain from work, so that your ox and your donkey may rest, and your home-born slave and the alien may refresh themselves” (Exodus 23,12, The Revised English Bible 1989, see also Deuteronomy 5,13-14). Rollin (1995, p. 52) expounded that rabbinical tradition also prescribes: „You are not to plough with an ox and a donkey yoked together“(Deuteronomy 22,10, The Revised English Bible 1989). Yoking an ox along with an ass is forbidden due to the suffering unavoidable on the side of the weaker animal. Similarly, in Deuteronomy 25,4 it is required not to muzzle an ox and allow it to eat, when it is threshing grain (Rollin 1995, p. 5; Gerlitz 1998, pp. 96-97).

Alike, the Talmud, a later scripture of Judaic teaching (Dolan 1999, p. 124), is concerned with the welfare of animals. Gerlitz (1998, pp. 96-97) pointed out that the Talmud prohibits overworking of animals. At the same time it prescribes the animal keeper to rest only after livestock is fed and it stipulates that a person that intends to purchase an animal is capable to

provide proper feed (Dolan 1999, p. 124). According to Teutsch (1985, p. 14) a general norm is formed by the commandment: „A right-minded person cares for his beast, but one who is wicked is cruel at heart“ (Proverbs 12, 10, The Revised English Bible 1989). Davis (1994, p. 33) pointed out that particularly domesticated animals are granted certain rights. For example, an fallen ox or ass should be assisted by human beings and from a bird's nest with young birds and eggs only the eggs and the young may be taken, while the mother must remain inviolate (see Deut. 22: 4,6-7).

All these examples clearly illustrate moral standards for the treatment of (farm) animals in early Judaeo-Christian communities. Rollin (1981, p. 52) argued that these religion-based regulations bespeak a position of animals as ends in themselves and imply that "*dominion* does not entail or allow abuse, any more than does the dominion a parent enjoys over a child". However, according to Linzey (1989, p. 20), the notion that animals should be respected was not always self-evident in Christian thought. On the contrary, Christian moral philosophers who were inspired by the Bible have tended to deny human duties in respect to animals (Dolan 1999, p. 124).

2.2.2.2 Early developments in moral philosophy

Western morality is not only grounded on a religious foundation, but also on ancient Greek philosophy. According to Dolan (1999, p. 12) the ancient Greek philosopher Socrates and Plato (about 400 BC) tried to develop concepts of morality and justice with regard to the nature of humankind, not with reference to a divinity. Early Greek notions considered human beings as "'the measure of all things'". For Plato a just person has a "harmonious nature arising from the practice of justice, prudence, temperance and fortitude". The Sophists, Plato's antagonists, advocated moral relativism in a pure form and regarded justice as "'the mere interest of the strongest'". Aristotle (384-322 BC) "assessed the moral worth of an action in relation to its capability to produce true happiness".

Rollin (1981, p. 10) maintained that since the ancient Greek philosophers Plato and Aristotle the lacking of a soul and the inability for rational thought excluded animals unlike humans from the scope of moral concern. According to Sambraus (1997, p. 3) the ancient Greek philosopher and writer Plutarch (about 45-125 AD) maintained that living beings have a perceptive faculty and the capacity to feel pain and to experience suffering. He observed that animals after sensual perception of stimuli either pay attention to beneficial stimuli or attempt to avoid painful stimuli and came to the conclusion that these responses presuppose the ability of thinking, making decisions and memory.

Along this line, the great Christian teacher Augustine (354-430 AD), whose thinking combines the antique philosophy and Judaeo-Christian theology (Hersch 2000, p. 69) held that animals do not take part in a community in which mutual duties between the members exist. As a result, human beings can use animals as they like (Dolan 1999, p. 124). On the other hand, Augustine said that the mercy of God is not merely directed to humankind but also to animals, which were subordinated to humans according to God's will (Schneider 1961, p. 99 cited by Teutsch 1985, p. 15). Teutsch (1985, pp. 14-15) interpreted these words as a demand on humans to develop this property of God and, therefore, to be kind to animals.

Similar to Augustine, Saint Thomas Aquinas (1225-1274) attempted to synthesize Aristotelian thought and Christian tradition (Hersch 2000, p. 85). He claimed that animals themselves do not fall within the scope of moral concern, but nonetheless cruelty to animals is prohibited, since negative implications on the interrelations between humans, who might act cruel, are assumed (Rollin 1981, p. 9; Dolan 1999, p. 124). Aquinas alleged that human beings are agents of God, while animals serve as human instruments (Dolan 1999, p. 124). According to Teutsch (1985, p. 15) Saint Thomas Aquinas, in his writing Summa theologica II/30, 4, 3

maintained that the practice of mercy makes humans similar to God and that Gods mercy is extended to all his creatures, as stated in Psalm 145, 9.

2.2.2.3 Inferiority of animals in Cartesian thought

Some centuries later the doctrine of the French philosopher René Descartes (1596-1650), latinized *Renatus Cartesius*, strongly influenced the human attitude towards animals. It has often been asserted that Descartes considered animals as lacking all mental capacity and incapable of thinking, feeling and suffering (e.g. Rollin 1981, p. 10; Kiley-Worthington 1990, p. 39; Orlans *et al.* 1998, p. 9; Dolan 1999, pp. 126, 152). Guerrini (2002, p. 57) made the point that many animal advocates *inter alia* such prominent figures as the Australian philosopher Peter Singer and the American philosopher Tom Regan, whose theories will be expounded later in this section, have misinterpreted the position of the French philosopher René Descartes and even demonized him. These contrasting views require a more detailed examination.

Sambraus (1997, pp. 3-4) alleged that Descartes while attempting to generate true scientific knowledge, doubted sensory experience and searched for general principles to explain natural phenomena. In this regard, his maxim: 'Cogito ergo sum' (I think therefore I am) was central (Sambraus 1997, pp. 3-4; Dolan 1999, p. 17; Guerrini 2002, pp. 57). It claims that only being of the own mind can be experienced by humans for sure and that even being of the own body remains uncertain (Sambraus 1997, pp. 3-4). Thus, the mind was the fundamental nature of humanity. The dualism of mind and body resulted in a complete division of substance and spirit (Guerrini 2002, pp. 57-58).

According to the Cartesian mechanical principle human and animal bodies consisted of "a collection of mechanisms" that can only be studied by the laws of mathematics and mechanics (Cottingham 1978 cited by Guerrini 2002, p. 57). As a consequence, Descartes regarded animals as living machines (Sambraus 1997, pp. 3-4; Dolan 1999, p. 17) who "act naturally and mechanically, like a clock […]. All [animal motions] originate from the corporeal and mechanical principle (Descartes 1989 cited by Orlans *et al.* 1998, p. 9). Descartes portrayed also humans as machines and explained the human body function in relation to mechanical principles (Sambraus 1997, pp. 3-4). Guerrini (2002, p. 58) pointed out that Descartes shared the fascination of mechanical clocks with Thomas Aquinas who made the statement that animals are (like) machines four centuries earlier.

While for many contemporary interpreters, Descartes' view gave rise to a modern science in which nature was understood as inanimate matter without spiritual share, for Descartes his mechanical principle granted the primacy of the soul that was inextricably linked with mind and thus had primarily a theological connotation (Guerrini 2002, pp. 57-58). The single-sided interpretation of Descartes' ideas led to fatal treatments of animals in the following periods (Sambraus 1997, p. 4). Cartesian view resulted in an enormous spreading of vivisection and cruelty to animals accompanied by the ignorance of animal suffering in experiments. Cartesian notions, which are justified by small differences in the neural anatomy between humans and animals, are prevalent until today (Rollin 1981, p. 10; Kiley-Worthington 1990, p. 39).

The ability to reason has usually been associated with the possession of language. René Descartes regarded the possession of language as a prerequisite for having minds and the capacity to think and feel (Rollin 1981, p. 10). Descartes in his work *Discourses* Part V claimed that animals „cannot form statements by which they may make known their thoughts and they do not act from knowledge, only from the disposition of their organs" (Dolan 1999, p. 126). Since animals do not have speech, they are incapable of thinking, feeling and reasoning and are therefore mere machines (Rollin 1981, p. 10; Dolan 1999, p. 126; Guerrini 2002, p. 58).

Guerrini (2002, p. 59) further asserted that for Descartes speech is essential for the existence of mind. He regarded sounds emitted by animals as a result of stimulus and merely to communicate their feelings. According to Guerrini "Descartes did not believe that animals suffered pain in the same way in that humans did". Descartes maintained that feeling pain in animals is merely a nervous phenomenon, but not tied to cognitive experience as in humans who possess a will and therefore a soul. Although Descartes denied the animal's ability to consciously and reflectively perceive pain, he did not hold that animals are completely insensitive to bodily pain (Maehle 1992 cited by Sambraus 1997, p. 4).

As a result, Cartesian view advocates that animals are excluded from the scope of moral concern, since they possess neither reason nor language (Rollin 1981, p. 11) and that humans have no moral obligations to animals (Orlans *et al*. 1998, p. 9). In this regard, Rollin (1981, p. 11) raised the objection that in fact being a moral agent ("a being whose actions and intentions can be assessed as right and wrong […]") or holding a person responsible for her or his actions is tied to the rationality of the person, but one need not be a moral agent to deserve moral consideration. Indeed, infants or the mentally disabled persons are morally relevant, although they are neither moral agents nor accountable for their deeds.

Unlike Descartes, the Scottish philosopher David Hume (1711-1776), who was in the British empiricist tradition, alleged that knowledge is based on experience and sensory perception rather than pure thought. Hume doubted the rightness of scientific theory including the notion of reason; for him all reasoning is attributed to habit or conditioning. He alleged that human beings reason about the world just like animals do (Rollin 1981, pp. 16, 23). According to Dolan (1999, p. 126) David Hume contradicts Descartes' view that animals lack mental capacities and Christian tradition stating

> [n]o truth appears to me more evident than that beasts are endowed with thought and reason as well as man [...]. In performing goal-directed actions, animals like men, are guided by reason and design, and from the similarity of their external actions to our own we can deduce the similarity of their internal or mental actions.

As an evidence of thought, Hume discussed the adaptive behaviour of animals in food acquisition and their strategic action, when using tools. Apart from the capacity to reason, Hume attributed also sensations, such as sympathy to animals and stressed the analogy in nonhuman and human abilities. On the other hand, the Scottish philosopher also calls attention to the obvious discontinuities between human and nonhuman animals, namely the lack of virtue (and vice) (Orlans *et al.* 1998, p. 10). Descartes' statement that animals lack both reason and speech also evoked criticism. The Jesuit Gabriel Daniel, in his V*oyage to the World of Descartes* (1690) argued against Descartes' doctrine and held that animals possess some sort of rational behaviour, which derives from a "'sensitive soul'", once suggested by Aristotle (Guerrini 2002, p. 63).

Alike, the French philosopher Voltaire (1694-1778) rejected Descartes' view that living beings have „the faculties of thought, feeling and memory" by virtue of language and argued that, when faced with the same stimuli, animals show much the same behavioural patterns as humans (Dolan 1999, p. 126). The moral philosopher Jean-Jacques Rousseau (1712-1778), finally, asserted that animals, although incapable to recognize it, take part in a "natural law". For Rousseau human beings have certain moral obligation toward animals, since sensations are equal in animals and humans. Unnecessary abuse and cruelty is forbidden and priority to human interest is given only, when the maintenance of human life is jeopardized (Sambraus 1997, p. 4).

2.2.2.4 Social contract theories

When considering the moral relevance of animals, it is also interesting to discuss social contract theories. These theories can be traced back to the ancient Greek philosophy and regard being an object of moral concern in relation to being a moral agent (Rollin 1981, p. 11). According to this theory, morality or moral concern is linked with a living beings' capability to enter into a contract and voluntarily agree upon a set of rules. The agreement among individuals guarantees mutual rights and obligations (Rollin 1981, p. 11; Regan 1987, p. 181; Wolf 1990, p. 30). In order to ensure justice when entering into a contract, John Rawls in his work *A Theory of Justice* demands the parties to look behind a *veil of ignorance*, i.e., no individual knows his own strengths and weaknesses (Rollin 1981, p. 12; Regan 1987, p. 182).

Only those beings having the ability to act morally, i.e., rational beings, fall within the scope of moral concern (Rollin 1981, p. 11; Regan 1987, p. 181; Wolf 1990, p. 30). „Since animals are incapable of entering into such agreements, lacking both reason and language and not being moral agents, they are not objects of moral concern either" (Rollin 1981, p. 11). Thus, social contract theories deny that humans have direct duties to animals (Regan 1987, p. 182). However, human beings do have moral obligations to humans – infants, mentally retarded, comatose, addicted, who are incapable of making or accepting a contract themselves (Rollin 1981, pp. 12-13; Regan 1987, p. 181). If contract theories advocate that humans have obligations to those human to whom great moral compassion is attached, then obviously other criteria than being rational and capable to enter into a contract are decisive to become an object of moral concern (Rollin 1981, pp. 12-13).

Alike, the possession of language as a necessity to make a contract has been called into question. Regarding the animal's incapability to enter into social contracts, since they lack language and therefore cannot express their acceptance of regulations, Rollin (1981, pp. 13-14) quoted David Hume in his *A Treatise of Human Nature*:

> two men who must row a boat across a river may adopt one certain rhythm from among many possibilities without verbally articulating this agreement in action, or even being able to affirm their acceptance. The point is that even if these rowers refuse to affirm that what they are doing involves an implicit agreement, they would surely still have one. The ability to affirm linguistically what one is doing seems irrelevant to having an implicit agreement - the mutually adjusted actions are what is important. So obviously, language-using reason is not necessary for such agreements. And it is quite clear that animals also exhibit behaviors that qualify as agreements, both with humans and with each other.

2.2.2.5 Kantian reason and indirect duties to animals

The moral thought of the German philosopher Immanuel Kant (1724-1804) is closely related to deontology claiming that the rightness of an action is not only determined by the consequences of the action but also by fundamental principles or rules (Tannenbaum 1995, p. 39; Orlans *et al.* 1998, p. 25; Dolan 1999, p. 46). In Kant's position it is not morally justifiable to treat animals in any way, although they are not themselves objects of moral attention. Evolving historically from the view of human dominion of animals, the writings of Kant had an influence on the arising European anti-cruelty legislation (Rollin 1981, p. 9).

Kant's approach in dealing with animals is embedded in his theory of reason. The notion of reason is fundamental in his philosophy and is explained in his main writing *Critique of pure reason*. "For him, the bases of science and ethics needed to be logically proved, much as theorems in geometry are proved, not merely assumed or derived from experience". Kant sharply contradicted the British empiricist tradition primarily represented by the philosopher David Hume, which founded the generation of knowledge on sensual experience. While Kant argued that only beings capable of reason are regarded as moral agents, i.e., to be held re-

sponsible for their actions and therefore only rational beings fall within the scope of moral concern, Hume denies that reason is unique to human beings (Rollin 1981, pp. 15-16, 23, 28).

Rationality is, according to Kant, closely related to *a priori* knowledge - „knowledge that cannot be shown to be false by experience and can be known to be true simply by thought". For example, the sum of the angels of a Euclidean triangle can be verified by reason and known to be true. Thus, in contrast to Hume, Kant held that natural phenomena can be known by science *a priori*. The possession of *a priori* knowledge allows making judgements that claim universality independent of time and location. Since only human beings can formulate and understand statements that are universal, only human beings are rational. Therefore, in Kant's view rationality depends on a beings ability to understand and articulate universal laws (Rollin 1981, p. 16).

Morality in Kant's deontological theory is founded on the *Categorical Imperative* or basic moral law, as described in his writings *foundation of the metaphysics of morals* and the *critique of practical reason*. Moral duties of a person are derived from this supreme, universally valid principle (Rollin 1981, p. 17; Tannenbaum 1995, p. 39; Orlans *et al.* 1998, p. 25; Dolan 1999, p. 46) that demands: 'Act only according to a principle which you can will would be a universal law' (Kant 1948, p. 421 cited by Rollin 1981, p. 17). According to Orlans *et al.* (1998, p. 25) for Kant "[a]n action has moral worth only when performed by an agent who possesses a good will, and a person has a good will only if moral obligation based on a universally valid rule is the sole motive for the action".

Kant (1948, p. 429) cited by Rollin (1981, p. 17) and Wolf (1990, p. 33) further concluded: 'So act that you treat any human being, whether yourself or any other, always as an end and never merely as a means'. Rollin (1981, p. 18) explained that

> [...] to be moral involves treating other men as ends in themselves. If rationality is the same kind of thing in all men, it would be absurd for one human rational being to treat another human rational being in a way that simply uses the other person as a means to some immediate goal, say, wealth. For as rational beings, we are seeking rational activity as our end or ultimate purpose or goal. Since others are striving for exactly the same goal, and all rational activity is the same, it is irrational for us to use them; rather, we are obliged to nurture them in their attempt to accomplish that which we ourselves are and ought to be trying to achieve.

According to Kant's theory solely rational beings are "'ends in themselves'" and are thus not to be used as a means to achieve a goal (Rollin 1981, p. 18). Human rationality that confers dignity puts humans in a privileged position in the order of beings and this outstanding position motivates moral action (Wolf 1990, p. 33; Orlans *et al.* 1998, p. 26). As only humans are capable of reason, only humans are objects of moral concern. Animals, on the other hand, are no "ends in themselves" but are „[...] merely as means to an end. That end is man" (Kant 1963, p. 239 cited by Rollin 1981, pp. 18-19). As a consequence, animals are excluded from being an object of moral concern, because they are not rational and have only instrumental value (Rollin 1981, p. 19; Orlans *et al.* 1998, pp. 25-26).

Kantian view further regards the possession of language, which has been associated with being rational, as a decisive factor to differentiate humans and animals. Reasoning requires the ability to develop concepts or general notions that are linked to individual words of a language. It involves making universal judgements, as for example, when pentagons have more sides than do squares and squares have more sides than do triangles, than pentagons have more sides than triangles. Like Aristotle and Descartes, Kant in his work *Critique of pure reason* "equated reason with the possession of language and denied linguistic ability to animals". Since animals are incapable of language, they are excluded from the scope of moral concern (Rollin 1981, pp. 19-20; 22).

Although animals are not themselves objects of moral concern, unnecessary cruelty to animals is prohibited, not, because they are morally relevant, but because humans who act cruelly against animals will also engage in brutality to other humans.Therefore, humans have, according to Kant, no direct obligations to animals, only indirect ones (Rollin 1981, pp. 9, 19; Orlans *et al.* 1998, p. 26). Wolf (1990, p. 35) claimed that in Kant's theory duties toward animals are reinterpreted as duties toward humankind in order to include the ordinary notion that animals should not be exposed to unnecessary cruelty.

Clearly, reason is necessary for a being to be considered as accountable for its deeds or as a moral agent, but inconsistency in Kant's argumentation arises with respect to the granting of moral concern. If, only beings that are rational and capable of language deserve moral attention, than babies, the mentally retarded, and the senile, etc. could not be regarded as objects of moral concern. Since owing to elementary commitment such humans are considered as morally relevant, rationality and linguistic ability cannot be a necessary precondition for moral consideration (Rollin 1981, pp. 27-29; Wolf 1990, p. 34; Orlans *et al.* 1998, p. 26). Thus, rationality is apparently not the sole criteria that make humans and animals fall within the scope of moral concern (Rollin 1981, pp. 29).

2.2.2.6 Bentham's theory of justice

Jeremy Bentham's theory, which is basically rooted in utilitarianism, emphasizes the importance of pleasure and pain in relation to the moral status of animals. Bentham (1748-1832), who was one of the earliest utilitarian (Orlans *et al.* 1998, p. 22), in his work *Introduction to the principles of morals and legislation,* claimed that an action is right when it produces "the greatest amount of pleasure (or least possible amount of pain) for the greatest number". To ascertain the total amount of consequences requires considering all beings capable of suffering (Rollin 1981, p. 29).

In Bentham's view the reason for denying legal rights to animals cannot be that they lack rationality, because little children lack rationality as well (Teutsch 1985, p. 23). In this regard, he stated: „The question is not, Can they [nonhuman animals] *reason*? Nor, Can they *talk*? But, Can they *suffer*?" (Bentham 1789 cited by Orlans *et al.* 1998, pp. 22-23). Bentham's statement was a reflection on Descartes' comment: „Animals cannot talk, therefore they cannot think, therefore they cannot feel" (Dolan 1999, p. 64). In contrast to Cartesian view, which denies any feelings in animals (Rollin 1981, p. 30), Bentham argued that animals, like humans, have the capacity to experience pleasure, pain and suffering (Orlans *et al.* 1998, p. 22).

Bentham has made the ability to suffer the sole criterion for moral relevance. Unlike Kant's approach, his theory does not exclude retarded persons or children from the scope of moral concern (Rollin 1981, p. 29). Lack of properties representing personhood, as reason or language, did not for Bentham justify denying the moral status of animals. Rather, in his view, animals are morally relevant in their own right; human obligations toward animals and noninfliction of pain and suffering are independent of any duty toward animal owners (Orlans *et al.* 1998, pp. 22-23). Bentham is opposed to the view that humans are allowed to exploit and kill animals merely, because of their dominance implied by rationality (Teutsch 1985, p. 23).

Furthermore, Jeremy Bentham in his work *On the Principles of Morals and Legislation* (1780) took first steps to a modern ethic of justice that bridged the differences between the species (Teutsch 1985, p. 23). Bentham included the principle of moral equality in his utilitarian approach. According to this principle „[t]he interests of every being [...] affected by an action are to be taken into account and given the same weight as the like interests of any other being" (Dolan 1999, p. 49). This principle of equality is based on the fact that both humans and ani-

mals share the capacity to experience pain and suffering and forbids cruelty to animals in the same way as abuse to humans that are at a disadvantage (Teutsch 1985, p. 24).

Sandoe *et al.* (1997, p. 8) argued that the utilitarian position lacks respect to the moral value of human and non-human individuals. Since utilitarianism is related to the overall well-being, it offends against the common notion of individual moral rights (Wolf, 1990, pp. 49-50). Nevertheless, when making ethical decisions concerning the treatment of animals, utilitarian considerations of alternative actions may be relevant. For example, utilitarian weighing of benefits and detriments is applied in the decision to euthanize a terminally ill animal to prevent it from unnecessary pain (Tannenbaum 1995, p. 126).

Dolan (1999, pp. 51-52) raised the objection of comparability of different qualities of pleasure and pain experienced by a person in different situations. The assessment will even be less reliable in interpersonal and inter-species comparisons. In addition, the question of the distribution of the greatest happiness arises: “Is a state of affairs in which one person is supremely happy and nine are miserable […], better than one in which all ten are equally happy, provided that only the total balance of happiness is greater?” Dolan claimed that neither intellectual endeavour nor investigation of facts can produce a satisfactory answer whether the interests of animals should be weighted without distinction to human beings.

2.2.2.7 Morality motivated by compassion

The German philosopher Arthur Schopenhauer (1788-1860) was strongly influenced by the “Romantic German biological theory known as *Naturphilosophie*”. The *Naturphilosophen* alleged that mind originated from nature and therefore denied the stringent Cartesian separation between body and mind (Guerrini 2002, p. 64). In his work *On the Basis of Morality* he disapproved of the Cartesian view that animals are not self-conscious and have no ego arguing: „If any Cartesian were to find himself clawed by a tiger, he would become aware in the clearest possible manner of the sharp distinction such a beast draws between its ego and its non-ego“ (Dolan 1999, p. 126). In this regard, Schopenhauer, along with Hume and Voltaire, highlighted evidences of similarity between humans and animals (Dolan 1999, p. 126). Although Schopenhauer shared Descartes’ view that animals lack reason and cannot conceive abstract concepts, he did not share lack of consciousness. However, the inability to reason was not a sufficient criterion for Schopenhauer to omit animals from moral concern (Guerrini 2002, p. 64).

Schopenhauer in *On the Basis of Morality* also criticized Kant’s theory of reason vigorously arguing against the view that abuse of animals is morally wrong only, because it can generate cruelty between human beings. He did not accept that lack of reason does results in being treated merely as means to a human end (Guerrini 2002, p. 64). Schopenhauer further disapproved that in Kant’s theory human moral obligation is grounded in a law. Since moral action is motivated by the avoidance of punishment and other costs, it is selfish and without moral value. For Schopenhauer the question of motivation remains unclear in Kant’s approach. Consequently, Schopenhauer’s directed his moral philosophy not to selfishness but to altruism; the motivation for moral acting is based on the emotion of compassion from which derives justice and kindness. Being constitutive for moral action, pity, as a phenomenon of daily life, can be applied to both humans and animals. Thus, animals are included directly in the sphere of moral concern (Wolf 1990, pp. 48-51).

As for Bentham’s utilitarianism, for Schopenhauer’s *Mitleidsmoral* (morality of compassion), the reduction of suffering is central (Wolf 1990, pp. 49-50). Schopenhauer regarded compassion as the only true moral motivation. The animal’s capacity to suffer makes it to a recipient of compassion (Guerrini 2002, p. 64). In contrast to utilitarian views that aim at overall welfare, the morality of compassion is directed to the welfare of individuals, i.e., pity is not con-

cerned with states of suffering in general rather than individual beings that suffer. While utilitarianism aims at minimization of suffering and maximization of fortune, Schopenhauer's morality demands not to cause suffering to other beings and to help them, if they suffer (Wolf 1990, pp. 50-52).

Like Bentham, Schopenhauer attempted to deduce justice from his moral theory. However, for Schopenhauer's ethic, the problem of impartiality arises (Teutsch 1990, pp. 60-61; Wolf 1990, p. 51). Although pity is related to individuals, the *Mitleidsmoral* cannot constitute a framework for individual rights, because it is not founded on an absolute value but on a general attitude. Thus, the question how to weigh the variety of attitudes remains open and the morality of compassion allows suffering in order to prevent more severe suffering. If, for example, a person holds both the *Mitleidsmoral* and the view that humans are more important than animals, it could be concluded that morality with respect to animals is of minor significance (Wolf 1990, pp. 52-53).

In Schopenhauer's work some elementary ideas are developed which recurred in the history of the animal protection movement. Although it appears to be unreasonable at first glance, Schopenhauer linked his philosophy of animal protection and antivivisection with anti-Semitic (Brumme 2001, p. 108; Guerrini 2002, p. 65) and partly anti-Christian notions (Brumme 2001, p. 108). In his work *On the Basis of Morality* Schopenhauer wrote that "'The "revoltingly crude" idea that we have no duties to animals was "a barbarism of the West, the source of which is to be found in Judaism'" (Guerrini 2002, p. 65). Additionally, Schopenhauer identified the unnatural division of human and animal world based on the prescriptions in the book of Genesis in the Old Testament as a cardinal fault of Christianity (Brumme 2001, p. 111). Guerrini (2002, p. 65) stated that even in the nineteenth and early twentieth centuries "the rhetoric of anti-Semitism remained tied in various degrees to sympathy for animals and particularly to antivivisection" and culminated in the inexpressible horror of Nazi Deutschland (a more detailed analysis of this issue is provided by Guerrini).

2.2.3 Contemporary ethical concepts about animals

Since domestication of animals has taken place around 10,000 to 12,000 years ago, human beings have been living in close contact with their animals (Hodges 1999, p. 159). The gradual introduction of new technologies in animal agriculture during the last century resulted not only in an increased efficiency of production but also in a change of the human-animal relationship. The animal ethic that traditionally accompanied animal husbandry lost its significance (Swanson 1995, p. 2744). Especially the dramatic structural alterations in the second half of the twentieth century gave rise to criticism of the poor treatment of animals in intensive animal production and new impetus to the philosophical study of farm animal welfare. Contemporary moral concepts about animals are primarily directed to animal interests and animal rights.

2.2.3.1 The impact of technological innovation on animal ethics

The husbandry of domestic animals enabled previously hunting and gathering people to engage in sedentary crop production and to reduce human dependence on nature (Stricklin and Swanson 1993, p. 69; Hodges 1999, p. 159). In traditional integrated agriculture, as it occurred in Europe until about the 1960s, the human-farm animal relation was characterized by mutual benefits. While animals provided draught power, dung to conserve soil fertility, protein-rich products for human consumption and raw materials, such as wool and leather, animals in turn were offered feed, shelter and care and most notably they were kept under con-

ditions to which they were constitutionally and physiologically adapted (Stricklin and Swanson 1993, pp. 69-70; Thompson 1993, p. 44; Rollin 1995, p. 5; Hodges 1999, pp. 159-160).

According to Rollin (1995, pp. 6-8) farmers had a strong interest in the well-being of their animals, because the thriving of the farming family was intimately connected with the thriving of livestock. Since human influence on natural conditions was limited, animals may have suffered from drought, rigors of weather and contagious diseases. Any infliction in livestock, such as castration, was short-term. Although rough handling may have occurred, harming the integrity of animals directly by the animal owners was in general avoided. Under these circumstances ethics and self-interest of farmers were closely related. „Any prolonged suffering inflicted on an animal by a producer, any systematic attempt to violate or work against the animals' natures would ultimately work just as much against the producers' interests as against the interests of the animals". Thus, good husbandry coincided with the self-interest of the farmer and was compulsory by traditional ethic. The anti-cruelty ethic banned cruelty to animals, mainly, because animal abuse was contrary to the economic interests of farmers.

Tannenbaum (1995, p. 120) maintained that the anti-cruelty position suggests that animals used by humans have an interest in not experiencing pain or suffering, or, if it is unavoidable, in not experiencing unnecessary pain or suffering. Since animal keeper normally cared for their animals, the anti-cruelty ethic, punished neglect in providing food, water, and shelter as well as deliberate sadistic and unnecessary infliction of pain and suffering. Many societies have enacted laws against cruelty to animals not only to protect animals but also because cruelty to animals may lead to brutality to humans. The first anti-cruelty laws of the early nineteenth century prohibited human deviant behaviour towards animals, while common agricultural practices remained unconsidered (Rollin 1995, p. 7; 2000, p. 88; 2001, p. 88).

This traditional ethic increasingly grew inapplicable, when technological innovations in animal agriculture were carried out. In Europe about 200 years ago first ideas about the modernization of agriculture emerged. For example, the German agronomist Albrecht Daniel Thaer (1752-1828) developed a new notion of farm animals, framed by an extensive modernization programme. A maxim of Thaer's approach was: "Kühe sind als Maschinen zu betrachten, die Futter in Milch verarbeiten" (Cows are to be regarded as machines which convert fodder into milk, own translation) (Thaer 1810-1812 cited by Inhetveen 2001, p. 13). Thaer's reform involved a change of the paradigm – from a traditional to a modern, efficient agriculture (Inhetveen 2001, pp. 13-14).

The most crucial alteration in agriculture took place in the second half of the twentieth century. According to Harrison (1993, p. 4) pattern of livestock farming shifted to mechanization as a result of food and labour shortage after World War II. Low cost protein supplements and fuel from the world market favoured high energy demanding animal production systems. Technological advancements, such as the wide-spread use of antibiotics, enabled farmers to keep large herds of animals without facing epidemics and therefore to engage in mass production (Stricklin and Swanson 1993, p. 67; Rollin 1995, p. 9). As a result, in capital intensive facilities large numbers of animals were kept under confinement (Rollin 2000, p. 89). Gradually fundamental agricultural values were replaced by industrial values based on economies of scale (Rollin 2001, p. 90).

Industrialization of animal agriculture has led to a significant increase of productivity and efficiency (Rollin 1995, p. 9 and 2000, p. 89). The enormous changes have also affected the lives of the animals (Regan 1983, p. 97; Rollin 1995, pp. 9-11). Owing to "small profit margins per animal", the number of stockpersons has declined while the number of animals reared per farm has increased. Thus, the attention paid to the individual animal has decreased. In addition, the availability of new technologies entailed the alteration of animal environments. While in traditional agriculture domestic animals were kept under extensive conditions to which they were adapted in a long-term breeding process, in modern systems (e.g.

battery cages, farrowing crates) livestock is often kept contrary to their natures (Rollin 1995, pp. 9-11 and 2000, pp. 89-92).

Under these novel conditions, animals are subjected to harm, because there biological needs and desires are disregarded (Regan 1983, p. 98). Suffering in animals is induced by physical and mental deprivation owing to limited space, restriction of movement, isolation or boredom as well as by system related illnesses, such as metabolic disturbances, mastitis, or hoof disorders (Stricklin and Swanson 1993, p. 67; Rollin 1995, pp. 9-11 and 2000, pp. 89-92). In traditional animal husbandry the productivity of animals was linked with the welfare of both animals and humans and therefore the animal keeper's self-interest ensured that farm animals were treated good. This bond did not continue to exist in industrialized farming systems (Rollin 2001, p. 90).

Since it cannot be asserted that farmers in industrialized animal agriculture act overtly intentionally cruel, the application of the traditional anti-cruelty ethic was inappropriate and new ethical concepts were required (Rollin 1995, p. 9). Accompanied by a growing public awareness a new ethic emerged that not only rejected unnecessary cruelty to animals but also took account for the interests of farm animals in altered environments. These interests that are integral part of an animal's nature go beyond freedom from pain or unnecessary suffering and their ignorance matters to the animal (Rollin 1995, pp. 17-18; Tannenbaum 1995, pp. 122-123). It is worth to be noted that these new moral standards are not contradictory to animal use, but the use of animals for food, fibre, and transport demands that they „live lives that respect their natures" (Rollin 1995, pp. 17-18).

However, respect for the animal's nature is not self-evident, as it was in traditional animal agriculture and hence there is a social need to encode it in law. The conferring of rights on animals is a consequent answer after traditional animal husbandry has disappeared and protects elementary interests of animals (Rollin 1995, pp. 17-18). The approach for animal rights follows moral categories of human minorities applied to, for example, women and blacks during recently (Rollin 2000, p. 93 and 2001, p. 89). Although the ethical debate is still going on, the Council of Europe has produced a number of directives with regard to animal welfare that have widely been adopted by the member states. Article 3 of the European agreement for the protection of animals in animal agriculture demands to consider the nature, the stage of development, adaptation and domestication as well as the physiological and ethological needs of individual animals (see Baumgartner 1999, pp. 2-3).

2.2.3.2 Animal interests and moral concern

Modern views concerning the moral relevance of animals are largely orientated towards the interests of animals. Regan (1983, pp. 87-89) in his book *The Case for Animal Rights* maintained that having an interest is not only being *interested in* something in the sense of desires or wants, something someone prefers having (*preference-interests*). From having or doing something a benefit could arise that would make a contribution to the well-being of an individual (*welfare-interests*).

> Despite many possible differences, however, certain conditions are universal for all humans and animals, if each is to have a reasonable chance to live well. Adequate nourishment, shelter, water, and rest, for example, are such conditions. They constitute basic biological needs of both humans and animals. [...] we can make sense of saying that cars and flowers need water without implying that they desire it. [...] there is no reason to deny that they are like us in having both episodic and dispositional interests relative to their basic needs. Like flowers, animals have a basic biological need for water and nourishment; but like us, and in this respect unlike flowers, they prefer to have these needs satisfied rather than unsatisfied. Correlated with their basic needs, in short, animals, like us, have desires. They are interested in food and water, just as food and water are in their interests.

Rollin (1981, pp. 34-36, 40-41) further explained the idea of animal interests. Pain and pleasure is not an entirely sufficient criterion to grant animals moral consideration, because human action may be immoral even, if it does not cause pain. For example, it is regarded to be morally wrong to kill a person painlessly to avoid her future suffering. Similarly, it is also considered to be wrong to confine a wild animal that naturally roams around a large territory in a small cage. Although such a treatment does not cause pain, it violates the animal's nature and dignity. Thus, Rollin argued that it is the presence of needs, desires, wants, or, more generally, interests what makes animals fall within the scope of moral concern. Having an *interest* means for Rollin that a certain need matters to the animal. Since animals are usually concerned, when their needs are thwarted, the possession of interests appears to be associated with at least some amount of conscious awareness. Animal interests can be helped or hindered by those who care for them.

Even at the beginning of the twentieth century the German philosopher Leonard Nelson (1882-1927) emphasized the importance of animal interests with respect to the moral treatment of animals. Nelson disapproved Kant's ethic that prohibited cruelty to animals only insofar that it predisposes humans to be brutal to each other (Teutsch 1985, p. 21). According to Nelson's philosophical concept animals do not possess an autonomous rationality like human beings, but they have interests and therefore they deserve moral consideration (Wolf 1990, p. 38). Nelson (1971, p. 87) cited by Teutsch (1985, p. 21) argued that who admits that cruelty to animals can occur, presupposes that they have interests and this implies the prohibition of cruelty to animals directly from the *Sittengesetz* (moral law). The *Sittengesetz* demands humans to ask themselves how they wish to be treated in a situation analogous to animals. Since no being wishes to be exposed to another being's arbitrariness helplessly, it is morally wrong to treat animals as a mere means to an end. Thus, right conduct requires humans to account for animal interests in a way in which they themselves could feel treated justly, if they were in place of animals (Teutsch 1990, p. 61).

Although there is a general consensus that the interests of animals should be helped, little agreement exists about how much weight the interests of animals should be given compared with human interests. Tannenbaum (1995, p. 127) assumed that the mental sophistication of individuals is crucial in weighing human and animal interests. For Tannenbaum the interests of humans and animals have equal weight as far as "living, not being eaten or experimented on, and in not being used as a means toward any one else's ends" is concerned. Hurnik (1993, p. 23) emphasized the relation between animal interests and the interests of farmers and society and made considerations in terms of the acceptability of certain production practices. According to Hurnik the acceptability is highest, when the interests of all affected parties are taken into account and their benefits are maximized to the greatest possible number (Table 2.10). While farm animals might be interested in leading a good quality of life in which their needs are satisfied, animal farmer may expect a fair income, agreeable working conditions and a good social reputation. The interests of the society are to obtain cheap and high quality food in an ecologically sound environment.

Table 2.10 Interests of groups involved in animal husbandry practices

Farm animals	Satisfaction of life-sustaining needs Satisfaction of health-sustaining needs Satisfaction of comfort-sustaining needs
Farmers	Occupational opportunity and fair income Satisfactory working conditions Good social reputation
Society	Healthy and affordable food Variety of available food Ecological sustainability of food production

Modified from Hurnik (1993, p. 23)

2.2.3.3 Contemporary utilitarian considerations by Peter Singer

The book *Animal Liberation* (1975) by the Australian philosopher Peter Singer has more than any other work influenced the present-day ethical debate about animals (Wolf 1990, p. 44; DeGrazia 1996, pp. 2-3). Adopting a utilitarian view (compare 2.2.1.4) Singer based moral action on the consequences of this action and pursues the goal to reduce suffering and to increase good fortune (Wolf 1990, p. 44). For Singer the capacity to experience suffering and pleasure is a precondition for the possession of interests. Being capable of suffering and being sentient implies a moral obligation to consider the suffering independent of the nature of the being (DeGrazia 1996, pp. 2-3; Dolan 1999, p. 118). Sentience and having interests bestows moral status on animals (DeGrazia 1996, pp. 2-3). As quoted by Orlans *et al*. (1998, p. 23), Singer in the work Encyclopedia of Bioethics stated that the justification of the human use of animals "takes account of their interests-utility from the animal's perspective". Thus, according to Singer the morality of any use of animals is directed to the maximization of interests in all affected individuals (Wolf 1990, pp. 44-45).

Singer (1990, p. 9) argued against the common views that "all humans are equal in moral status" and that "all humans are of superior moral status to non-human animals", which he supposed to reflect the Judaeo-Christian notion of the human-animal relation. Singer's approach is guided by the idea of *equal consideration of interests* that was first discussed by Jeremy Bentham (Dolan 1999, p. 134). Accordingly, "[…] the interests of every being affected by an action are to be taken into account and given the same weight as the like interests of any other being […]" (Singer 1989, pp. 74-79 cited by Sandoe *et al.* 1997, p. 6). Singer (1992) cited by Dolan (1999, p. 114) claimed that the basic principle of equality that is extended to all human beings should also be extended to other species and thus grounded his ethic on the principle of equality.

For Singer (1990, pp. 9-10) being a member of the species *Homo sapiens* does not entitle a being to particular moral concern. Opponents of this view defended *speciesism*, which refers to the idea that "species membership is, *in itself*, a reason for giving more weight to the interests of one being than to those of another". Singer (p. 10) objected that they do not defend the membership in a species in itself, but for them the morally relevant differences in mental capacities of the species are the reason for unequal weighing of interests. Thus, human properties, including self-consciousness, rationality and moral judging, are equalized with being *human* or member of *Homo sapiens*. In fact, these traits could justify a higher level of moral consideration. However, according to Singer, basing the principle of human equality on superior mental complexity incorporates a problem: Newborns and mentally disabled human beings lack these capacities and, therefore, do not fall within the scope of human equality.

Singer further argued that in order to include human beings being at a disadvantage "under the protection of the principle of human equality", not intellectual abilities, but the capability to feel pleasure and pain could be made a criterion to fall under the principle of human equality. Though, these new standards would also be fulfilled by animals. Since their intellectual capacities overlap, it is impossible to draw a line that clearly separates humans from animals. In this regard, Dolan (1999, p. 116) stressed that applying the principle of equality in two different groups does not imply that both groups must be treated in the same way, nor granted the same rights. On the contrary, equal consideration of distinct beings may result in different treatment.

Another issue developed to defend speciesism is that it is the *essential feature* of a species what counts. According to this view, the essential nature of humanity differs from the essential nature of animals. Singer in his argumentation against this point of view followed feminist statements. He alleged that arguments for the admittance of women to higher education clearly focused on the individual capacity of a woman or a man, not on the capacity of the respective group, when equality between the sexes was under debate (Singer 1990, pp. 10-11). Contradicting speciesism, Singer also developed analogy to anti-racist considerations.

While in a conflict of interests the racist partially weighs the interests of humans being members of the same race, the speciesist gives preference to the interests of his own species. The principle of equality is violated in both cases (Dolan 1999, p. 118).

Singer's ethic also drew attention to the point of killing animals for food and pleads for human vegetarianism. Singer claimed that eating animals is treating them as means to a human end (Dolan 1999, p. 118). He advocated humans to abstain from meat consumption, because commercial animal production causes animals to suffer. It is worth to be noted that Singer does not condemn killing of animals as long as their needs are fulfilled and they are killed painlessly (Singer 1979, pp. 152-153 cited by Sandoe *et al*. 1997, p. 7). He maintained that inflicting suffering on live animals may more clearly indicate speciesism than killing them (Singer 1975 cited by Dolan 1999, p. 119).

Since in Singer's morality priority is given to the overall benefit, interests of individuals may be violated (Wolf, 1990, p. 45; Orlans *et al.* 1998, p. 24) and respect for the moral value of human and non-human individuals is lacking (Regan 1987, p. 184; Sandoe 1997, p. 8). The American philosopher Tom Regan attempted to overcome this weakness by his theory of rights. This theory essentially differs from Singer's utilitarianism in that it protects the interests of one individual against the interests of another, while the utilitarian decision is based on the strongest interests, when the interests of two parties are in conflict. Although the rights view gives priority to the interests of individuals, difficulties may arise, if "it is not possible to respect the rights of all individuals" (Sandoe *et al.* 1997, pp. 9-10). Hurnik (1993, p. 29) provided a modified comparison of utilitarianism and animal rights view in terms of the tolerability of different forms of animal treatment previously given by Hurnik and Lehman (1988), as shown in table 2.11.

Table 2.11 Comparison of the acceptability of killing, harming and using animals in utilitarianism and animal rights position

Type of human action directed towards animals	Utilitarianism	Animal rights
Killing in self defense	Acceptable	Acceptable
Killing for other purposes	Conditionally acceptable [2]	Unacceptable [3]
Harming [1] in self defense	Acceptable	Acceptable
Harming [1] for other purposes	Conditionally acceptable [2]	Unacceptable [3]
Using but not killing or harming	Conditionally acceptable [2]	Conditionally acceptable [4]

[1] Includes deprivation, overstimulation, aversive stimulation, or any other situation which causes suffering.
[2] Only if positive consequences of given action for humans and animals outweigh, as much as possible, the overall negative consequences.
[3] It would violate the basic Animal Rights demand that animals which are able to control their own lives must have the right to do so.
[4] Only if such use would respect the inherent rights of animals and not interfere with their ability to control their own lives.

Source: Hurnik (1993, p. 29)

2.2.3.4 Tom Regan's animal rights view

The moral theory of Tom Regan can be assigned to a type of deontology (compare 2.2.1.4) called *inherentism* (Orlans *et al.* 1998, p. 26) which recognizes animals as having inherent value and therefore deserving moral consideration (Regan 1983, pp. 236-237 cited by Orlans *et al.* 1998, p. 26). In Regan's view the level of intellectual or moral capacity has no influence on the inherent value of a creature (Orlans *et al.* 1998, p. 27). In his book *The Case for Animal Rights*, he stated that "[...] animals [...] are creatures with a sophisticated mental life - a

mental life that differs from ours, in Darwin's words, in degree, not in kind" (Regan 1983, p. 83).

As a consequence, Regan's theory aims at the abolition of "recreational hunting, sports that exploit animals, scientific research involving animals, use of animals for food", and the like (Orlans *et al.* 1998, p. 27). Regan (1987, p. 188) asserted that

> [t]he fundamental moral wrong [of commercial animal agriculture] is not that animals are kept in stressful close confinement or in isolation, or that their pain and suffering, their needs and preferences are ignored or discounted. All these are wrong, of course, but they are not the fundamental wrong. They are symptoms and effects of the deeper, systematic wrong that allows these animals to be viewed and treated as lacking independent value, as resources for us – as, indeed, a renewable resource. Giving farm animal more space, more natural environments, more companions does not right the fundamental wrong […].

Regan's assumption that the possession of properties, such as memory, self-consciousness, emotions etc. generates inherent value in animals and therefore moral concern is highly disputed (e.g. Narveson 1987, p. 192; Wolf 1990, pp. 42-43; Tannenbaum 1995, pp. 127-128; Orlans *et al.* 1998, p. 27). Orlans *et al.* (1998, p. 27) criticized that it seems reasonable to suppose that "the lower the level of the traits the less the inherent value", when tying the inherent value of animals to certain properties. Tannenbaum (1995, pp. 127-128) maintained that Regan can not give credible evidence that, for example, a laboratory animal can be as self-conscious or can experience as sophisticated feelings as a human being.

> […] it is just not the case that a hamster, cow, horse, dog, or even a chimpanzee, is capable of all the same kinds of pleasures and pains, thoughts and decisions, and autonomous life as an adult human being of average mental ability. Regan's blanket generalizations are incompatible with the kind of ethical approach to animals we surely need - one that is willing to look carefully and scientifically at what animals really are and what they can do, and one that takes into account the enormous variety among animal species and individual animals of the same species.

Wolf 1990 (pp. 42-43) further asserted that since mental capacities that determine the inherent value of individuals are distributed empirically unequal, only a former stage of these capacities can be the basis of inherent value. However, this is a metaphysical premise and thus not accepted by everyone. Conferring rights to individuals based on the specific properties of these individuals is, therefore, vague. Alike, Hurnik (1993, p. 28) maintained that the rights theory is based on a vague concept of "inherent value". Wolf suggested the rejection of the model of individual rights and the development of a moral theory, which is based on the needs or interests of individuals.

In order to ascertain which individuals have inherent value and are therefore objects of moral concern, Regan regarded the autonomy of beings. Regan (1983, pp. 83-86) maintained that in the Kantian sense individuals are autonomous only if they are capable of reasoning, evaluate the merits of acts and make decisions in a way they can will that any other individual acts in return. From this point of view it is, according to Regan, highly doubtful that any animal is autonomous. Regan alternatively discussed that creatures are autonomous, if they have the ability to initiate action to satisfy their preferences. Autonomy in this sense, called *preference autonomy*, offers inherent value and moral status to adult mammals.

Regan (1983, p. 86) further pointed out that

> [t]he Kantian interpretation of autonomy does not give us a condition that must be met if one is to be autonomous in any sense. It provides a condition that must be met if one is to be an autonomous moral agent - that is, an individual who can be held morally accountable for the acts he performs or fails to perform, one who can rightly be blamed or praised, criticized or condemned. Central to the Kantian sense of autonomy is the idea that autonomous individuals can rise above thinking about their individual preferences and think about where their moral duty lies by bringing impartial reasons to bear on their deliberations.

As many before him, Tom Regan based his morality on the formal principle of justice, which demands providing for any individual what is owed to it. This principle rests on the postulate that all individuals are equal, since they have equal inherent value. The principle of justice implies that all individuals with inherent value deserve moral concern and respect. Having intrinsic value entails that animals have a legitimate claim for consideration - this claim Regan calls a moral right (Wolf 1990, pp. 38-40).

Regan's concept of animal rights is closely related to the concept of human rights. "Rights are justified claims that individuals, groups, and institutions can make upon others or upon society" (Orlans *et al.* 1998, p. 28) and have traditionally been protected the interests of individuals against the general welfare of the society (Rollin 1981, p. 73). Regan (1987, pp. 185-186) maintained that all human beings have equal inherent value and possess an equal right for respectful treatment. "[…] the rights view *in principle* denies the moral tolerability of any and all forms of racial, sexual, or social discrimination; and unlike utilitarianism, this view *in principle* denies that we can justify good results by using evil means that violate an individual's rights […]".

The animal rights view is based on the rights theory, which is grounded in contractarianism (compare 2.2.2.4, social contract theories). According to contractarianism, moralities comprise a set of regulations that people voluntarily agree upon as if they were written down in a contract. Those people who enter a contract themselves have rights they are entitled to in the contract. In addition, such rights are assigned to those who lack the ability to enter into a contract themselves including babies, mentally retarded humans and animals (Reagan 1987, pp. 181-182).

It is interesting to note that the notion of animal rights is not new. About 2000 years ago in the *Corpus Iuris Civile* of the Eastern Roman emperor Justinian it was formulated that the natural right is the right that nature has given to all living beings not only to human beings (Loeper 1994, p. 253). In the 18th century the protagonists of human rights Jeremy Bentham and Jean Jacques Rousseau demanded animal rights to protect them from pain and suffering (Loeper 1994, p. 253; Orlans *et al.* 1998, pp. 27-28) and a decade after Tom Regan the American philosopher Bernard Rollin (1995, p. 138) advocated the application of animal rights and their enforcement by law, because respect of the animals' natures is no longer self-evident in modern agriculture.

Nevertheless, Regans concept of animal rights has, particularly in the United States, been violently disputed (Teutsch 1987, p. 171). Dolan (1999, p. 134) criticized that the link between animals possessing interests and having rights is unclear. Cohen (1986, pp. 865-866) cited by Orlans *et al.* (1998, p. 29) in general denied rights for animals, since claiming a right is tied to a community of moral agents authorized to make such claims. Rights can solely possess those who are capable to make moral judgments and to exercise moral claims. Animals lack these abilities and therefore do not have rights. To make progress in the debate about the granting of animal rights, it seems to be useful to distinguish different types of rights.

According to Dolan (1999, pp. 135-136) "'A right is the power to claim what is due.' That power draws its force from law in the case of legal rights, from morality in the case of moral rights, and from the state of things in the case of natural rights". What is due in this definition is related to duty and duties correspond with rights. Dolan (pp. 139-140) further stated that natural rights are derived from "the nature of things", e.g., "'Man is born free…'". For Dolan natural rights of animals appear to arise from animals having certain interests and needs that are part of their intrinsic nature and from the awareness that humans, as their stewards, are obliged to treat them appropriately with regard for their intrinsic nature. As a consequence, humans have a duty to satisfy the needs of animals and to give them sufficient freedom to express their nature.

Dolan (p. 141) further expounded that moral rights may be derived from a symbiotic relationship between humans and animals in which the human use of animals places human beings under an obligation to their animals. Dolan compares the situation of humans and (farm) animals with a human profiteer and an exploited animal. Since it is widely accepted that a profiteer has duties to those being exploited, rights for animals are implied. The duties arising from moral rights could have more gravity than natural rights due to a more exact definition.

For Rollin (1981, p. 47) conferring moral rights on animals expresses that animals are objects of moral attention and have a legitimate claim to attention. However, for him (p. 50)

> [r]especting an animal's rights does not mean subordinating one's own interests to those of animals, any more than respecting human rights means letting other people take advantage of one. It does mean looking for ways of resolving conflicts of interests that consider the animal's interests [...]. Sometimes it may perhaps mean subordinating or sacrificing some of one's own interests, if reflective analysis tells one that they do not outweigh the interests of the animal [...].

Legal rights designate "'an interest recognized and protected by the law, respect for which is a duty and disregard of which is a wrong'". However, at present clear legal statements on animal rights are absent (Dolan 1999, p. 138). Recent initiatives to introduce animal rights in the German Constitution failed, because they did not achieve the necessary majority (Kloepfer 2000, p. 30). Granting of legal rights to animals is faced with the problem that animals can neither sue nor can be sued. Therefore, they cannot exercise their rights and are dependent on humans to enforce their rights (Wolf 1990, p. 40; Dolan 1999, p. 142, Kloepfer 2000, p. 32).

Loeper (1994, p. 253) applied the idea of human rights to sensitive non-human creatures and formulated: Firstly, animals have a right to lead a harmonious life according to their nature and their innate needs. Secondly, animals possess a fundamental right not to be treated arbitrarily and cruelly. Animals also have a right to be treated equally within their species. They have a right to be respected as a being with dignity that prohibits genetic manipulation. Finally, animals have a right to live. It requires that killing an animal is not the mere result of habit or economic benefit, but is grounded on responsibility. All these demands can certainly give rise to a new controversial discussion.

Peter Singer's Utilitarianism and Tom Regan's animal rights view have provided convincing argumentation about why farm animals deserve moral consideration. This ethic fills the gap that evolved, when new technologies were increasingly introduced in animal agriculture and the traditional ethic has grown to be ineffective. Though, from a farmer's point of view and the farmer is the most relevant acting person in relation to farm animal welfare the total abolition of the use of animals for food may meet disapproval, because it would abolish what was practiced since animal husbandry exists and in some cases would rob the farmer's livelihood. Therefore, a stop of killing farm animals would be a strong intervention in the traditional values of farming people and the society as a whole.

In this regard, Dolan's approach (1999, p. 141), which claims that it is the mutual human-animal relationship and the obligations arising from this relation that bestows moral rights on animals, appears to be more appropriate, because it is more orientated towards those who act. Hurnik (1993, p. 30) maintained that „*every sentient, living organism subjected to full, direct human control should have an opportunity to experience an environment for which its own genotype is predisposed, in order to develop into a physically and psychologically healthy organism*". Thus, Hurnik's concept aims at the farmer's code of profession that demands adequate concern for animals in captivity that are in need of human care. Stockpersons are responsible for their animals, because they use them and gain income from them. Such ideas that place emphasis on the farmer-farm animal relationship may have a great potential to initiate further progress in farm animal welfare.

It is further worth to portray Kiley-Worthington's scenario (1990, p. 40) for a situation in which meat production is refrained from. According to Kiley-Worthington a stop of killing farm animals would probably result in a situation in which domestic animals live in "game" parks. Some species would become distinct; for those which would survive in isolated populations there would be a need to be regulated, if they grow beyond the capacity of natural feeding resources. This means that at least a certain number of animals has to be killed. Though, it is important to note, that this is not a plea for continuing present-day intensive animal farming.

2.2.4 Prospects in the light of novel reproductive technologies

All the ethical theories about the human use of animals, which have been discussed, can be more or less subsumed in general categories, as, for example, formulated by Teutsch (1985, pp. 18-25): (1) Naturalism claims the rightness of the exploitation of animals by humans who pursue their goals under severe natural conditions as animals do (Teutsch 1985, pp. 18-19). (2) Humanism suggests that the superiority of humans in nature justifies giving priority to human values (Clark 1998, p. 68). (3) Alike, the position of humanity rests on the supreme position of humans. However, it denies the rigorous exploitation of animals for reasons of humanity. (4) The ethic of justice applies the maxim of equality to animals. Due to the animal's capacity to experience pain and suffering, alike humans, cruelty to animals is prohibited (Teutsch 1985, pp. 21-24). Some authors, made a somewhat different categorization. For Hurnik (1993, p. 27) common ethical theories about farm animals include divine command, rational egoism, utiliarianism, and animal rights.

2.2.4.1 Cloning and transgensis

The question is posed: Are these theories sufficient and applicable, in the light of modern reproductive technologies? A widely known technology in this field is cloning. In 1997 a lamb was born "generated by the transfer to an enucleated oocyte of a nucleus derived from a mammary cell of a 6-year-old ewe". Clones can develop from the physical separation of embryos produced either in *vivio* or in *vitro.* Another way of cloning is to take cultured cell lines from undifferentiated embryonic stem cells or primordial germ cells of foetuses. Recently, it is focused on the use of various foetal tissues to generate cell cultures for nuclear transfer. A combination of reproductive techniques involves the integration of cloning and transgenesis in order to produce cloned transgenic individuals (Kinghorn *et al*. 2000, pp. 214-215).

Since the early 1990s techniques for the production of genetically manipulated (transgenic) animals exist. The new "technology" includes the production of pharmaceutical in transgenic animals, the so called *gen pharming* or the production of disease resistant animals and can be applied in medicine and animal agriculture. Transgenic animals are *inter alia* generated by the transfer of a desired gene in the fertilized egg cell. The animal that develops from this egg cell keeps the desired gene that can be activated in certain organs of the animal. In first experiments medically effective proteins have been produced in the milk of transgenic cows, sheep and goats and it is planned to produce pharmaceuticals in this way more rapidly, cheaper and in higher quantities than today (Bundesministerium für Bildung und Forschung 2000, p. 17).

2.2.4.2 The integrity and dignity of animals

A further question arising from the new technological developments is: Is genetic engineering ethically justified? In this regard, particularly in Switzerland, the ethical concept of the *Würde der Kreatur* (the dignity of creatures) has aroused considerable interest. Reproductive technologies do not necessarily inflict pain and suffering in animals and are therefore indifferent in view of a *pathozentrischer Tierschutz*, which aims at the avoidance of pain and suffering in animals. Thus, the integrity of animals, which is not covered by the *pathozentrischer Tierschutz*, is an important aspect to be focused on (Schneider 2001, pp. 228-229). The dignity and integrity of living beings or *Würde der Kreatur* implies intrinsic worth of humans, animals and plants that are morally relevant for their own sake has mainly be discussed in relation to the genetic modification of animals and other organisms (Mepham 2000, pp. 65-66).

The renaissance humanist Pico della Mirandola, in his work *Oration on the Dignity of Man'* as well as Kant in his *Foundations of the Metaphysics of Morals* and many later Kantians related the notion of human dignity to the superior position of humans in the order of beings (Teutsch 1985, p. 20; Orlans *et al*. 1998, p. 26; Dolan 1999, p. 121). According to Kant (1959, p. 58) cited by Orlans *et al*. (1998, p. 26) "[t]he idea of human dignity is that humans have properties (rationality, souls, creation in the image of God) that place them in a fundamentally different category from animals. For example, only human beings intentionally perform actions that are motivated by *reason* and by *moral rules"* (see Schneider 2001, p. 230).

Mepham (2000, p. 68) has extended Kant's concept of the dignitiy of humans to animals. The idea that "every creature possesses a goal in life" that was denoted as *telos* by Aristotle has much in common with the notion of *dignity and integrity*. *Telos* is assumed to be morally relevant in itself and should therefore be respected. Since the principle of the *telos* widely corresponds with the notion of dignity of creatures, dignity implies moral relevance, too. "Respect for the *telos* of non-human animals would extent the Kantian principle and ascribing them rights analogous, even if not identical, to those acknowledged for humans".

According to Schneider (2001, p. 231) moral agents are obliged to respect fellow human beings who lack the capacity to reason and to act morally (e.g. infants, the mentally retarded), because they are members of the human community. Likewise, other living beings, such as farm animals, form a *Nutzungsgemeinschaft* (community of mutual benefit) with humans and therefore deserve moral consideration. For Schneider animals are ends in themselves in a biological sense, because their activities are directed to self-maintenance and survival of the species. It matters to them whether their needs and desires are met or not and it is, according to Schneider, the possibility of fulfilling or thwarting of interests that bestows intrinsic value on animals. The dignity of animals is based on this intrinsic value.

Schneider (2001, pp. 232-233) linked the modern animal ethic with the intrinsic value of animals: The *pathozentrischer Tierschutz* demands to protect animals for their own sake and thus implies an intrinsic worth of animals. Avoiding unnecessary suffering, which is central in the *pathozentrischer Tierschutz* is grounded on the assumption of this inherent value. If animals would not possess intrinsic value, humans could behave indifferent to their suffering. Though, in this regard it has to be noted that even suffering of animals as such is, as explained elsewhere, enough to make animals objects of moral concern. Schneider (pp. 233-235) concluded that the postulation of intrinsic value and the deduced dignity of animals are the normative basis of an animal ethic that attempts to protect animals from unnecessary suffering. It appears to be that the awareness about the intrinsic value of farm animals has disappeared in intensive animal production and that the disregarding of dignity and intrinsic worth in animals is closely related to the de-individualization and mass production of animals on modern farms.

2.2.5 Proclaiming the dualism of animal welfare

Animal welfare science primarily aims at generating fundamental knowledge about the animals' biological functioning and their subjective experiences. The practical goal of this field is to improve the situation of domestic animals consistent with their legitimate use by humans. Ethical issues raised by animal welfare science require judgement about how animals ought to be treated (Tannenbaum 1995, p. 9). In this regard, it is essential to note that the term *animal welfare* evolved in society to communicate moral concerns about the use of animals from an ethical point of view. Scientific study of animal welfare provided useful interpretations concerning the quality of animal life, but difficulties arose on how to conceptualize a concept in scientific terms that is primarily based on values (Duncan and Fraser 1997, p. 20).

Tannenbaum (1995, pp. 152-153) alleged that the idea that welfare is a purely scientific concept and that the study of animal welfare is value-free is widely accepted by animal welfare scientists. Rollin (1996, p. 7) pointed out that definitions of welfare related to the animal's adapting to or coping with the environment deny any involvement of moral values (e.g. Broom). Alike, concepts of welfare that recognize the subjective experience of animals, such as those provided by Dawkins, presupposed the conceptual separation of scientific investigation and ethical judgements made by the public.

For example, Duncan and Poole (1990, pp. 194-195) maintained that science may be able to give information about how painful a particular husbandry practice (e.g. beak trimming) is for an animal or how frustrated it may be under close confinement. However, the judgement as to whether or not that practice or environment should be permitted is an ethical decision and should be made by society. Similarly, Fraser and Broom (1997, p. 4) claimed that animal welfare can be assessed in an objective way without any reference to moral considerations by "[m]ortality rate, reproductive success, extent of adrenal activity, amount of abnormal behaviour, severity of injury, degree of immunosuppression, or level of disease incidence". In addition to these measures of poor welfare, animal preferences can be tested in relation to resources and environmental stimuli. According to Fraser and Broom moral considerations about unacceptable states of poor welfare should be made, if scientific investigations have been conducted. Then, ethical questions can be addressed to the farmer, the veterinarian, the scientist, or the member of the public.

Though, many agree that it is not efficient to regard science only, because ethical statements are implicitly made, when considering the situation of farm animals, or when designing an experiment. Accordingly, many scientists and philosophers adopted the view that the concept of animal welfare is not a purely scientific one, which encompasses only objective, factual information and that the underlying values should be made explicit (e.g. Rushen and de Passillé 1992, p. 721; Mason and Mendl 1993, pp. 301-302; Fraser 1995, pp. 113-114; Tannenbaum 1995, p. 153; Stafleu *et al.* 1996, p. 233; Duncan and Fraser 1997, pp. 19-20). These authors argued that ethical concerns and values about what is better or worse for the quality of life of animals have an important role to play in the assessment of animal welfare. Hence, there is a broad consensus that the concept of animal welfare encompasses both facts and values.

Referring to the huge variety of definitions that has been arisen in animal welfare science, Moberg (1993, pp. 1-2) asserted that „[e]ach of us defines animal welfare with reference to our perceptions of the ideal relationship between animals and humans" depending on personal experience and philosophies of life and is, therefore, a matter of values. Rushen and de Passillé (1992, p. 721) claimed that animal welfare embraces not only scientific but also philosophical, ethical, economic and political aspects. They maintained that a scientific definition of welfare must address societal concerns. However, to implement this is impeded by the controversy about what good welfare involves. Swanson (1995, p. 2745) pointed out that the concept of animal welfare changes over time. „[T]he definition of animal welfare/well-being will be dynamic rather than static", because the public debate about the treatment of

animals is evolving. Swanson highlighted that present concepts of welfare or well-being can include both socially accepted standards for the use of animals and the scientific measures of physical and mental states in animals.

Tannenbaum (1995, pp. 160-163) stated that the various definitions provide evidence that welfare involves value judgements. Tannenbaum claimed that, on the one hand, the vast variety of *definitions* of animal welfare may originate from different views about what animals themselves experience or about what can be measured in them. On the other hand, the dissimilar *definitions* may result from different ethical views about how animals ought to be treated. For example, „someone who believes that welfare is the absence of suffering takes the position that what constitutes an acceptable kind of life for an animal is one without suffering". Thus, Tannenbaum concluded that the term *welfare* is inextricably connected with moral judgements.

However, values are not only integral part of the concept of animal welfare but are also part of the research process. Mason and Mendl (1993, p. 301) alleged that „interpreting welfare measures involves subjective judgements, which will be influenced by the nature of our concern for the animal under consideration". Hurnik (1993, p. 34) advocated this view stating that scientists make moral decisions prior to, during and after research is accomplished, and, hence, scientific information is not free of value judgments. In this context, Fraser (1995, p. 104) emphasized:

> A little reflection shows that in categorizing attributes as relevant or irrelevant to the animal's welfare, we classify them not by scientific discipline (behaviour versus anatomy), nor by bodily system (nervous system versus digestive system), nor by whether the attribute contributes to homeostasis (breathing versus vocalizing). Rather, we consider an attribute to be related to the animal's welfare if we judge it relevant to the animal's quality of life - if it is somehow good for or bad for the animal. Thus, animal welfare is unlike the many scientific concepts (temperature, viscosity, metabolizable energy) that can be quantified without necessarily invoking any sense of better or worse.

Fraser (1995, pp. 105-106) further claimed that the numerous factors incorporated in the concept of animal welfare cannot be weighted in an entirely objective way. In the generation of an overall measure, subjective judgements are inherently involved. Science cannot „eliminate value-based differences by, for example, proving whether liberty is more important than health, or establishing objectively whether freedom from coccidiosis is better than freedom of movement". Fraser (1995, p. 112) concluded that the conceptualization of animal welfare should not try to outline purely technical definitions, rather than to make the underlying values explicit to avoid value judgements and technical models not to be mistaken.

Tannenbaum (1995 pp. 162-163) maintained that the denial that values are implicit in the concept of animal welfare results in methodological problems. Scientists, who accept the pure science model, exclude ethical issues from the research process. For example, someone who defines welfare solely in terms of the satisfaction of needs will ignore the fulfilment of *wants* or desires and the satisfaction or pleasure deriving from them. Tannenbaum (p. 163) further argued that potentially significant scientific questions will be overlooked by the adoption of the pure science model. Defining welfare as the „absence of suffering" implies the value judgement „that people ought not to permit animals they use to suffer". However, this standpoint will disregard investigating that animals should be allowed to express their preferences and whether environmental conditions, which are conducive to pleasant states in animals, ought to be provided to improve their welfare.

Nevertheless, the possibility to make a choice is considered as a fundamental feature of welfare, independent of the long-term effects the choice has on the individual's health. As far as human welfare is concerned, the freedom to enjoy both harmful and harmless pleasures is important, since getting pleasure from such freedoms is considered to be better than a life without them. This might also be true for farm animals. Tannenbaum (p. 164) came to the conclusion that „[t]he only way to determine which of such value judgments is preferable is to

approach them as value judgments and to assess them accordingly". Thus, the assessment of animal welfare has to include both scientific knowledge and ethical judgements.

After reviewing the animal welfare debate in the West, which highlighted the importance of a dualistic consideration of the animal's well-being, farm animal welfare concerns in agrarian countries in the South shall be illuminated.

3 Animal welfare concerns in tropical livestock husbandry

So far the topic of animal welfare had only minor importance in livestock research in less industrialized countries. Though, animal keepers have an age-old, deeply rooted knowledge of the highly positive correlation between the good treatment of farm animals and their productive traits. Calm handling of cows during milking, for example, is recognized to positively affect the milk yield, because stress in animals inhibits the release of oxytocin that in turn reduces the milk let down. Alike, it is self-evident that prompt treatment of injuries is beneficial to the animal. This basic interrelation between animal well-being and its productive capacity may have sunk into oblivion, but it offers an enormous potential for the enhancement of the productive and reproductive performance of animals in resource-poor husbandry systems.

For large scale livestock producers in the tropics who are integrated in the international trade, it is vital to monitor the demands of their export markets. Thus, European consumer preferences for *animal-friendly* meat products may have an impact on the conditions under which the export goods are produced. Recently raised demands to consider product qualities related to animal welfare in the international trade of meat and meat produce underline the importance to assess animal welfare concerns in tropical livestock husbandry, in order to make explicit the particularities of animal rearing in tropical environments and the local human-animal relationship.

The ensuing discussion is based on the previous analysis of the current animal welfare debate, which highlighted the significance of both scientific and ethical issues in the assessment of animal welfare. It will be centred on four main points: First of all, a brief overview of animal production systems in less industrialized tropical countries will be given and four systems will be selected for a more detailed inquiry. Secondly, major animal welfare problems related to hunger and thirst, discomfort and disease, pain, non-performance of natural behaviour and fear will be assessed from a scientific point of view. Thirdly, the ethical treatment of animals will be reflected on from different cultural perspectives and finally, the scope for changes in individual production systems will be considered.

3.1 Characterization of animal production systems in the tropics and identification of relevant animal welfare-related problems

The term *tropical livestock production systems* is widely used in the literature about international animal agriculture in order to characterize animal husbandry in less industrialized or, as often used, developing countries. What is exactly meant by *tropical* and *production system* will briefly be explained in the following paragraphs.

3.1.1 The tropical environment

Tropical and subtropical environments are clearly distinct from temperate zone environments. Compared with temperate settings tropical locations are often at a disadvantage in terms of agricultural production.

3.1.1.1 Geographical boundaries

According to general definition the *tropics* geographically comprise the area between the Tropics of Cancer and Capricorn, i.e., between 23.5º north and 23.5º south of the equator. The zone of transition between the tropical and temperate climatic zone is denoted the *subtropics.* It lies between 23.5º and 35º north and 23.5º and 35ºsouth of the equator (e.g. Crowder and Chheda 1982, pp. 1-2; Payne and Wilson 1999, p. 3).

3.1.1.2 Agro-ecological zones

Annual rainfall, temperature, humidity, altitude and the like form the basis for the classification of tropical and subtropical climates and environments. Troll (1966) cited by Ruthenberg (1980, pp. 1-2) identified rainfall as the most relevant factor to classify tropical lowland climates. Humid areas have 7 or more humid months, semi-humid areas 4.5-7, and semi-arid areas 2-4.5 humid months. Highland climates constitute a separate class that is divided into subclasses related to precipitation, altitude, and latitude. Climatic and ecological conditions are major determinants of the type of farming and the use of farm animals. Following the climatic classes, Jahnke (1980, pp. 16-17) and Ibrahim (1998, pp. 1-4) differentiated five agro-ecological zones: humid, sub-humid, semi-arid and arid zone and highlands. These zones are mainly characterized by rainfall and plant growing days as given in table 3.1.

Table 3.1 Categories of agro-ecological zones in the tropics

Zone	Precipitation (mm/a)	Annual plant growing days	Farming pattern
Arid	< 500	< 90	Almost no cropping
Semi-arid	500-1000	90-180	Grazing land, cropping
Subhumid	1000-1500	180-270	Cropping and livestock integration
Humid	> 1500	> 270	Cropping
Highlands	Dependent on altitude	Dependent on altitude	Dependent on altitude

Adapted from Jahnke (1982, p. 17) and Ibrahim (1998, pp. 1-4)

3.1.2 Animal production systems and their classification

According to Ruthenberg (1980, pp. 2-3) the analysis of farming situations requires adequate information. Hence, the variety of phenomena observed on farms is grouped into „sets of related elements“ or *systems*. Describing and analyzing farm-systems is directed to system theory. Farm systems and farming systems (“classes of similarly structured farms”) are interrelated with ecological, social and political systems.
Ruthenberg (pp. 6-8) alleged that the farm is a complex system with internal and external relations. Within the farm the relation between livestock and crop activities “may be competitive with regard to labour and capital, but complementary through the use of manure, the utilization of crop residues, the reduction in risk, etc.“ (internal relations). The farm system is influenced by its environment, e.g., climate and soils, technical, economic, social, cultural, and political factors (external relations). Changes in external relations may include technical innovations and changes in economic scales or societal values.

Different farm systems are apparent in relation to cropping patterns and technologies, to the local natural, economic and societal conditions (Ruthenberg 1980, p. 14). Based on distinct criteria, various classification schemes were formulated for farms in the tropics (e.g. Ruthenberg 1980; Jahnke 1982; Seré *et al.* 1994). In this study a simplified form of Jahnke's classification (1982, p. 7) of animal production systems will be adopted. Jahnke broadly differentiated pastoral systems, crop-livestock production systems and commercial systems with an increasing degree of intensity in the sequence given (Table 2). A categorization orientated towards the intensity of production appears to be most relevant for the analysis of animal welfare concerns in tropical livestock production, because, as it has been shown in the previous chapter, the well-being of animals was found to be increasingly compromised in the continuing process of intensification of animal agriculture in the West.

Pastoral systems are closely related to arid environments where low precipitation limits crop production as the sole basis of subsistence (e.g. in the Sahel). Grazing ruminants are the primary source of land use and constitute the mainstay of the pastoral subsistence economy. Income is generated by the sporadic purchase of animal products or young stock. The herds consist of various species which are complementary in growth rates, feed requirements, disease risks and adaptability to harsh environments. Small ruminants with their shorter generation intervals are very important to rebuild the stock after periodic droughts. Rangelands are the major feeding resource (Jahnke 1982, pp. 66-87; Seré *et al.* 1994, pp. 18-19). The production of milk is central in pastoral range-livestock production systems. Unlike small ruminants whose meat occasionally supplements the human diet, large ruminants are rarely slaughtered. The value of livestock in pastoral societies goes far beyond being an asset and, therefore, plays a dominant role in social life. Pastoral systems are land and labour-intensive, but capital-extensive. Land and labour productivity in pastoral livestock is very low compared with other production systems (Jahnke 1982, pp. 66-87).

Crop-livestock production systems or mixed farming systems are characterized by both activities in animal husbandry and agricultural land use. By the term mixed farming it is particularly referred to "farming systems in which crop production and livestock production display pronounced and mutually beneficial interactions within a farm" (Jahnke 1982, p. 104). Crop-livestock production systems evolve, when migration is no longer an option to overcome scarcity of land. Sparse grazing land is the major feed resource of animals strategically supplemented by straw and crop stubbles. In mixed systems crop production is benefited by animal manure and work, while livestock is fed on crop residues from the fields. Thus, integration of livestock permits re-utilizing of resources, risk reduction and distribution of labour. Despite these complementary effects, resource degradation and overgrazing are common (Seré *et al.* 1994, p. 27; Schiere and Kater 2001, pp. 3, 8). Mixed crop-livestock farming in low external input agriculture has generally low access to the production factors land and capital, but high access to the factor labour (Schiere and Kater 2001, pp. 3, 8). Smallholders in general produce on an extensive level with minimal use of purchase inputs (Seré *et al.* 1994, p. 27).

Commercial production systems are primarily discussed in the context of landless systems in which monogastric species, mainly swine and chicken are produced on the large-scale to supply urban consumer markets. Kept on a high level of intensity, the animals are fed on purchased feeds of high energy concentration (e.g. cereals, oilseeds) (Jahnke 1982, pp. 202-207). The landless monogastric system uses high producing exotic breeds and modern technology. An expansion of this system leads to in the extinction of traditional breeds and creates environmental problems by the disposal of manure (Seré *et al.* 1994, pp. 35-36). Specialization is another important feature of the system. In poultry production, additionally specialized egg and broiler units exist. Commercialized production systems require capital-intensive inputs and investments. (Jahnke 1982, pp. 202-207; Seré *et al.* 1994, p. 36). "Production efficiency is high in terms of output per unit of feed or per man-hour, less so when measured in terms of energy units" (Seré *et al.* 1994, pp. 36).

Table 3.2 Classes of tropical livestock production systems and important characteristics

	Pastoral system	Crop-livestock production system	Commercial system
Agro-ecological zone	Arid	Semi-arid Subhumid Humid	Independent
Degree of intensification	Extensive	Semi-intensive	Intensive
Access to production factors			
Land	High	Low	Low
Labour	High	High	Low
Capital	Low	Low	High
Productivity	Low	Medium	High

3.1.3 Methodological approach for the analysis and selection of livestock production systems

3.1.3.1 Integrated analytical approach

Livestock production systems in the tropics are multifaceted entities composed of individual elements that are linked with each other (see Ruthenberg 1980, p. 2). Similarly, animal welfare issues deal with interrelated aspects, such as animal biology, environmental conditions, animal ethics etc. Therefore, it appears to be justified to apply a *system approach* for the analysis of farm animal welfare in tropical animal husbandry, too. For animal welfare science the well-being of the individual animal in relation to its biology or *animal system* in its environment is central. However, there are some other *systems* associated with the animal in its husbandry system.

Aside from the human impact on the well-being of livestock, the natural environment, the values of a society and economic factors form interconnected systems, which have to be recognized in the analysis. For example, exposure to harsh climates may give rise to extreme suffering in livestock, while the level of economic development may be very important in view of the possibility to change the precarious situation of an animal. The involvement of values may also imply the reflection on

> the quality of and acceptable standards for human life. […] Hence, anthropological […] and religious studies become important pieces of the debate, both in terms of understanding varieties of [the human treatment of animals] within on cultural context, and the more general features that characterize national attitudes and approaches.
>
> (Chapple 1998, p. 14)

Accordingly, the analysis of tropical livestock production systems focuses on agro-ecological conditions of the particular site, value systems, level of economic/technological development in the respective society and the degree of human intervention. The integrated approach aims to identify animal welfare-related problems in animal husbandry systems and to provide an adequate basis for the subsequent study of scientific and ethical issues.

3.1.3.2 Selection of husbandry systems to be investigated

In order to approach animal welfare concerns in tropical animal agriculture, an exemplary strategy is pursued, which includes the investigation of four distinct livestock production systems. Criteria for the selection of these systems are a difference in (1) the geographical region, (2) agro-ecological conditions, (3) class of the system, (4) prevailing species and (5) products gained. By the broad variation of systems to be investigated it is primarily intended to identify the vast diversity of animal welfare concerns in tropical livestock production. The detection of common features of the "phenomenon" *animal welfare* in different systems may provide additional information for a more fully understanding of the subject. The production systems selected for animal welfare considerations are:

(1) The Fulbe pastoral system in northern Nigeria
(2) The llama and alpaca breeding system in the Andean highland of Peru
(3) The smallholder crop-livestock production system in India
(4) The commercial pig and poultry production systems in Thailand

An overview of the selected production systems and their determining factors is given in table 3.3.

Table 3.3 Livestock production systems to be investigated and criteria of their selection

	Production systems	Agro-ecological zone	System classification	Dominating species	Animal products
1	The Fulbe pastoral system in northern Nigeria	Arid to semi-arid	Pastoral	Cattle Sheep Goat	Milk Meat
2	The llama and alpaca breeding system in the Andean highland of Peru	Highland	Pastoral	Llama Alpaca	Fibre Transport Meat
3	The smallholder crop-livestock production system in India	Semi-arid subhumid	Crop-livestock production	Cattle	Work Milk (Meat)
4	The commercial pig and poultry production systems in Thailand	Subhumid humid	Commercial	Pig Poultry	Meat Eggs

3.1.4 Example 1: System determinants and animal welfare-related problems in the Fulbe pastoral system

Pastoral Fulbe herders in northern Nigeria keep cattle, sheep and goats to saveguard their livelihood.

3.1.4.1 Natural conditions and resulting patterns of the pastoral system

Nigeria comprises various agro-ecological zones including the arid, semi-arid, sub-humid, and humid zone. The northern part of the country contains the drier areas where the large majority of livestock is maintained (Ibrahim 1998, pp. 1-3). Rainfall is monomodal in Nigeria

resulting in a rainy season and a dry season that carries north-easterly cold wind, called the harmattan. The rainy season lasts from May to October in the south and from May to September in the north. In the northern region rainfall is less than in the southern region (Falola 1999, p. 2) and in the far north of the country the dry season is nearly 8 months long (Encyclopaedia Britannica). Gefu (1992, p. 52) found a mean annual precipitation of between 750 and 850 mm and high evaporation due to low humidity in the semi-arid zone of Nigeria. Mean temperature is often as high as 40ºC, with April being the hottest month. December records the minimum temperature of about 12ºC.

Nigeria possesses the largest farm animal population in the subregion (Otchere 1987, p. 50). The distribution of animals directly reflects the country's agro-ecological conditions and the prevalence of trypanosomiasis, which is transmitted by the tsetse fly (Glossina). There is a clear concentration of ruminants in the northern semi-arid zone, where 88 percent of the cattle, sheep and goats are maintained. Although in humid environments forage is abundant, the infestation of tsetse fly thwarts the keeping of large populations of livestock. Hence, the total number of livestock in these areas is low and limited to breeds and species well adapted to the challenges posed by the environment (Josserand 1985, p. 8; Otchere 1987, p. 50; Ibrahim 1998, p. 10, Gefu 2005, personal communication).

Jahnke (1982, p. 38) pointed out that milk production is concentrated in the arid zone. In Nigeria nomadic and semi-nomadic Fulbe significantly contribute to the country's milk production. Selling of dairy products including yoghurt, butter and skim milk is the main occupation of the Fulbe (Gefu 1992, p. 65; Iro 2004c, pp. 1-2). Milk processing and marketing of dairy products is generally done by the women who exchange these products for grain and other goods. Pastoralists who are not engaged in crop production entirely depended on agriculturalists to meet their supply for grain and vegetable food (Gefu 1992, p. 71). According to Stenning (1994, p. 5) meat consumption is always bound to ritual ceremonies and animals are only sold, when cash is needed. In general, selling of animals is restricted to bulls, although "[o]cassionally unproductive cows and heifers are also sold" (Gefu 1992, p. 65).

The seasonal distribution of fodder and water in the semi-arid pastoral zone is the main problem and is the driving force that causes pastoral people to move. Iro (2004a, pp. 1-5) stated that although most of the Fulbe have a permanent home, they "engage in extensive pastoral movements". Mobility is necessary, because pastoral resources are variable and "access to them requires movement". According to Stenning (1994, p. 4) in the dry season herders and herds migrate southwards in response of scarcity of grass and water and go northwards to keep away from tsetse fly in the wet season. Intention of movement is variable depending on the environment, disease prevalence, and access to markets. However, seasonal migration is a constant pattern of Fulbe pastoralism.

Iro (2004a, pp. 4-5) maintained that over the centuries a livestock management system has evolved in which repeated movements to different locations induced by natural conditions have resulted in an annual pastoral cycle. This cycle encompasses five distinct stations:

1. At the end of the wet season and the beginning of the dry season (October to December) the Fulbe start to migrate southwards or seek for grazing land along the rivers and flood plains.
2. The harmattan season (January to February) is characterized by extreme dryness. Fodder and feedstuffs deteriorate in quantity and quality so that the animals are compelled to forage on bush-stubbles and where available on crop residues left on fields after harvesting grains and other food crops. Scarcity of forage and water requires prolonged grazing times, frequent visits of water sources and sometimes splitting of the herd. Despite the efforts animals lose weight and Southward migration progresses.
3. During the hot season (March to April) temperatures rise excessively and grazing is restricted to the cooler evening and night hours. The body condition of livestock is at its worst, when they are at the southernmost locations.

4. May to June coincides with the end of the hot season. With the onset of the rainy season vegetation reappears and the Fulbe pastoralists start to move northwards.
5. In the rainy season (June to September) the Fulbe arrive at their homes - the northernmost sites. Milk yields are highest in this period in which food and water is plentifully available.

(Iro 2004a, pp. 4-5; Gefu 2005, personal communication)

As a rule, cattle herds that consist of up to 80-100 head (White Fulani and Red Bororo breeds) are moved along with flocks of small ruminants to the grazing grounds (Otchere 1987, pp. 51-52; Gefu 1992, pp. 54-56). Gefu (1992, p. 71) described:

> After the daily milking routine both cattle and small grazing animals were taken out for free range grazing by children and young adults. Usually small ruminants were in the lead while the cattle trailed after, with the herd boys and girls following in the rear. Late in the afternoon the animals were led back to the camp, where the cattle and small grazing animals were separately corralled.

Grazing on crop residues on farmland is practised, when pastures are inadequate during the dry season. However, the amount of available residual fodder often remains insufficient and pastoralists have to purchase supplementary animal feeds, such as cotton seed cake, groundnut cake, harvested crop residue and grain husk at distant places (Gefu 1992, pp. 56-58).

Alike, the limited availability of water in the dry season causes serious problems and may require herds and herder to walk long distances to obtain drinking water. While during the rainy season drinking water is abundant from sources on the surface, such as rivers or ponds, these sources dry up during droughts. If possible, the animals are watered from wells; farmers give pastoralists access to their water facilities in exchange for milk or dung (Gefu 1992, pp. 58, 71; Iro 2004b, pp. 1-2). When drinking water is lacking, the Fulbe pastoralists reduce the watering frequency of their animals. Then, for example, the small stock is watered only every other day (Western and Finch 1987 cited by Iro 2004b, p. 2). Thus, scarcity of grazing land due to poor rainfall and shortness of water supply are major constraints of livestock rearing in the Fulbe pastoral system.

3.1.4.2 Economic conditions and the level of human intervention in the system

Agriculture is the mainstay of the rural population and the majority of Nigerian people are occupied with agriculture (Falola 1999, p. 8). The agricultural sector accounts for two-fifths of the gross domestic product (GDP) (Encyclopaedia Britannica). While in the savanna zone livestock husbandry primarily contributes to the household incomes, in the southern forest zone agriculture is the main livelihood, (Falola 1999, p. 3). Although in the savanna zone the cultivated area per family is almost double compared with the forest zone, farm incomes are generally below those gained in the forest zone due to lower yields (Upton 1985, p. 57). The nearly steady economic growth in the twentieth century was induced by the production of cash crops, mining, manufacturing, and banking. In addition, since the 1970s Nigeria's economy is largely dependent on oil revenues. "However, since the 1980s a decline has set in, the local currency, the Naira, has suffered massive devaluation, and inflation has been running at a high rate" (Falola 1999, p. 8).

Earnings from livestock production make a considerable contribution to Nigeria's national income providing about 40 percent of the total agricultural production. Livestock production is basically in the hand of over 9 million pastoralists whereby Fulbe pastoralists keep more than 85 percent of the countries' animal stock (Gefu 1992, p. 11). In microeconomic terms, Fulbe pastoralism is characterized by a subsistence economy in which dairy product surpluses are

sold or bartered for grain on village markets (Stenning 1994, p. 4). Due to little monetary reserves, systems based on subsistence, widely fail to make extensive investments and, therefore, the extent of human intervention into the production system can merely be low. As a consequence, agro-ecological conditions are the determining factor in the Fulbe pastoral system. Neither sheltering of animals against detrimental environmental conditions nor regular veterinary inspections can be applied. However, it might be advantageous for the animals that comparatively little restrictions of movement are imposed on them by management measures.

3.1.4.3 The socio-cultural background in relation to the human animal bond

In Nigeria live over 200 ethnic groups each with its own traditions and customs. Approximately 21 percent of the population are Hausa speakers which are concentrated in the north, just as Fulbe speakers which account for 7 percent of the population. Other main groups are the Yoruba (about 20 percent) in south-western Nigeria and Igbo speakers (about 17 percent) in the south east of the country (Encyclopaedia Britannica; Falola 1999, p. 5). The Fulbe are an ethnic group, which is widespread all over Western Africa from Senegal to Central African Republic. In the Anglo-Saxon language area they are named *Fulani* and they themselves use the name *Fulbe* or *Pulla* (*sing.*) (Duda 1984, pp. 39-40).

Alike, the religious affiliation of Nigerian inhabitants is diverse. Muslims, who constitute about 50 percent of the population, are concentrated in the north and southwest (Falola 1999, p. 7); the Fulbe are predominately Muslims (Encyclopaedia Britannica; Iro 2004a, p. 6). About 40 percent of the population are Christians who are mainly found in the southern and the middle belt states of the country. Further, there are adherents of traditional and other religions. Faith in various gods, witchcraft, and charms is prevalent in the society and often age-old ceremonies are carried out (Falola 1999, pp. 7-8). In Muslim ceremonies preferentially sheep are slaughtered for religious sacrifices (Josserand 1985, p. 7).

The Fulbe pastoralists are known for their wise animal management in the precarious environmental situation of the Sahel. Most notable is their close relationship towards animals. According to Mtetwa (1982, p. 6) herding techniques in African pastoralists include “close control by word and gesture of cattle while grazing, at water, in transhumance, or when in danger from wild beasts“. De St Croix (1945) cited by Iro (2004a, p. 4) reported that “[a] Fulbe man can identify his animal by its name, color, hair, spots, patches, twist of the horn, or shape of breast”. However, Mtetwa (1982, p. 7) pointed out that despite the close verbal, tactile and ocular contact with cattle, the statements of herdsmen about the handling and treatment of cattle convey a sense of cause and effect and the “notion of cattle as things is not altogether alien to the African pastoralist“.

The care of animals also plays an important role in the Fulbe mythology:

> In the Pastoral Fulbe myth a kind of agreement between man and cattle is suggested, brought about by the water spirit. The water spirit tells a man to water all the beasts of the field. He does so, heroically, and as a reward for his exertions cattle rise up from the river and follow him. This first Fulbe man is cautioned never to fail to light the morning when the cattle leave for pasture. If when they return at dusk the cattle see that the fire is not lit, they will flee and return to their wild state.
>
> (Raay 1974, p. 3 cited by Mtetwa 1982, p. 9)

3.1.1.4 Scientific and ethical issues to be elaborated

From the previous analysis it can be concluded that in the Fulbe pastoral system animals and the herders are frequently exposed to severe climatic stress caused by extremely high temperatures and intensive solar radiation. An indirect effect of the aversive environment is the scarcity of food and water, which compels the Fulbe pastoralists to move with their herds to distant settings. Shortness of feed and water cannot only be identified as a key limiting factor for livestock rearing under precarious ecological conditions but has also an effect on the well-being of animals. High mortality rates among ruminants in the dry season were assumed to be attributed to the poor nutritional status of the animals (Gefu 1992, pp. 78-79). Another issue to be raised in view of the problem of hunger is the milk supply of calves. In general the calves compete with human beings for the amount of milk (Waters-Bayer 1986a cited by Iro 2004c, p. 3) and "a pastoralist must ration his milk in such a way that the well-being of the calf is not jeopardized by a disproportionate consumption of milk by human beings (Western and Finch 1987 cited by Iro 2004c, p. 3). Thus, a major animal welfare-related problem identified in this area is the animal's suffering from hunger and thirst.

The socio-cultural aspects of the Fulbe pastoral system identified the Fulbe as both predominately Muslim and an ethnic group with close relations to animals. Indeed, van Raay (1974, pp. 5-6) cited by Mtetwa (1982, p. 19) stated that

> no topic among the Fulani dominates daily conversation as much as matters pertaining to cattle and their rearing. Cattle are loved for their beauty and peculiar traits as much as they are valued for more strictly utilitarian functions which, if they had been critically assessed in terms of the standard of living they permit, would no doubt have struck and frustrated the Fulani pastoralists.

Gefu (2005, personal communication) provided some other examples that express the close human-animal relationship between herd animal and herder. He alleged that in the event that a cattle is sick the pastoral Fulbe leaves every other thing including his children to attend to the health of the sick animal. The pastoralist is often prepared to spend a considerable amount of money to revive the sick animal. In some instance, he may not be willing to spend equivalent amount on medication for one member of the household. Gefu further maintained that before a medication is offered to an animal (either for curative or prophylactic measures) the owner (pastoral Fulbe) first takes a bite at the medicine to ensure that it is not likely to be harmful to the animal. Gefu supposed that also the common practise not to slaughter their animal for the purpose of meat supply to the family could be linked to the bond that exists between the animal and the pastoral Fulbe.

In this context, it would be interesting to know, which values or ethical principles the affectionate treatment of animals underlies. Since the treatment of animals in a culture is generally attributed to the prevailing value system or ethic, which is often embedded in religion, an ethical reflection on cattle values and Islamic values in the Fulbe pastoral system will be provided. In addition, from a scientific point of view the problem of hunger and thirst in relation to animal welfare shall be discussed.

3.1.5 Example 2: Characterization of the llama and alpaca breeding system in the Andean highland and relevant aspects of animal welfare

Llamas and alpacas are mainly found in the Andean highland (Payne and Wilson 1999, p. 521) and were domesticated in the Native (American) cultures in South America (Benecke 1994, p. 332). The vast majority of more than 7 million domestic llamas and alpacas are kept in Peru and Bolivia, although larger camelid stocks also exist in the adjoining countries (Hervas Ordoñez 1991, p. 67; Payne and Wilson 1999, p. 522).

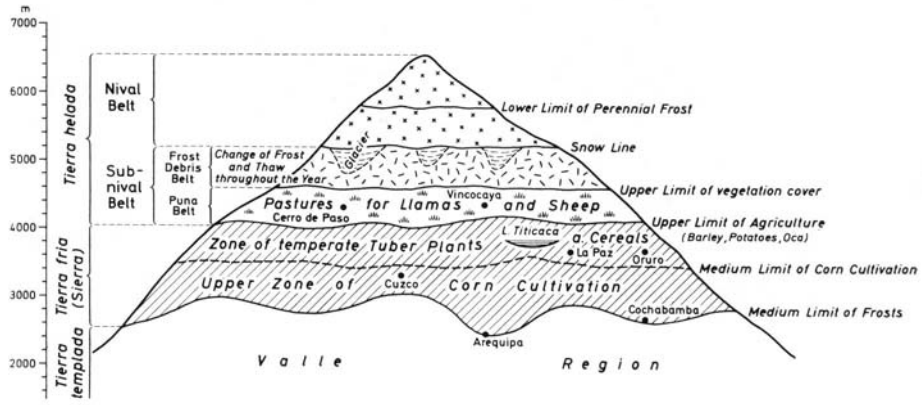
3.1.5.1 Agro-ecology and the camelid production system in the Andes

The principal habitat of the llama and alpaca "is the altiplano or 'puna' ecosystem of the central Andes" (Payne and Wilson 1999, p. 522) - a dry altitudinal zone (Troll 1968, p. 22). Andean pastoralists are primarily engaged in raising llamas (*Lama glama*) and alpacas (*Lama pacos*), because sparse vegetation at 4,000-4,500 m above sea level permits merely limited agricultural activities. Often pastoral communities possess small areas of communal agricultural land at 4,000-3,500 m where tubers, such as potatoes and quinoa are planted. Nevertheless, the pastoral people of the puna largely depend on barter with farmers in the temperate zone (3,500-2,500 m) who cultivate maize and other cereals (Bennett 1946, pp. 14-15; Tomoeda 1996, p. 187; Nuernberg and Valle Zárate 2001, p. 28).

The location of the puna and other important zones of the highland are shown in figure 3.1.

Up to 3,500 m maize can be grown in the frostfree rainy season. The zone is followed by the region of tuberiferous plants where wheat and barley were introduced in modern times, and which reaches up to the upper limit of cultivation at 4,100 m. In this altitudinal zone, on the Altiplano and in the Titicaca basin, in the valleys of La Paz and Cuzco, there is regular night-frost during the dry season […]. Still higher up, we get into the grassland of the puna region where llama and alpaca […] have their ecologically appropriate environment. At 4,700 m the uninterrupted plant cover ends.

Figure 3.1 Vertical climato-ecological zones of the Andean highland



Modified from Troll (1968, p. 33)

The climate of the puna is characterized by a rainy season from November to April (southern summer) and a dry season from May to October (southern winter) (Bennett 1946, p. 14). Annual rainfall varies with a peak during the southern summer. In the dry season or southern winter drought may occur (Encyclopaedia Britannica). The wet puna (7-10 humid months), which extends over the western parts of the highland belt including Lake Titicaca, Puno and Cuzco and the dry puna (4.5-7 humid months), which occupies the eastern regions of the belt are distinguished (Troll 1968, pp. 44, 47). While rainfall in the wet puna is 600 mm or more per year, in the dry puna only 250-420 mm rain falls annually. Precipitation is concentrated from December to March and both snow and hail are common (Payne and Wilson 1999, p. 522). Browman (1990, p. 323) maintained that at some locations in the Bolivian Andes land receives even less than 100 mm annual precipitation.

The average annual temperature at high altitude in the Andean region is 0-6ºC (Payne and Wilson 1999, p. 522). There is substantial temperature variation between day and night with a maximum daytime temperature of 20ºC and a night minimum of -15ºC or even -18ºC (Payne and Wilson 1999, p. 522). Troll (1968, p. 22) indicated that up to 3,000 m virtually no frost occurs in the puna region, while at an elevation of 4,000 m night frost occurs more than

300 days per year. Above 4,700 m night frost is permanent, i.e., there is a diurnal change of frost and thaw. Often chilly winds reinforce the effects of low temperature (Encyclopaedia Britannica).

Apart from the cold, inhospitable environment and scanty vegetation, in the high Andes wild and domestic animals have to cope with low oxygen pressure (Encyclopaedia Britannica). Browman (1990, p. 323) claimed that

> [r]educed partial pressure, a lengthy dry season, irregular precipitation, low temperatures with frequent frosts and freezes, rugged topography, and poorly developed soils result in a variety of stresses and risks; llama and alpaca pastoralism is a major strategy for dealing with these problems.

In fact, llamas and alpacas are very well adapted to the arid climate of the puna that offers optimal conditions for the thriving of camelids (Gareis 1982, pp. 13, 16; Payne and Wilson 1999, p. 522). Owing to their specific digestive physiology and grazing behaviour alpaca and llama are compared with introduced domestic animals capable to thrive on the prevailing coarse vegetation of the puna ecosystem. Therefore, South American camelids occupy a superior position among the farm animals in this region (Gareis 1982, p. 205; Pfister *et al.*, 1989, p. 237; Payne and Wilson 1999, p. 534).

Additionally, camelids are well adapted to low oxygen pressures at high altitude in the Andean highland. Their adaptation is attributed to a variety of mechanisms, including haemoglobin concentration of the blood, erythrocytes with large surface area, high affinity of haemoglobin for oxygen and efficient oxygen utilization in the body (Fowler 1989, p. 218; Payne and Wilson 1999, p. 527). However, despite the excellent adaptation of llamas and alpacas, Raggi *et al.* (1994, p. 73) observed that seasonal variation in the amount and composition of grazing land affects the late stage of gestation, lactation and weaning in adult and young animals respectively.

The camelid husbandry system that evolved under Andean natural conditions is characterized by a low-input management. As a rule, llamas and alpacas “are managed traditionally in small or medium sized flocks on communal lands” (Raggi *et al.* 1994, p. 73). Güttler (1986, p. 37) and Nuernberg and Valle Zárate (2001, pp. 27-30) observed that camelids in general graze freely on natural rangelands far distant from the village and are driven down from the hillsides only for shearing and slaughtering. Güttler (1986, p. 37) confirmed Payne and Wilson’s observations that llamas herds are corralled in the evening to protect them against predators, such as fox and puma, while Nuernberg and Valle Zárate (2001, pp. 27-30) found no corralling in camelids.

During communal grazing the determination of animal ownership may create problems, thus a specific marking is applied in the Andean pastoral system. Individual animals are identified by

> cutting distinctive notches in the ears of the animals and using various colored yarns in the ears of the stock […]. Colored yarn tassels have multiple functions. They allow individual family members using the same notch pattern to distinguish their own animals. They may also be added for aesthetic purposes or religious propitiation, at the time of major community festivals, at the time the animals are brought together for a […] ceremony before breeding, or when a drover is bringing a caravan back from a successful trading trip.
>
> (Browman 1990, p. 336)

Shearing is an important management measure, because camelids, particularly alpacas, are used for fibre production. Information concerning shearing intervals is variable. However, in traditional management systems a routine of two years appears to be applied (Browman 1990, p. 337; Hervas Ordoñez 1994, p. 69; Nuernberg and Valle Zárate 2001, p. 30). Payne and Wilson (1999, p. 540) reported shearing intervals of one or two years. Camelids are

regularly sheared either in May or November. Shearing in November, when the rainy season begins and daytime temperatures rise gradually, is widespread. It is important to note that regular shearing has positive effects in view of disease control, since parasites are removed (Browman 1990, pp. 337-338; Nuernberg and Valle Zárate 2001, p. 30).

3.1.5.2 Socio-cultural factors and the importance of religion in pastoral life

Domesticated South American camelids have had a significant impact on Andean cultures. In this context, Browman (1974, p. 188) pointed out that

> [c]amelid pastoralism represents a cultural adjustment to a semiarid grassland ecosystem that can support grazing animals but is poorly suited to cultivated crops. In the central and southern highlands of Peru, herding of llama and alpaca is the most effective form of land use and resource exploitation. Pastoralism, though just one set of potential solutions, seems to be the one best suited to the puna biotope.

Before the European Conquest in 1532, the Inca civilization dominated life in the Central Andes area. A crucial change in the life of indigenous Andean residents took place after the Conquest. The conquerors induced societal adjustments and brought Roman Catholic religion and Spanish language to the local people. At present about 70 percent of the Peruvian population speak Spanish. However, the languages of the Inca - Quechua and Aymara - are official languages in Peru too. The descendants of the pre-Columbian inhabitants mainly settled on high altitude in the Andes and have preserved the traditions of their ancestors (Atlas 2003, pp. 2-4).

According to Bennett (1946, pp. 20-22) intensive agriculture formed the mainstay of the Inca. Agricultural cycles and religious activities were closely interconnected and the symbolic veneration of food was practiced. Llamas and alpacas, which generally grazed in the high puna, were valued for producing various goods on inferior lands. Benecke (1994, p. 337) pointed out that during the Inca realm llama and alpaca husbandry reached its largest territorial extension in the Andes. Apart from herds for secular purposes, holy herds were kept for animal sacrifices. As the main symbol of power of the Inca sovereign, every morning the *napa*, a white llama, was sacrificed in the Inca's main temple in Cuzco.

Although with the introduction of new plants, domesticated animals and agricultural techniques after the European conquest traditional subsistence pattern have changed, they have not entirely been eliminated. In the highland of Peru and Bolivia indigenous inhabitants still cultivate their land in the traditional way. Despite the dramatic decrease in the camelid population after European Conquest (Benecke 1994, p. 337), llamas and alpacas are the favourite livestock species in the present-day pastoral system (Bennett 1946, pp. 22-23).

Likewise, Native American religion was subjected to crucial changes after the arrival of Christians in the Conquest and Colonial Periods, but the traditional religious concepts accompany the agro-pastoralist people to date. While many religious symbols of the Inca Empire were destroyed, "Indian religious beliefs and practices that did not conflict with the Church doctrines were tolerated as superstitions." At present, Native American religion consists of a conglomeration of traditional religious and Catholic elements. Feasts once in accordance with the agricultural cycles now fuse with the Catholic ceremonial calendar (Bennett 1946, p. 35; Gareis 1982, p. 35).

The most important supernatural beings of the Andean inhabitants are God, Christ and the Sun. However, in everyday affairs lower divinities, such as mountain spirits (Apus), play a central role. Residing in mountain peaks Apus, keep large herds of livestock including condors, being the spirits chicken; vicunas, their llamas; and the Ccoa, their cat. The Ccoa is

capable to send hail and lightening that destroys crops and kills animals and human beings. The Ccoa may be substituted by Santiago (the saint), who, on the one hand, causes thunderstorm and, on the other hand protects the harvest (Mishkin 1946, pp. 462-464). Métraux (1949, p. 564) stated that in modern times the Inca Thunder God is conceived as Santiago.

Mishkin (1946, p. 462) emphasized that

> Quechua religion is not a negligible factor in the life of the community. The supernatural beings are closely involved in the economic and social life of the inhabitants. Ritual and ceremonialism are allied to the most practical and serious objectives of men and women. The public ceremonials are pivots and high points of communal life. Magic and curing enter into the whole field of human relations. Moreover, outside of Government, the Church is the only other great constant whose pressure is felt in every community.

In the current pastoral camelid breeding system the religious ritual has an important role to play. Shearing and slaughtering of animals are generally accompanied by ritual ceremonies. Before shearing an animal's fleece and before slaughtering, "a pago, a propitiatory rite to the guardian spirits or 'owners' of the animals, dwelling among the mountain peaks, is necessary" (Browman 1974, p. 193). Shearing schedules are influenced by personal economic demands due to obligations in religious festivals or local trade fairs.

> In the Lake Titicaca basin, several major religious festivals and associated markets occur as early as August; similarly, many herders have ceremonial obligations for major religious holidays, such as Easter in the spring. The herders recognize the fact that these are less desirable times to shear animals in terms of maximum fleece yield, but on the other hand they have financial needs that must be met. Thus, for August shearing, the herders emphasize that only males may be shorn, as the environmental stress will cause pregnant females shorn at this period (late winter) to abort.
>
> (Browman 1990, p. 339)

3.1.5.3 Economic framework and potential for innovative measures

Although primarily based on agriculture, Peru's economy has become more and more market-oriented. Peru is largely dependent on the export of raw materials, such as agricultural produce, minerals and fish meal to meet the needs for import goods. In 1999 the natural disaster El Nino led to considerable losses in agriculture and financial crises, which reduced economic growth in the time after (Atlas 2003, p. 4).

Llamas and alpacas play a substantial role in the economy of peasants in the Andes (Raggi *et al*. 1994, p. 73; Payne and Wilson 1999, p. 522). However, the productivity in the Andean pastoral system is low and it is chiefly produced on a subsistence level with little market-integration (Nuernberg and Valle Zárate 2001, p. 28). Camelids provide fibre, meat and dung, which is used as fertilizer and fuel for cooking. Additionally, they deliver hides, fat, bones and carry loads (Benecke 1994, p. 332, 336; Nuernberg and Valle Zárate 2001, p. 29). Alpacas are preferred for fibre production, because they produce the finer fleeces. While alpaca fleeces have a desirable low mean fibre diameter of 21-25 µm, llama fibres have mean fibre diameter of more than 30 µm (Payne and Wilson 1999, pp. 540-541). Llamas are primarily used for transport of agricultural products and other goods. In general animals are slaughtered only at the end of their productive life, when they are ill or are not to be expected to survive the following season (Hervas Ordoñez 1994, p. 69; Payne and Wilson 1999, p. 543; Nuernberg and Valle Zárate 2001, p. 31).

Similarly to the Fulbe pastoral system, Andean llama and alpaca husbandry is characterized by a subsistence economy. Owing to the high ecological variability and uncertainty as well as to the limited market orientation human intervention is limited. Therefore, the harsh climatic

effects remain the dominating factor in the Andean llama and alpaca breeding system. The Andean pastoral economy is embedded in a cultural system that is closely related to natural elements, such as hills and springs and reflects a close relationship between human, animal and nature.

3.1.5.4 Identification of relevant aspects for further reflection

In the pastoral Andean production system the rough climatic conditions have a major impact on the welfare and health of camelids. High mortality and morbidity lead to slow growth rates, low reproductive performance and cause tremendous economic loss. Very important in this context are effects of hypothermia and cold related diseases. Especially newborn llamas and alpacas suffer from high mortality and morbidity (Güttler 1986, p. 128; Payne and Wilson 1999, p. 537). Payne and Wilson (1999, p. 537) reported on relatively moderate average annual mortalities of 27% for young animals before weaning, 5% for weaned animals and 3% for adults respectively. Göbel (1998, p. 166) found that 30-50% of the newborn and young animals died and in some years even more. In the traditional extensive production system usually no preventive or curative measures are applied to diseased animals (Güttler 1986, p. 129; Nuernberg and Valle Zárate 2001, p. 31).

High mortality in neonatal llama and alpaca is often caused by Enterotoxaemia (*C. perfringens*), which results in severe diarrhoea (Güttler 1986, p. 147). Hervas Ordoñez (1994, p. 70) and Nuernberg and Valle Zárate (2001, p. 31) confirmed that diarrhoea is widespread in camelids and identified pneumonia as another serious illness. In accordance, Güttler (1986, p. 138) detected almost exclusively signs of disease in the respiratory tract of dissected dead llama fowls. Particularly those fowls were affected who were born very late in the Andean summer, when strong night frosts occur. Other causes found for early death in suckling animals were insufficient milk supply of the dam (Güttler 1986, p. 128).

On the other hand, the previous analysis of the socio-cultural background of Andean pastoralists showed that the value system of the camelid breeders is attributed to both the dominant Catholic religion and the traditional American religion that derived from pre-Conquest times. Syncretism was promoted, since Christian places of worship or ritual symbols were erected at places, which were worshipped by Native American population (Bennett 1946, p. 35; Gareis 1982, p. 35). Alike, some dates of Catholic Church festivals coincide with autochthonous feasts (Valcárcel 1946, p. 472 sqq). For example, the ceremony for the reproduction of animals took place at the time of carnival in February, (also in January or March, or from August to October) (e.g. Aranguren Paz 1975, p. 103; Nachtigall 1965a, p. 207 cited by Gareis 1982, p. 109). Other important days for Andean llama and alpaca breeders are the 25th of July, the day of St Santiago, a former representative of Catholic Church, to whom the well-being of llamas and alpacas is attributed (Mishkin 1946, p. 468; Nachtigall 1966, p. 296 cited by Gareis 1982, p. 110) and the ceremony on the occasion of animal shearing (Gareis 1982, p. 109). On several occasions ritual ceremonies are carried out that predominately aim at the well-being and successful breeding of llamas and alpacas.

Therefore, relevant aspects for further reflection are the effects of climatic conditions on animal comfort, welfare and health status and local moralities about the treatment of South American camelids.

3.1.6 Example 3: Brief description of the smallholder crop-livestock production system in India and pertinent problems of animal welfare

Integration of livestock has a long tradition in India and forms a major component of agricultural land use (Devendra 1995, p. 5; Malik *et al*. 1996, p. 148). The country possesses the largest livestock population in the world and accounts for 15 percent of the total number of bovine worldwide (Government of India 2004, p. 60). Cattle (*Bos indicus*) are the major source of traction and agricultural productivity is largely dependent upon 74 million draught cattle (Ramaswamy 1998, p. 75) that are engaged in land preparation and drawing carts (George 1990, p. 120; Malik *et al*. 1996, p. 148).

3.1.6.1 The Indian monsoon climate and the corresponding integrated farming system

The climate in India is determined by the monsoon - prevailing winds in reversal direction that cause rainfall. These winds arise from the seasonal difference in temperature between land and sea and the resulting changes of vapour pressure. The tropical monsoon climate is characterized by three distinct seasons: the cool, dry season from mid-October to mid-February; the hot, dry season from mid-February to mid-June; and the hot, wet season from about mid-June to mid-October. During the rainy season heavy rains fall as a result of winds that blow from the Ocean carrying moist air over the Indian subcontinent. On the other hand, during the dry season dry air from the continent moves towards the Sea (Encyclopaedia Britannica, Macropaedia; Fahimuddin 1989, p. 49).

There is great variation of rainfall and temperature within India. While areas with highest annual precipitation are located in the northeast of the country and the West Coast, in the northwest of the country annual precipitation may be below 200 mm. During the dry season in the drier areas very high temperatures (more than 40ºC) can be reached and the daily and seasonal temperatures fluctuate within a wide range. In comparison, in the north-eastern wetter regions and coastal lands temperatures are lower and the temperature range is smaller. The central plains are characterized by cold dry seasons and occasionally occurring frost. “Other important features of the monsoon climate are the uncertainty of rainfalls, untimely advent of the monsoon, and variation in the total rainfall from year to year” (Fahimuddin 1989, p. 49). Indian agriculture strongly depends on the monsoon. Late onset and small quantity of rainfall may substantially influence crop yields (Encyclopaedia Britannica, Macropaedia).

As a consequence of the climatic conditions in India mixed farming systems predominate (Devendra 1995, p. 4). According to Fahimuddin (1989, pp. 51-52) subsistence agriculture is traditionally based on wheat, barley and millet in low rainfall zones and rice in heavy rainfall zones. Additionally, cash crops, like sugarcane, cotton, and oilseeds are cultivated. In recent decades the introduction of irrigation, high-yielding varieties of crops, fertilizer and other technical innovations has increased the agricultural output.

On account of heavy pressure on land for the production of food and cash crops, pasture lands are fast disappearing in the monsoon region except in some parts where the density of human population is comparatively low at present. Under the characteristic system of land utilization in the monsoon belt, livestock are mainly reared on the by-products of Arable farming – cereal and pulse straws, and oil cakes supplemented with rough grazing on stubbles of crops, and seasonal growth of grasses during a part of the year.

In India approximately 50 million farms comprise less than three hectares (Ramaswamy 1986, p. 2). Unlike fossil fuels draught animals are a readily available and cheap source of renewable energy for drawing agricultural implements, hauling carts and generating motive

power for mechanical or electric devices (Ramaswamy 1998, pp. 74-75). Thus, for millions of smallholder farmers in India draught animals are inevitable. Approximately 75% of the energy necessary for land preparation on small farms is provided by draught animals (Ramaswamy 1986, p. 2). This situation is unlikely to change in the immediate future because of high oil prices and poor infrastructure (Falvey 1986, p. 109; George 1990, pp. 138-139). In addition, working cattle provide manure for the cultivation of crops, dung for fuel, companionship and bullocks are a living asset suitable to generate cash in times of need (Ramaswamy 1986, p. 3).

Draught oxen are mainly used for drawing agricultural implements (e.g. plough, weeder) in land cultivation and devices (e.g. water lifter) or hauling carts to transport harvested crops. According to Williamson and Payne (1978) cited in Falvey (1986, p. 110) the working capacity of a pair of oxen permit "ploughing of 0.4 hectare in 6.5 hours […] at a constant speed of 3.2 km per hour" or "haulage of carts of a gross weight of 1.02 tonne over a distance of 32 km at a speed of 3.2 km per hour". Animals are generally controlled by a cotton rope that is passed "through a hole punched in the middle cartilage of the nose", the face and the horns where a rein is spliced (Williamson and Payne 1959, p. 237).

A critical problem farmers are being faced with is the feed supply of their working animals at the beginning of the rainy season (Ramaswamy 1998, p. 76), because this time of most exhausting work coincides with the time of lowest fodder availability and therefore highest nutritional stress. It is unlikely that bullocks can meet their energy requirements by diets of low nutritive value consisting of poor quality pastures, straw or crop residues, even if provided *ad libitum* (Pearson 1999, p. 792). According to Ramaswamy (1994, p. 206) in working animals there is deficit in food supply of 50%. Apart from inadequate nutrition, draught animals are often impaired by heat stress and disease (Pearson 1999, p. 793).

Exceeding the carrying capacity of draught animals by excessive working periods and too heavy loads may also significantly depress their well-being. Lack of adequate feeding and resting periods can result in considerable weight loss (Williamson and Payne 1959, pp. 240-241). Ramaswamy (1998, pp. 74-75) also referred to overworking and overloading in draught animals:

> Draught animals are invariably overworked and overstressed. In order to goad draught animals to exert and work beyond their normal capacity, they are ill-treated in crude ways, such as beatings, twisting tails, prodding with sharp devices, and tickling their underside causing acute pain. Often, sick and injured animals are made to work, as owners would otherwise starve. Farmers and carters resort to such cruel methods in order to get more work done. As they themselves are eking out a subsistence existence, users are not sensitive to animal suffering and invariably overload and overstress draught animals. Many become unproductive and are sent for slaughter.

Apart from rough handling Indian bullocks also suffer from inadequate technologies, when pulling agricultural implements, carts and various devices. As a consequence of ill-fitting, rough yokes and harnesses, injuries are inflicted on the animals, which may not only be accompanied by discomfort but also by acute pain (Ramaswamy 1998, p. 76). Yoke galls mainly occur at the beginning of the working season and are caused by the "almost inevitable friction" of the yokes. Injuries are also caused from bruising or extreme pressure of heavy loads over prolonged time (Williamson and Payne 1959, p. 239). Yoke galls and harness sores result in reduced work output (Pearson 1999, p. 794).

Drawn from different sources Wells (1986, pp. 53-54) summarized various forms of pain-causing injuries in draught animals that are pertinent in terms of animal welfare:

- Bruising as a result of excessive pulling on the nose rope or needless beating
- Sores caused by improper fitting, rough harnesses
- Muscle, joint and tendon strains through too heavy tasks
- Discomfort from stones and earth between the hooves

- Injury inflicted by inadequate handling
- Chronic irritation from head ropes predisposing to horn cancer

Malik *et al*. (1996, p. 149) reported that Indian livestock keepers know a variety of ethnoveterinary remedies and preventive measures to alleviate pain in draught animals. For example, a bullock's urine is poured on its hump, in order to prevent yoke gall; hoof injuries are bandaged and the treated animal is withdrawn from work.

3.1.6.2 Religion, social life and the ban of cattle slaughter in India

Religion is an influential part of social life. Although there is a vast multiplicity of religions in India, Hinduism dominates by far. According to Government of India (2004, p. 19) Hindus constitute 82.41 percent of the population, Muslims 11.67 percent, Christians and Sikhs about 2 percent, Buddhists less than 1 percent and Jains less than 0.5 percent.

Protection and reverence of cattle is central in Hinduism and is deeply rooted in Indian culture. Particularly, in the rural society the bullock is highly esteemed for its active role in food production on agricultural lands. For the large majority of farming families, cattle are the only asset and available monetary resource in times of need. The various functions rendered by cattle to secure livelihood of smallholders are appreciated in the philosophical concept of the *sacred cow* (Compassion in world farming 2000, p. 28). Cattle protection is also manifested in legislation, which prohibits cattle slaughter in almost all of the states (Harris 1985, p. 44). Only two Indian states, namely, Kerala and Bengal permit cattle slaughter (Compassion in world farming 2000, p. 38). Nelson (1998, p. 4) reported that „Hindu and Jain organizations are actively opposing the construction of modern, export-oriented slaughterhouses".

George (1990, pp. 121-122) and Harris (1989, p. 63) interpreted the ban of cattle slaughter as a form of economic thinking. The ban on cattle slaughter is reasonable in the prevailing mixed farming system, because keeping a cow alive ensures food production on the fields "'for many years to come'". Cows produce bullocks for cultivating agricultural lands and milk that is processed to curd and ghee (clarified butter). In addition, the "contradictory demands of breeding for meat and breeding for heavy work, the former requiring a fleshy animal and the latter a muscular one", may explain the denial of beef consumption in India. Fattening stocks would mainly depend on food grains that are essential for human nutrition and, therefore, permission for cattle slaughter would not improve human food supply in a crucial manner.

The worship of cows as divine entities in contemporary Indian life was described by Harris (1989, pp. 45-46): People live with them in domestic community, give them names, adorn them with flowers, let them go first on main roads, and take them to municipal or private cattle shelters, if they grow old and people cannot care for them at home. Raising a cow is regarded as a form of service providing spiritual pleasure. In the Hindu tradition excretions of the cow and the bull are holy and, therefore, milk and dung of bovines are part and parcel of ritual practises. Ghee is burned in Hindu temples and in their homes Hindus use dried manure and ash of manure in order to ritually clean their floors and cooking places. The protection and adoration of cows symbolically integrates the worship of motherhood. In this regard, the cow is considered as the mother of mankind that herself provides milk and butter, while her male calves plough the land and supply people with (vegetarian) food.

3.1.6.3 Importance of agriculture in the country's economy and extent of human impact on animals in the draught animal system

Indian national economy depends on agriculture to a large extent. Agricultural production accounts for almost 25 percent of Gross Domestic Product (GDP) and about 70 percent of the population are engaged in farming for their livelihood. The untimely onset of monsoon may affect the agricultural output considerably, because nearly 60 per cent of the arable land is rainfed. "Animal husbandry and dairy development plays a prominent role in the rural economy in supplementing the income of rural households, particularly, the landless and small and marginal farmers." The output deriving from animal husbandry constitutes about 30 percent of the country's agricultural output (Government of India 2004, pp. 60, 80).

The work of bullocks plays a substantial role in the microeconomy of Indian farms, because it does not only generate food for human consumption but also crop residues as fodder for cattle (George 1990, pp. 121-122). In crop-livestock production systems the degree of human intervention is substantially higher than in pastoral systems. Stables are generally provided to shelter animals from adverse climatic influences and supplementary feed. Nevertheless, the impact of climate and its indirect effects on fodder availability remain relatively high in the system. The economic situation of the farmer is usually not as good that massive investments can release bullocks from any burden and can replace them by a tractor. In comparison to pastoral and commercial livestock production systems, crop-livestock husbandry has an intermediate position in view of the human intervention in the system.

3.1.6.4 Welfare-relevant aspects for further inquiry

Despite the religious and legal protection of cattle in India, draught animals are frequently exposed to abuse and cruel treatment. Indian farmers often attach little importance to the welfare of their animals (e.g. Ramaswamy 1998, p. 78). Work animals are particularly subjected to heavy physical performances, which may result in various forms of painful injuries and distress (Wells 1986, p. 51). Alike, ill-fitting equipment and inadequate handling of owners may cause animals' severe pain. As a consequence, the effects of pain on the welfare of animals and its assessment will be examined.

The Hindu tradition was found to be the most influential cultural element in India. While the concept of the *sacred cow* and the prohibition of cattle slaughter are well-known, little is known about Indian ethical concepts with regard to the treatment of animals. Therefore, investigations in this respect will be carried out.

3.1.7 The large-scale commercial swine and poultry production systems in Thailand – main features and relevant aspects of animal welfare

In Southeast Asia pig and poultry production traditionally plays an important role. The population of pig accounts for about 577 million head in Asia and about 7 million head in Thailand respectively and the number of chicken raised is 8389 million head in Asia and 170 million head in Thailand respectively (FAO 2005).

3.1.7.1 Agro-ecological conditions, land use and animal husbandry in Thailand

Thailand, which is situated between latitudes 6 and 20ºN and between longitudes 93 and 106ºE, can be divided into four physiographic regions (Table 3.4): The northern mountainous region is suitable for cultivating cash crops and for forestry. Unlike the north-eastern Plateau where, due to low precipitation and sandy soils, yields of rice, sugar-cane and cassava are low, the fertile Chao Phaya River basin in the densely populated central region is the rice basket. In the southern region the main occupation of farming people is tree cropping and fishery (Wanapat 1995, pp. 185-186; The New Encyclopaedia Britannica). Forests cover more than half of the area of Thailand (Bunge 1981, p. 58).

The country has a tropical monsoon climate occasionally influenced by cyclones (Wanapat 1995, p. 186), which consists of three distinct seasons: the cool season (November-February), the hot season (March-April), and the rainy season (May-October) (Bunge 1981, p. 57; The New Encyclopaedia Britannica). Annual average temperatures are within a range of 25ºC and 29ºC (The New Encyclopaedia Britannica; Rivas-Martinez 2005). Total precipitation in Thailand is appropriate for abundant crop and fodder growth. However, the amount of rainfall and pattern of annual rainfall vary significantly in the different areas (Wanapat 1995, p. 186). Humidity is high in Thailand's hot and humid environments.

Table 3.4 Physiography, distribution of rainfall, and land use by region

Region	Physiographic features	Rainfall (mm/yr)	Main land use
Northern	Mountainous	1500	Paddy field, field crops, forests
North-eastern	Plateau region	1000	Paddy field, field crops (less productive), grazing land
Central	River basin	1300	Paddy field, field crops
Southern	Mountainous, coastline	2100-4725	Plantation crops, fruit trees, fishery

Modified from Centre for Agricultural Statistics 1993 cited by Wanapat (1995, pp. 186, 189) and Devendra *et al.* (1997, p. 88)

Natural conditions have an impact on the regional distribution of livestock production systems, while economic and infrastructural factors chiefly determine the degree of intensification within the system. In the north-eastern and northern region Thai farmers have traditionally kept a small number of cattle and/or buffaloes primarily for draft purposes. Recently, semi-intensive dairy and beef cattle production systems have evolved in the central and northern parts of Thailand. Integrated in tree crop systems small ruminants predominate in the southern parts of the country. In the central region commercial, large-scale pig and poultry production is concentrated, which emerged during the last few decades (Wanapat 1995, pp. 185, 190).

3.1.7.2 Economic growth and the development of large-scale commercial poultry and pig production systems

There was a remarkable growth of the Thai economy from the 1960s until the mid 1990s (Tisdell *et al.* 1997, p. 2) and the country's economy was „among the most rapidly growing in Asia" (Atlas 2003, p. 4). Agriculture accounts for about one-eighth of the gross domestic

product (GDP) (The New Encyclopaedia Britannica). According to Devendra and Chantalakhana (1993) cited by Wanapat (1995, p. 190) livestock economy accounts for about half the total agricultural production. About 80 percent of Thailand's population (about 60 million people) earn their living from agriculture (Wanapat 1995, p. 185).

The process of intensification in animal agriculture was based on the rapid development of the economy. The poultry and pig sector expanded tremendously (Tisdell *et al.* 1997, pp. 2-3, 5). Industrialized livestock farming in the central plains accounts for more than 35 percent of broiler production and for approximately 36 to 40 percent of the pig production in the country (Tisdell *et al.* 1997, pp. 3, 5). Industrial production represents about 80 percent of both the poultry and swine sector in Thailand. Livestock industry is mainly owned by large multinational and transnational companies (Sheehan 1993 cited by Tisdell *et al.* 1997, p. 3; FAO 2004, p. 20). Though, at the village level small scale, backyard raising of poultry and pigs is still widely practised (Tisdell *et al.* 1997, pp. 3, 5). Mukherjee (1992, pp. 4, 7) ascertained that due to vertical integration in pig and chicken production industrial systems are more efficient than semi-intensive and extensive systems.

After introducing modern production methods, intensive poultry production units were increasingly set up in the 1970s. Simultaneously, modern chicken slaughterhouses for the processing of frozen chicken for the export market were established (Tisdell *et al.* 1997, pp. 6-8). In large-scale slaughter units chickens run on a conveyor line where they are shackled by their legs prior to electric stun and slaughter (FAO 2001, pp. 52, 54). Unlike for pork, Thailand has a highly developed export market for poultry products shipping about 30.000 tonnes of poultry meat into the EU (European Commission 1998 cited by Radford *et al.* 2000, pp. 17-18). Before the break out of avian influenza, "Thailand was the fourth largest exporter of chicken meat and products in the world" (FAO 2004, p. 20), due to comparative advantages in feed and labour costs (Tisdell *et al.* 1997, pp. 6-8). Currently, many poultry importing countries have banned poultry imports from Thailand (FAO 2004, p. 22).

Thai poultry production is highly vertically integrated. The production process is centred on eight or nine big feed milling companies that are situated in the central region. Keeping the parent birds, which are imported from the US or nowadays raised in Thailand, these companies provide day-old chicks to farmers by their agencies. As a rule, farmers are supplied with all the inputs being necessary (e.g. feed, equipment); though some farmers provide their own facilities. Animal health and welfare are controlled by veterinarians of the feed mill companies once a week. Finally, the birds are sold to the contracted enterprises after a growing period of 45 days. Economic efficiency of intensive poultry production is achieved with a minimum output of 10.000 birds per week, but up to 100.000 birds per week are reached (Radford *et al.* 2000, p. 21). Mukherjee (1992, p. 8) ascertained an average feed efficiency of 1.75 in laying hens and of 1.90 in broilers for industrial chicken production in Thailand. According to Tisdell *et al.* (1997, p. 8) the feed conversion ratio of the Thai broiler industry roughly corresponds with those of other major exporters in the world.

Similarly, in the 1980s the Thai pig sector became increasingly commercialized through governmental and private initiatives. A key factor for the development was the use of improved breeds, ready mixtures of animal feeds, regular veterinary treatment and modern housing equipment, which were provided by feed mill companies to contracted pig producers (Tisdell *et al.* 1997, pp. 2-3). Mensch (1986, pp. 18, 20-21) described a modern operation with 700 sows where fattening hogs are kept in slatted-floor pens, while breeding sows are raised in individual barns. On an average 8.5 piglets are weaned per litter. Producing in total more than four million pigs per year, the Thai swine industry is the major source of protein supply for the rural and urban population.

Mensch (1986, p. 18) and Devendra *et al.* (1997, p. 88) stressed the importance of imports of superior parental stocks and their adaptation to the local agro-ecological conditions by diversified pig breeding programmes. In this context, Mukherjee (1992, pp. 16-17) maintained that

[a]mong the major advances made in the field of swine production in Asia has been the genetic improvement of pigs. The use of exotic breeds for improving the local strains begun [sic] about 40-50 years ago. Based on the performance of pure exotic and crosses, the Landrace, Duroc Jersey and Large White are found to be suitable. While the Local x Exotic crosses are the popular choice now for extensive and semi-commercial systems, the industrial production relies on Duroc x Landrace, Duroc x Large White, Landrace x Large White crosses.

Wanapat (1995, pp. 192-193) identified main constraints for industrial pig production on producer side including the necessity of a large number of imported swine breeding stocks that require high investments while the productive output remains low due to heat stress, parasite infestation and poor feeding regime. Tisdell *et al*. (1997, pp. 8-9) claimed that feedstuffs such as corn and soybean meal are scarce. "It is predicted that Thailand will become a net importer of corn by the end of this century. Both its poultry and pig production may therefore be constrained by feed supplies". Songkitti (2005, personal communication) maintained that there have been regular supplies of soybean meal and corn from China, since the last decade. In addition, corn production has increased in the central plain where large animal producers are located.

According to Tisdell *et al.* (1997, p. 5) the stagnating pork exports are attributed to rapid outbreaks of illnesses, unhygienic conditions in many slaughterhouses and the low level of meat inspection. Songkitti (2005, personal communication) alleged that at present a major barrier for Thailand's export activities in the pig sector is the Foot and Mouth Disease. Although the Specific Pathogens Free (SPF) pigs and pork products have been produced in cooperation with Japanese counterparts, import bans of trade partners still exist.

3.1.7.3 The socio-cultural background and consequences of human intervention in animal husbandry

More than 85 percent of the country's population are Thai speakers and more than 90 percent of the population share Theravada Buddhism (Bunge 1981, pp. 61, 92; Wanapat 1995, p. 186) – a doctrine of Buddhism that is widespread in Southeast Asia. Other main groups of the society are Chinese and Malay people. While the former are concentrated in the central region, the later primarily live in the southernmost parts of the country. Moreover, there are various smaller ethnic groups living in the hilly areas in northern Thailand that are often engaged in traditional religions (Bunge 1981, pp. 61-71).

The *Kingdom of Thailand* is a constitutional monarchy with a parliamentary government (The New Encyclopaedia Britannica). There is a formal and ideological association between Buddhist clergy (the sangha) and the state (Bunge 1981, p. 92; Swearer 1989, pp. 112, 123). However, the role of Buddhism in the Thai society is not only a matter of its relation to the state. Important events in the lives of farmers are frequently accompanied by Buddhist clergy and the social and political life in villages is centred in the local wat (Bunge 1981, p. 92). The majority of rural communities maintain a wat – an arrangement of communal buildings that serves as monks residence, place for religious ceremonies and centre for communal meetings (Bunge 1981, p. 82). According to Wanapat (1995, p. 186) in rural communities three concepts are prevalent: "spiritual life, village-centered life and family life".

Swearer (1989, pp. 108, 120) drew attention to the point that

Thailand's rapid and widespread modernization and secularization have undermined many traditional aspects of the religion. […] Faced with Western imperialistic expansion from the seventeenth century onward and the challenge of modernity, the classical religious worldview, institutional structures, and cultural ethos have been changed, modified, and reasserted in a variety of ways. […] Thailand's rapid urbanization over the past fifty years has dramatically changed the village of town milieu that has historically informed and supported Buddhist religious practice.

Besides the disappearance of traditional values, Thai villagers have also experienced enormous changes in the conventional way of animal husbandry and in their interaction with farm animals. Old ethical-religious concepts with regard to the treatment of animals can be expected to fade in the light of modern production methods.

Owing to their export activities, many Thai animal farmers are not only potentially faced with challenges derived from their own moral tradition, but also with ethical concepts of societies in other parts of the world. For example, in the EU the severe intervention in the quality of life of farm animals in modern livestock production has aroused public concern for animals and has resulted in a revision of the current animal welfare legislation. In 1998 the EU set minimum standards for the protection of farm animals in a European directive, which implements the European Convention for the protection of animals kept for farming purposes. This directive demands not to cause „any unnecessary pain, suffering or injury" to farm animals and to take into account the animal's physiological and ethological needs (Radford *et al.* 2000, p. 5).

As far as chicken are concerned, currently there is no EU welfare standard for the keeping of broilers. For laying hens a minimum living space of 450 cm² per bird is stipulated (Council Directive 88/166/EEC) and for sows the use of tethers is prohibited (Council Directive 91/630/EEC) (Radford *et al*. 2000, p. 6). The implementation of these standards for import products basically depends on multilateral trade negotiations within the World Trade Organisation (WTO) and the General Agreement on Tariffs and Trade (GATT). Although „'[…]current WTO practice does not allow distinctions based upon them to be made unless they change the character of a product in a discernible way compared to similar products […]'" (RSPCA 1998 cited by Radford *et al.* 2000, p. 10), the General Agreement on Tariffs and Trade GATT Article XX admits:

'Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:
(a) necessary to protect public morals;
(b) necessary to protect human, animal or plant life or health; [...]'

An implementation of animal welfare standards could be based on these items, but so far no concluding decision has been made by the WTO (Radford *et al.* 2000, pp. 10-11). On the other hand, EU initiatives to incorporate animal welfare standards in international trade agreements would hardly affect Thai livestock industry, because exports of eggs and pork, the products that are most likely to be targeted by EU animal welfare regulations, are negligible (Radford *et al.*, pp. 21, 28-30). Since there are no specific EU policies for poultry meat, Thai exports of poultry would remain entirely unaffected. Hence, from a macro-economic point of view there would be no incentive for Thai poultry production to catch up with EU animal welfare regulations and animal ethics.

In tropical countries stocking rates in poultry units generally tend to be lower than those in the temperate zone, because due to high environmental humidity there is considerable risk for Chronic Respiratory Disease, if birds are overstocked. To promote animal health in the industrialized poultry production "[t]he Thai government has laid down standards for minimum the area per animal, free space per animal, water and light levels" (Radford *et al.* 2000, pp. 21, 28-30). Recently, the Thai Department of Livestock Development has launched obligatory standards for pig, poultry and dairy cattle farms, which aim at animal health, welfare and the protection of the environment (Songkitti 2005, personal communication).

3.1.7.4 Scientific and ethical issues to be investigated

At present large, industrialized units dominate the swine and poultry production in Thailand. Compared with traditional animal husbandry systems the Thai pig industry is conducive to high productivity, but new detrimental effects on animals have evolved. Under extreme confinement the animal's performance of natural behavioural patterns is thwarted and this deprivation may result in severe health problems. On the other hand, stress and reduced resistance to disease induced by high temperatures and humidity (Tisdell *et al*. 1997, p. 8) are serious threats to the well-being of the birds in large poultry units. Further, crowded environments and the impossibility to escape can give rise to the development of fear and distress in animals.

The previous analysis also showed that more than 90 percent of the population in Thailand follow the Buddhist tradition. It will therefore be evaluated which ethical concepts Buddhism provides for the treatment of farm animals.

3.1.8 Summary of examples

The interrelations of selected production systems with ecological, socio-cultural and economic systems, as well as the *human* factor are summarized in table 3.5:

Table 3.5 Features of selected animal husbandry systems and their interacting factors

	Agro-ecological conditions	Value system	Economic development	Human intervention
1 The Fulbe pastoral system in northern Nigeria	Semi-aridity giving rise to climatic stress and food and water shortage	Islamic values	Low	Low
2 The llama and alpaca breeding system in the Andean highland of Peru	Rough highland climate causing thermal discomfort	Christianity mixed with traditional religion	Low	Low
3 The smallholder crop-livestock production system in India	Subhumid environment with seasonal food availability	Hindu tradition	Medium	Medium
4 The commercial pig and poultry production system in Thailand	High humidity in the subhumid to humid climate	Buddhist doctrine	High	High

These results will initiate further investigations in the well-being of animals from a scientific perspective, in the moral status of farm animals in different cultures and the scope for change in the treatment of animals in tropical livestock production. The identification of major animal welfare-related problems for scientific inquiry was guided by the question: What are the dominating threats to the well being of animals in the given system? Such threats constitute direct and indirect effects of the climate including climatic stress and shortness of fodder and water as well as the prevalence of contagious organisms and parasites. In addition, missing shelter from weather imponderability, pain, suffering and distress causing management practices and adverse housing conditions that thwart the animal's desire to express normal behaviour are detrimental for the welfare of farm animals.

As a result, the scientific reflection on animal welfare-related aspects will be directed to:

1. The problem of hunger and thirst in the Fulbe pastoral system
2. Discomfort and disease caused by cold and missing shelter in the camelid breeding system in the Andean highland
3. The impact of pain on animal welfare in the smallholder crop-livestock system in India
4. Freedom to express natural behaviour and freedom from fear in the commercial pig and poultry production system in Thailand

3.2 The scientific study of the well-being of animals related to tropical environments

Scientific research in the field of animal welfare was initiated because of people's ethical concern for animals. Animal welfare science has provided own concepts of animal welfare and numerous experiments were conducted in order to develop the understanding of animal welfare (Duncan and Fraser 1997, p. 19).

3.2.1 Conceptual aspects

Comstock (2000, pp. 101-102) explained the relation between ethics and science:

> There are scientific questions we can answer without having to think about ethics at all, just as there are arithmetical questions we can answer without having to do ethics. However, there are few ethical questions one can resolve without basing one's judgements on accurate scientific information. […] The difference here is that whereas science tries to tell us what is, applied ethics tries to tell us what ought to be. The sphere of ethics is a sphere of moral choices, and moral choices differ from the operations of the natural world in that moral agents can choose to act in ways that science cannot predict, in ways that are contrary to our instincts and nature's physical laws. None of the moral questions facing animal science may be answered by simply doing more scientific research, no matter how carefully crafted.

The subjective state of animals is central in the scientific debate; most pertinent in any investigation is the animal's welfare from its own point of view. While subjective states, such as pain, sickness and frustration aggravate welfare, states, such as comfort and pleasure improve it. In this study the investigation of the well-being of farm animals in tropical settings is directed to two main points: The structure of the *five freedoms* and the emphasis on the main features of tropical animal husbandry in the scientific discussion of animal welfare. This analysis employs the *five freedoms* as a governing framework and therefore discusses hunger and thirst, discomfort and sickness, pain, expression of natural behaviour and fear in relation to livestock husbandry in the tropics. Thus, a reductive view on selected aspects of animal welfare is applied to gain new insights into the phenomenon. The four paradigms that have been examined in the previous section form the basis for the scientific study of detrimental effects on the well-being of animals in tropical livestock production (Table 3.6):

Table 3.6 Exemplary analysis of production system and animal welfare-related problems

	Production system	Harmful effects
1	The Fulbe pastoral system in northern Nigeria	Hunger and thirst
2	The llama and alpaca breeding system in the Andean highland of Peru	Thermal discomfort and illness
3	The smallholder crop-livestock production system in India	Pain
4	The commercial pig and poultry production system in Thailand	Non-performance of natural behaviour and fear

3.2.2 Connecting scientific principles and characteristics of tropical animal husbandry

Science is directed to description, explanation and prediction, when making an effort to find out regularities of relationships between natural objects and attempts to formulate natural laws (Comstock 2000, p. 101). Scientific study traditionally aims at discovering objects in the natural environment in a way that is independent of the subject investigating or objective (Diekmann 2000, p. 216). The premise of objectivity claims that results of scientific experiments are absolutely true, when certain conditions are fulfilled. Principles of science include not only objectivity but also reliability, validity and generalizability. Reliability involves the accuracy of research methods and techniques and can, for example, be achieved by standardized instruments (Mason 1996, p. 24). According to Diekmann (2000, p. 218) reliability shows the reproducibility of measures implying that results must be equal, if an experiment is repeated. Generalizability describes the extent to which wider general claims can be made on the basis of own measurements. It expresses how representative a sample is (Mason 1996, p. 24). Finally, the validity of an experiment represents to what extent actually those features are measured, which are intended to be measured (Mason 1996, p. 24; Diekmann 2000, p. 224). A key element to accomplish this goal is the representative sample (Diekmann 2000, p. 224).

Being characterized by an “instrumental view” and a dominant understanding of nature the philosophy of modern science is, unlike ethics (Özdemir 2003, p. 5), pursued in all research laboratories worldwide. The idea of science is closely linked to Cartesian theory. Although the scientific study of animal welfare in tropical livestock production underlies this universal philosophy of science, the subjects studied, i.e., the animals in their habitats, and the ecological systems in which they are studied may differ substantially in the different regions of the world. Similarly, the organization and the degree of intensification of the livestock production system where the investigation is carried out vary. For example, farm animals in arid zone or in low-input systems are subjected to other threats to their welfare than animals in modern confinement systems. In this chapter these particularities of animal husbandry in the tropics will be connected with the scientific inquiry of hunger, thirst, comfort, disease, pain, expression of natural behaviour and fear in farm animals.

3.2.3 Example 1: Hunger a threat to animal welfare in the Fulbe pastoral system

In the current animal welfare debate *freedom* from hunger and thirst has high priority to maintain good welfare in farm animals. On the other hand, in tropical livestock production the scarcity of feed and water is a common problem, particularly in arid and semi-arid environments. The inevitable short supply of feed and its effects on the well-being of animals highlights the need to study hunger of animals in tropical livestock production systems.

3.2.3.1 The definition of hunger

According to Kyriazakis and Savory (1997, p. 50) there is bewilderment over the term *hunger* in that a widespread definition (e.g. Le Magnen 1985 cited by Kyriazakis and Savory), which refers to "'[the state of the animal] in which it is stimulated to eat', implies that when an animal is not feeding, it is in 'a passive state of no hunger'". This definition does neither take into consideration the physiological state of the animal nor external factors that influence food intake. In addition, "'freedom from hunger and thirst' is a *non sequitur*": Hunger is a necessary precondition to eat. Kyriazakis and Savory argued that

> [i]t might be more useful if feeding behaviour is viewed within the context of what the animal is trying to achieve. Animals have nutrient requirements to carry out specific bodily functions (e.g. to grow and reproduce), and at the same time 'possess the desire' to meet these requirements (the latter being an extension of the Aristotelian concept of 'telos', that all animals desire or strive to reach the functional end for which they were designed):
>
> In the Aristotelian and evolutionary sense an immature animal seeks resources such as food and water from its environment because it desires to grow. This desire is to grow towards the mature size in the shortest time that is consistent with reproductive success and thus to ensure the preservation of the animal's genetic material.
>
> (Kyriazakis 1994, p. 85 cited by Kyriazakis and Savory 1997, p. 50)

Meeting nutritional requirements and growth presupposes a variety of possibly non-limiting nutritional and environmental circumstances. Limitations in the animal's nutritious demands in relation to insufficient requirements cause undernourishment, while inadequately balanced rations lead to malnutrition. Especially in extensive livestock production systems in the arid tropics, the harsh environmental conditions may result in combinations of both inadequate quantity and quality of food. Alike, detrimental environments in terms of physical and social circumstances (e.g. ambient temperature, social rivalry) may produce undernutrition and/or malnutrition in animals. In order to take into account the issue of feeding behaviour more appropriately, Kyriazakis and Savory (1997, p. 51) use the terms *undernutrition* and *malnutrition* rather than *hunger* in their discussion.

Although Kyriazakis and Savory (1997, p. 61) regard hunger (and thirst) in terms of the animal's requirements to serve physiological functions, they do not deny eating (and drinking) as a source of positive sensation or pleasure. Psychological aspects are also part of Webster's definition of hunger. According to Webster (1994, pp. 39-40) „[h]unger is a primitive sensation induced by integration of signals from a range of sensory nerves recording information concerning the balance between supply and demand of nutrients to the tissues of the body". As a sole reference to a homeostatic physiological state that includes the desire for food *per se* or for specific nutrients, Webster suggested to use the term *metabolic hunger*. He assumed that all vertebrates can suffer from hunger.

As a result, hunger may be defined as a feeling related to the supply and demand of nutrients in the animal body. While Kyriazakis and Savory emphasized the aspect of undernutrition and regarded hunger as nutritional requirements to maintain body functions implying the desire to meet these requirements, for Webster hunger as a sensation is central. Referring to the maintenance of homeostasis, hunger is caused by signals of stimulated receptors, which are transmitted to the brain. These findings reveal that the phenomenon of hunger contains both a physiological and a psychological component and therefore the dichotomy that was detected many times before in the previous sections.

3.2.3.2 The physiology of hunger and mechanisms of feed intake control

Hunger in farm animals is associated with a strong motivation for feed intake and satiety is achieved by the rise of negative feedback signals. Thus, hunger sustains, if these signals from the gut, liver and other organs are absent. The physiology of hunger is closely related to mechanisms of feed intake control. In this context, it is important to know, what gives rise to food intake signals (Toates 1980, p. 49) and what induces satiety? Feed intake is influenced by the nutrient requirements of the animal and various other interfering factors (Forbes 2000, p. 319). As a consequence, satiety is determined by a number of internal and external control mechanisms that will be subject of the following discussion.

Feed is supplied to digestion, absorption and metabolism. The digested and absorbed nutrients go to the liver and blood circuit. Receptors, which are chiefly located in the liver, but also in the stomach and intestines, send information to the central nervous system (CNS) (Forbes 2000, pp. 319-320). The importance of the CNS in view of feed intake control was described by Forbes (p. 321) as follows:

> While the hypothalamus and surrounding parts of the forebrain are likely to be the seat of intake control, there are centres in the hindbrain, such as the nucleus of the solitary tract, which receive information from receptors in the visceral organs such as the stomach and liver. Also in this area are neurons directly sensitive to shortage (but not to excess) of energy-yielding substrates.

Thus, hunger and satiety are a function of the metabolic energy available.

A variety of gastrointestinal receptors were reported to contribute to feed intake behaviour in livestock. During food ingestion the level of fill and the chemical composition of swallowed feed alter in the digestive system (Forbes 2000, p. 323). The idea that eating is terminated by the distension of the stomach owing to the bulkiness of feed was central for the development of the *empty stomach theory* being one of the earliest theories in relation to feed intake control. Although animals generally eat, when their stomach is empty, the distension of the stomach may be merely one of several mechanisms to end meals, since „animals with stomach surgically removed (the oesophagus was connected directly to the duodenum) controlled energy intake almost normally“ (Toates 1980, pp. 49-50). Therefore, the presence of hunger can be attributed to the fill of the stomach.

The early assumption of fodder intake in consequence of an empty stomach corresponds with the mechanoreceptors found in the wall of the digestive tract that inform the brain about the degree of distension. In ruminants these receptors occur particularly in the anterior dorsal range of the rumen wall (Leek and Harding 1975 cited by Forbes 2000, p. 323). Nevertheless, Forbes (2000, p. 323) alleged that it is doubtful that feed intake is solely controlled by stomach distension, because in this case ruminants would go on foraging, if the distension is somewhat reduced rather than eating discrete rations with longer intervals between them, as they commonly do.

It was further ascertained that the receptors in the lumen of the digestive tract are not only sensitive to mechanical stimuli but also to chemical stimuli (Forbes 1999, p. 3), such as volatile fatty acids (Forbes 2000, p. 324). These chemoreceptors signal properties of the internal milieu (e.g. pH and osmolality) to the CNS (Forbes and Barrio 1992 cited by Forbes 1999, p. 5). In this context, it is important to note that „the relative importance of changes in osmotic pressure of rumen fluid in the control of feed intake by ruminants is not yet clear […]" (Forbes 2000, p. 324). Thus, it seems to be that mechano- and chemoreceptors are decisive for the rise of hunger signals.

Another mechanism involved in the regulation of hunger and satiety is the monitoring of glucose in the liver and the blood circuit, the later providing the basis for the *glucostatic theory*. There is evidence that after being absorbed glucose is monitored in the liver by receptors sensitive to the nutrient. The liver signals both „a toxic threshold of metabolite supply" and „a significant deviation in body reserves" to the CNS via the autonomic neural system (Forbes 1988 cited by Forbes 1999, p. 4; Forbes 2000, p. 324). Ruminants synthesize glucose from propionate and amino acids. An increase in the concentration of propionate in the liver was found to depress food intake. The metabolic information obtained in the liver is communicated to the brain (Toates 1980, p. 56; Forbes 2000, pp. 324-325).

In addition, the CNS monitors the glucose concentration in the blood (Forbes 2000, p. 326). The realization that the blood glucose level influences the experience of hunger and satiety or the beginning and ending of a meal lead to the development of the *glucostatic theory* by Carlson in 1916 and by Mayer in 1953 (Toates 1980, p. 51; Forbes 1999, p. 4). This theory is basically founded on homeostatic considerations suggesting that feeding is stimulated, when the blood glucose level drops below a threshold value and that a meal is terminated, when the glucose concentration rises above a threshold value (Toates 1980, pp. 50-51; Forbes 2000, p. 326). Forbes (2000, p. 326) maintained that to date the interest is more on receptors in the liver and intestine as a main determinant of feed intake control than on the glucose level in the blood circulation.

Likewise, lipids and body fat deposits have a role to play in the endogenous control of fodder intake and, therefore, for the presence of hunger. Metabolites in the blood that cannot be utilized are excreted by the kidneys or stored in body tissues (Forbes 2000, p. 326). Aiming at an optimum body composition, feedback from adipose tissues to the intake-controlling circuits of the CNS is a primary control mechanism and is expressed in Kennedy's *lipostatic theory*. If, body stores are excessive the organism reduces its food intake and if, body reserves deplete food intake increases. It is assumed that this process is assisted by the hormone leptin that is released by adipose cells. After entering the blood stream, leptin is capable to activate brain receptors (Forbes 1999, pp. 3-4; Forbes 2000, p. 327). These findings imply that in a situation of acute shortness of feed the hunger signal is less intense, when the animal possesses stores of energy reserves in form of adipose tissue.

Combining glucose concentrations and body fat tissues, David Booth developed an energy flow model with reference to the control of feed intake. The major determining factor for feeding is „the rate of supply of readily metabolizable energy to the organism" (Booth 1972, 1976, 1978 cited by Toates 1980, p. 56). Food intake is inhibited, when glucose from the gut or fat from a deposit is sufficiently available. According to Booth's model the energy rate, which may depend on glucose, fat, or amino acid levels, is the crucial factor for initiating and terminating feed intake behaviour (Toates 1980, p. 57). This strongly suggests that the experience of hunger and satiety is also associated with the available energy supply.

Feed intake behaviour is not only guided by internal control mechanisms but also by various external control mechanisms. Subsequent to feed intake, the sense of taste can provide the CNS with information about „potential changes in metabolic status, and risk of toxicity", which may lead to the rejection of forage. Prior to feed intake properties of fodder including odour, shape and colour are ascertained by the animal. In a process of learning, animals have ac-

quired the ability to establish a link between the sensory qualities of feed and its nutritional value (Forbes 1999, p. 5). Similarly, Grant and Albright (2000, p. 379) pointed out that decisions concerning feed intake are founded on information about chemosensory stimuli in the forage detected by olfaction and taste. Thus, external factors are also involved in the monitoring of the CNS with regard to the animal's metabolic state and this strongly suggests that information about sensory properties of forage obtained by the brain is also integrated in the complex processes that induce hunger.

In response to water deprivation an animal will reduce its feed intake compared with an animal in a well-hydrated state, although it is expected that both animals receive the same hunger signal (Toates 1980, pp. 118-119, 123). Schlecht *et al*. (1999, pp. 171, 176) found that all these aspects have minor importance with regard to indigenous animals in tropical environments in which feed intake remained almost constant under detrimental conditions. According to Toates the hunger signal is equal in both favourable and unfavourable situations. However, this statement requires further investigation with reference to tropical livestock husbandry.

To recapitulate, control of feed intake integrates a range of internal and external stimuli. The availability of metabolizable energy is a crucial factor. Forbes (2000, p. 328) alleged that it is

> [...] most likely that the stretch signals are integrated with the metabolic signals, and there is evidence that this integration is by simple addition. [However,] voluntary intake is not controlled only by physical factors, even in ruminants, and that it is the sum total of the strengths of signals received by the brain from many types of receptors in many parts of the body which determines how much an animal eats.

Hunger necessarily occurs in order to initiate feed intake and to maintain a homeostatic state in the animal. All mechanisms involved in feed intake control are inextricably associated with the initiation of hunger and satiety. Thus, from a physiological point of view there is much credibility that the presence of hunger is closely related to the following factors:

1. Insufficient availability of metabolic energy
2. An empty stomach
3. Detection of a deficient nutritional state by mechano- and chemoreceptors
4. Inadequate glucose concentrations in the liver and the blood circulation
5. The size of body fat deposits in that little or no adipose tissue aggravates the problem of hunger, when fodder is in short supply
6. External factors (e.g. sensory features of forage) that influence feed intake. For example, an unpleasant taste of feed may manipulate the feeling of hunger

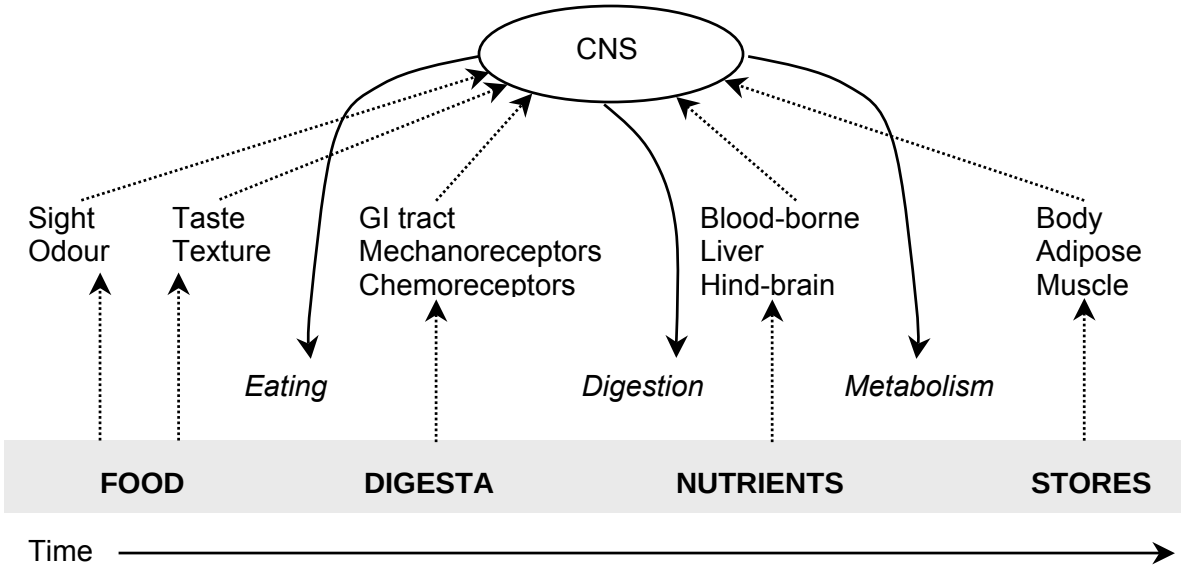
The huge variety of mechanisms involved in feed intake control is manifested in the satiety cascade (Figure 3.2). In general, the termination of eating is related to satiety. Webster (1994, p. 40) defined satiety as „the motivational opposite of hunger, i.e. the (largely internal) drive that motivates an animal to make the conscious decision to stop eating and do something else [...]". Blundell and Halford (1994) cited by Forbes (1999, p. 5) developed the *satiety cascade* in which the information flow to and from the CNS with regard to food-related items is shown.

Termination of feeding and satiety is related to the following control mechanisms:

1. Feedback from body fat deposits to the feed intake-controlling circuits of the central nervous system (CNS) (primary system)
2. Monitoring of nutrient supply in the liver and CNS (secondary system)
3. Information given by stretch and mechanical receptors in the intestinal tract
4. Monitoring of the taste and texture of the food, after entering the mouth
5. Ascertaining visual appearance and odour of fodder in relation to its nutritional value

(Forbes 1999, p. 3)

Figure 3.2 Satiety cascade



Modified from Forbes (1999, p. 5)

3.2.3.3 Psychological components of hunger and the conscious sensation of appetite

Criticizing traditional models that almost exclusively related ingestive behaviour to animal physiology, Collier *et al*. (1972) cited by Toates (1980, p. 73) stated that

> [...] such thinking as following firmly in the restricted traditions of Descartes' hydraulic model of animate motion. [A] homeostatic feeding model inevitably ignores ecological variables which are instrumental in shaping a species' responses, and it pays no regard to the evolutionary history of the species.

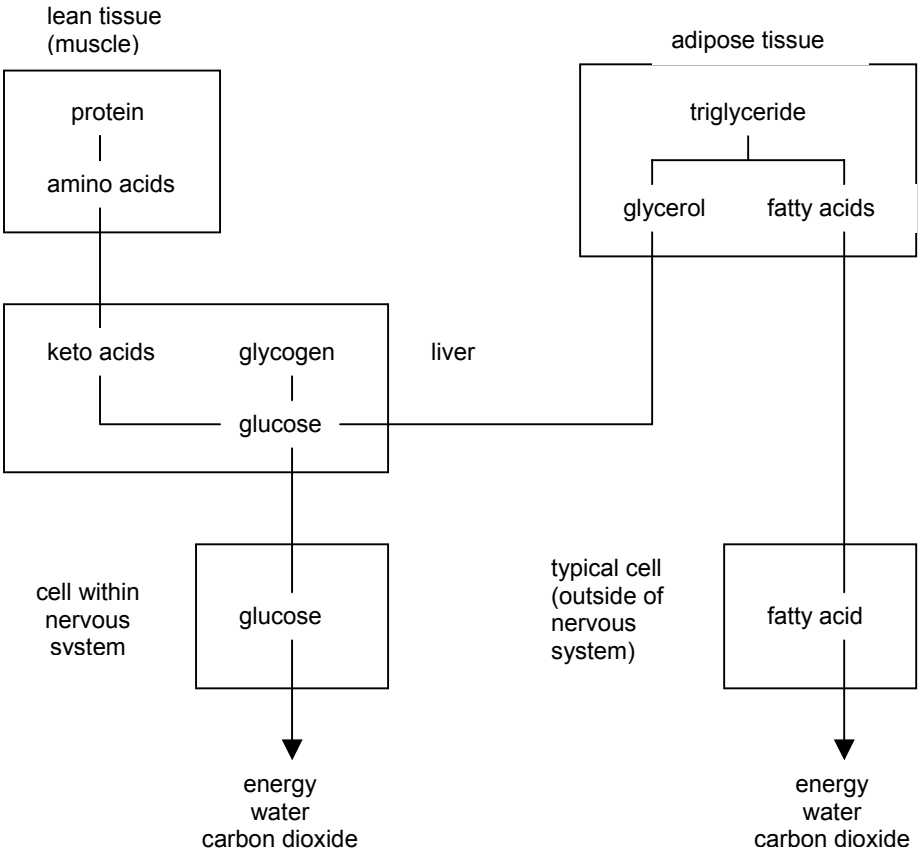
Webster (1994, pp. 40-41) introduced the term *appetite* as a „complex conscious sensation" that is evoked by a number of internal and external stimuli. These stimuli involve metabolic hunger ("sensation which recognizes the balance between supply and demand of nutrients to the tissues of the body") that arises independent of the presence of food, direct external stimuli (e.g. smell), and social stimuli (e.g. competition). The expectation that appetite will be satisfied can produce pleasure and contentment in the animal. Webster concluded that food intake is not only controlled by metabolic hunger but also by conscious appetite.

Moreover, Webster (1994, pp. 44-45) discussed eating as a source of pleasure. Foraging behaviour in farm animals kept in natural environments indicates that „[t]he simple visceral sensation of hunger is [...] modulated by the sense of pleasure [or oral satisfaction] that an animal derives from the pursuit of food [...]". Therefore, domestic animals are motivated to feed and forage for food not only by metabolic hunger but also by the oral satisfaction they obtain. Webster (pp. 55-56) further alleged that in intensively kept farm animals suffering may occur despite the full provision of the nutrient requirements, because they experience frustration by unmet oral satisfaction. This argument was supported by the fact that stereotypic behaviour, such as tongue rolling in cattle, was observed increasingly in deprived environments. However, Webster conceded that stereotypies cannot exclusively be related to the absence of oral satisfaction.

3.2.3.4 Animal metabolism and energy supply during fasting and realimentation

In the state of fasting no glucose is being supplied to the animal body. However, the blood glucose concentration in the organism should remain constant, because glucose is essential for the nervous system. If during fasting no glucose can be absorbed from the digestive system, glucose can alternatively be converted from various other sources (Figure 3.3). Alternatively, glucose supply can be obtained from the splitting of lean tissue in the liver and muscles into glycogen or the breakdown of fat (triglycerides) in the adipose tissue („collection of cells containing largely fat deposits") into glycerol and fatty acids (lipolysis). The glycerol received in this process is further converted to glucose in the liver. In addition, glucose can be supplied by the conversion of lean body mass into proteins and glucose (Toates 1980, pp. 46-48).

Figure 3.3 Scheme of energy flows during fasting



Adapted from Vander *et al*. (1975) cited by Toates (1980, p. 47)

If no glucose is being supplied from the digestive tract, three levels of metabolism can be distinguished: First, no new energy reserves can be deposited and the mobilization of glucose from adipose tissue starts. The breakdown of body fat deposits for the metabolic process has minor impact on the animal. According to Aristotle's concept of *telos* (see above) emphasis is placed on the animal's desire to achieve their functional end. The presence of energy reserves could be regarded as necessary to reach this end and thus a lack of fat deposits would negatively affect the animal. At the same time adipose tissue is stored just for overcoming periods of nutritional short supply and the breakdown of reserves or surplus fat does not affect homeostatic equilibrium and normal body function. On the contrary, too much fat deposits may have negative effects on animal health and reproduction and therefore re-

duce reproductive success, which is also a functional goal of animals in Aristotle's sense. Since the functioning of the organism remains unimpaired, it may be resumed that the breakdown of body reserves has only minor influence on the quality of life of animals.

Second, nutrient supply is inadequate for anabolic processes including growth, pregnancy and lactation. "The nutrient requirements for these processes are regulated by a biological programmer which sets targets which are defined by the genetic constitution and physiological state of the animals (e.g. […] lactating)" (Webster 1994, p. 42). A situation in which body tissue growth or milk production ends owing to shortage of nutrient supply is not in agreement with an animal's *telos*, which implies the animal's desire "to grow towards the mature size in the shortest time" (see Kyriazakis and Savory above). This goal cannot be achieved in a fasting state, when nutritional requirements are not met. Although at this step growth and reproduction is seriously impaired (in mature animals only reproduction), all other body systems function satisfactorily and homeostasis can still be maintained. In view of the dramatic deterioration of productive traits, animal welfare is clearly depressed.

Third, the maintenance requirements cannot be met, i.e. the available nutrients cannot balance the loss of nutrients in metabolic processes. Thus, metabolism necessary to maintain homeostasis and body mass cannot be sustained (Webster 1994, p. 42). When energy can neither be provided by the gut nor by body reserves for a prolonged period, physiological control systems become overtaxed, the animal shows exhaustion and finally dies. Since in this case not even normal body functions can be maintained, undoubtedly the functional end of an animal, which is implicit in the concept of *telos*, is disregarded and the well-being of animals is seriously impaired.

In this regard, it is interesting to review long-term control mechanisms in animals that „meet genetically programmed targets during pregnancy and growth, or during recovery from illness or undernutrition". Webster (1994, p. 41) described the phenomenon of catch-up growth or compensatory growth in farm animals: In Europe extensively kept growing cattle are generally brought off the grasslands in the autumn, when the vegetation period ends. Fed on a relatively low quality diet (hay, grass silage) in the following months, the animals will eat to appetite and continue to grow, but at a rate below their genetic potential. After the winter feeding period the animals' height will have increased, but muscle fibres and particularly fat deposits will have decreased relative to the animals' size. When the young stock returns to pasture in the spring they consume much more fodder and gain weight at a much faster rate than animals without "restricted" feeding.

Compensatory growth appears to be more prominent in tropical livestock production, where, especially in drier areas, such as the Fulbe grazing grounds, feed availability between dry and rainy season fluctuates dramatically. Since in times of fodder scarcity ruminants often solely depend on natural pastures, severe stagnation in the growth process of the young stock occurs, while mature animals dramatically lose weight. Only, if resources are accessible, the cyclic annual short supply can be overcome by purchasing food stuffs. When grasses come up again in the wet season, fully-grown animals can restore their body constitution and young animals that have not reached their mature weight grow at a much faster rate catching up their previous weight loss. If, however, the higher growth rate during realimentation in the wet season does not persist, only incomplete compensation can be achieved. Animals that respond with equal growth rates prior to and subsequent to feed restriction show no compensatory growth at all (Ryan 1990, p. 653; Kamalzadeh 1996, p. 6).

It is hypothesized that after long-term feed restriction animals are more susceptible to stress and infectious diseases, which are manifold in tropical environments. Broom (1991, p. 4171) alleged that difficulty in coping with the environment results in elevated activity of the adrenal cortex and thus in an impaired function of the immune system. Animals that could not compensate their body weight during realimentation require comparatively higher inputs of energy in order to maintain body functions under stressful conditions than normally constituted

animals, because body reserves are absent. In weak animals even minor stressors may cause severe health problems and lead to a very poor state of welfare.

3.2.3.5 Assessment of undernutrition and malnutrition in terms of animal welfare

Although the previous discussion revealed that the subjective element is well recognized, no attempt has been made so far to include this aspect in the assessment of animal welfare related to hunger. On the contrary, Kyriazakis and Savory (1997, p. 61) maintained that measuring an animal's well-being in relation to nutritional deficiency (and water restriction) must be based on abnormal behaviour, stress-related physiological indicators and pathological processes. This view clearly implies that measuring animal welfare has to be associated with the testing of hypotheses and mathematical proof prescribed by Cartesian science. Kyriazakis and Savory also mentioned an alternative way of assessment, which is centred upon an animal's subjective experience of the state of hunger, but this way was not pursued any further.

It has been observed by Lawrence *et al*. (1993) cited by Kyriazakis and Savory (1997, p. 57) that intensively kept farm animals whose nutrient requirements are not met direct their foraging behaviour towards other available stimuli what results in stereotyped behaviour. In tethered sows such stereotypies were detected by Rushen (1985b, p. 1064) cited by Kyriazakis and Savory (1997, p. 58) in association with restricted feeding regime. Undernutrition led to abnormal behaviours, such as bar-biting, rubbing the snout against bars, manipulating the drinker, and head-weaving. While bar-biting, rubbing and head-weaving is exhibited immediately prior to feeding (terminal responses), prolonged drinking in relation to rooting or rapid movements as rubbing was performed immediately after feeding (interim responses). Independent of the provision of feed vacuum-chewing and playing with the chain was displayed (see also Fraser and Broom 1997, pp. 312-316; Keeling and Jensen 2002, p. 81).

Displaying abnormal behaviour or stereotypies is regarded as a disturbance of the animal's motivational state, which is expected to reduce the welfare of animals. Although to the author's knowledge investigations concerning the behaviour of tropical ruminants in times of scarcity of natural feed have not been carried out yet, it is likely that also in these animals the internal motivational system is disturbed and thus the well-being is impaired. In addition, Webster (1994, p. 40) identified stereotypies as a sign of frustration in those intensively reared animals that are provided with balanced nutritious rations, but do not have the opportunity to graze or search for food for which they have a strong motivation. Kyriazakis and Savory (1997, p. 57) further maintained that livestock under intensive conditions exhibit „increased general activity, exploratory chewing and rooting behaviours", when offered an imbalanced food *ad libitum*.

According to Kyriazakis and Savory (p. 59) „[t]emporary or sudden restriction of food and/or water to an animal that has been previously able to meet its nutrient requirements could be regarded as an acute stressor". Animals in general respond to a stressor by increased plasma cortisol concentrations (Dantzer *et al*., 1980 cited by Kyriazakis and Savory 1997, p. 59). It is not unambiguous whether undernourishment, malnourishment and water restriction on the long term leads to chronic stress as well, but chronic stress is supposed to impair the animal's immune system (Kyriazakis and Savory 1997, pp. 59-60). Therefore, blood cortisol levels can indicate nutritional stress and thus reduced welfare. Though, the increase of hormone values is unspecific, it may also be caused by other stress-inducing factors.

In tropical low input systems undernutrition and malnutrition often occur in combination. In some instances fodder quantity is high, but fodder quality low and vice versa. To the author's knowledge no experiments have been conducted so far on farms in the tropics, which have

regarded the effects of insufficient and unbalanced rations on animals in relation their welfare. Though, it is strongly supposed that in tropical farm animals similar to temperate breeds shortage in feed supply results in behavioural and physiological changes and has a negative impact on their welfare.

The complex mechanisms that control feed intake and satiety in animals have evolved in a long-term evolutionary process and therefore play a substantial role for the well-being and survival of animals. This implies that animals have a strong interest to maintain a homeostatic equilibrium of metabolites. The regulation of hunger and satiety within the limits of the control system may also be interpreted in terms of the notion of *telos*, which expresses that all animals endeavour to arrive at the end for which they were created (see Kyriazakis and Savory 1997, p. 50). Thus, within the regulatory boundaries established by nature an animal may lead a life that is in accordance with its *telos* and survives. Welfare is very likely to be depressed always, if an animal feels hungry, but detrimental effects on health and life time may only occur, if physiological control mechanisms are impaired.

3.2.4 Example 1: Thirst and its effects on animal welfare in the Fulbe pastoral system

Kyriazakis and Savory (1997, p. 49) alleged that complete deprivation of eating and above all drinking causes a quick death in the animal, while a mild deficit of food and water has negligible effects on the animal's health and welfare. Forbes (1995) cited by Kyriazakis and Savory (1997, p. 49), for example, detected no negative physiological effects in experimental animals after their water supply was reduced to 70-80% of *ad libitum*. In view of these statements, it seems worth to explore thirst and its effects on the well-being of farm animals in more detail.

3.2.4.1 The concept of thirst

"Thirst is a subjective sensation aroused by lack of water". Accordingly, the feeling of thirst "can strictly only be studied directly in man […]. However, animals including man, when deprived of water, are in a state of drive in which they will search for and ingest water, and 'thirst' can be used in a different way to that described above as a name for this state of drive" (Rolls and Rolls 1982, pp. 1, 3). Kyriazakis and Savory (1997, p. 54) stated that definitions, such as "'drive for ingesting water'" are not very helpful with reference to the assessment of thirst. They suggested investigating the state of water restriction in animals based on the conception that „the only function of water intake is to meet physiological requirements".

Although Kyriazakis and Savory (p. 61) considered thirst as well as hunger solely in physiological terms in order to assess the welfare of animals, they do also recognize positive and negative sensations associated with drinking and the restriction of water intake. According to Webster (1994, pp. 40, 54) the phenomenon of thirst does not only include the physiological need for water induced by dehydration but also a psychological element:

> [Thirst] is an instinctive response to dehydration, triggered primarily by a rise in the osmotic pressure of the blood. I think it fair to assume that for any animal with sufficient sentience to suffer at all then water deprivation must constitute the most severe source of suffering. The nature of this suffering will include, in all cases, the intense desire to drink water and the malaise consequent upon dehydration. This sense of malaise will involve a progressive sense of weakness and disorientation and, almost certainly, a progressively severe headache (of the 'hangover' type). In higher mammals this desire for water and sense of malaise will be compounded by a sense of anxiety if the animal sees no clear prospect that its thirst will be assuaged.

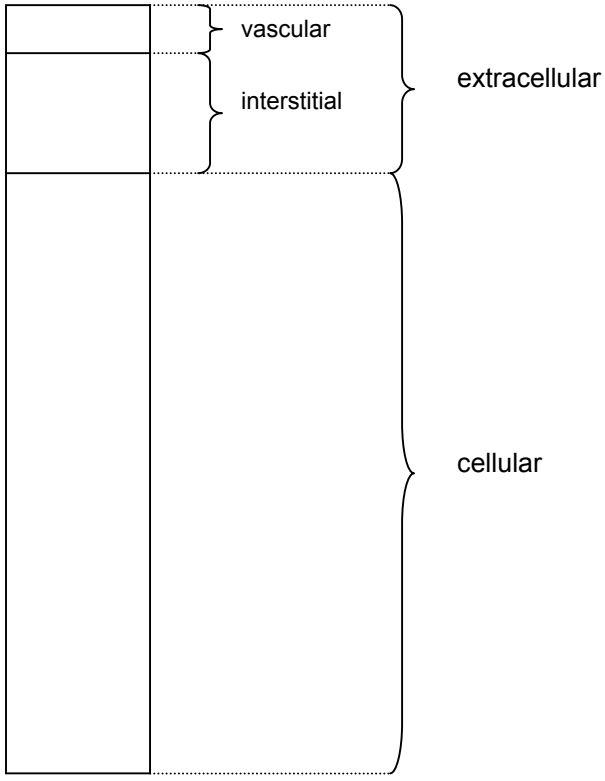
Alike, McKinley and Johnson (2004, p. 1) emphasized the emotional perceptive character of thirst stating that “[t]hirst is a subjective perception that provides the urge for humans and animals to drink fluids. It is a component of the regulatory mechanisms that maintain body fluid homeostasis and ultimately is essential for survival”.

3.2.4.2 Thirst physiology and initiation of drinking

In fact, water is indispensable to maintain normal body function in animals (e.g. Toates 1986, p. 68; Squires 1988, p. 217; McFarland 1993, p. 295). According to Kirchgessner (1987, p. 40) the loss of only one tenth of the body water content leads to death of the animal, since all biochemical processes in the organism take place in a fluid phase. Water is the medium to transport soluble substances absorbed of the alimentary tract, to convey waste products from the cells, and to dissipate surplus heat by the evaporation of water (Kirchgessner 1987, p. 40; Squires 1988, p. 217).

Thirst arises in response to lack of water or to a change in the body fluid compartments (Rolls and Rolls 1982, p. 4). Body fluids are located in two main compartments or phases. The *cellular* or *intracellular compartment* is the total amount of water inside the body cells, while the *extracellular compartment* refers to all fluid outside the cells (Figure 3.4). The *extracellular compartment* is divided in the *vascular compartment*, i.e., blood that flows in vessels, such as arteries, veins, arterioles and capillaries and the *interstitial compartment*, i.e., fluid that surrounds the cells (Rolles and Rolles 1982, pp. 11-12; Toates 1986, p. 68).

Figure 3.4 Body fluid compartments



Modified from Toates (1980, p. 85)

Permeability of cell membranes and the resulting osmotic water flow play an important role in the initiation of drinking. “When two solutions are separated by a semipermeable membrane, the solvent (e.g. water) tends to move from the more dilute solution to the more concentrated solution”. The distribution of the solvent across the membrane into the more concentrated solution is denoted osmosis (Rolles and Rolles 1982, p. 13). In the animal organism osmosis causes water exchange through cell membranes in the cellular-extracellular space dependent on the concentration of solute molecules (e.g. sodium chloride). For example, a high concentration of NaCl molecules in the blood give rise to water movement from the cells into the extracellular space until a new equilibrium is accomplished (Toates 1980, pp. 86-88).

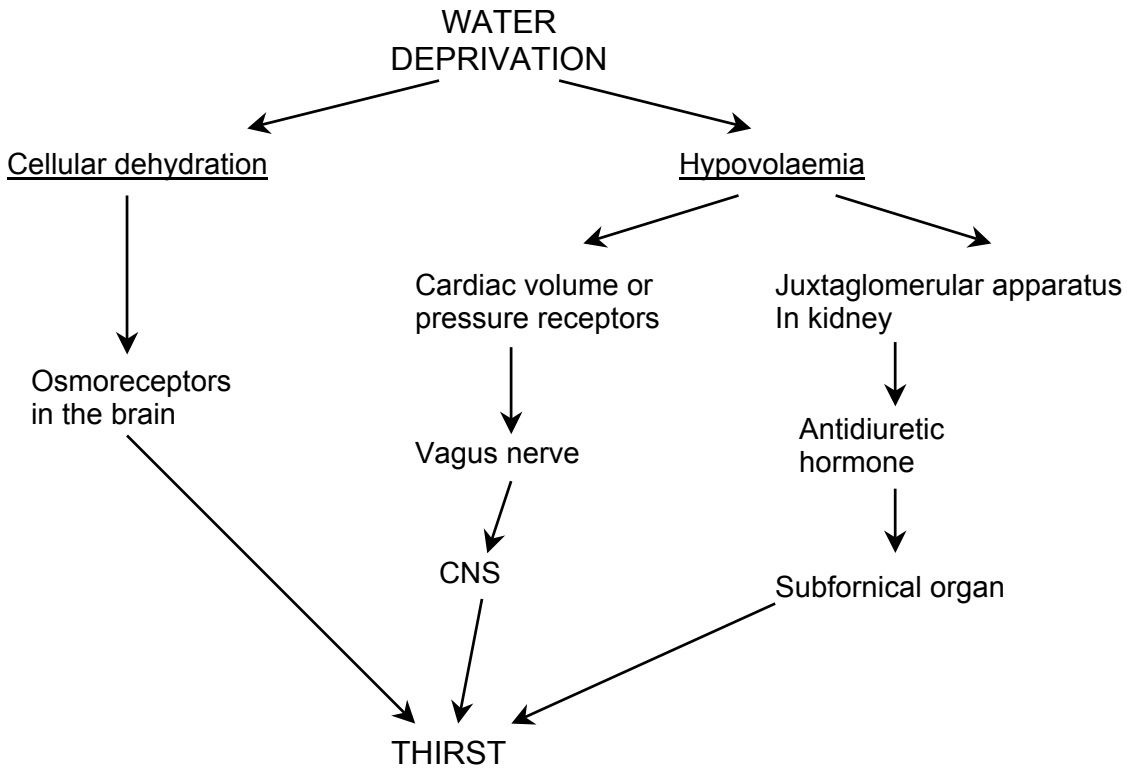
Toates (1980, pp. 91-108) and Rolles and Rolles (1982, pp. 23-31) reviewed various theories of thirst based on the publications of Grossman (1967) and Fitzsimons (1973): According to Hippocrates’ dry mouth theory of thirst, the dry mucosa of mouth and throat induces water ingestion. Toates (p. 91) argued that animals can be stimulated to drink through local dryness and deficiency of saliva in the mouth, but wetness of mouth and throat as such does not satiate a thirsty animal. Evidence for this hypothesis was provided by an experiment in which an animal’s oesophagus was surgically manipulated in a way that water did not reach the digestive tract and therefore body-fluids could not be restored, although the dryness of the mouth was relieved. This experiment showed that in a water-depleted animal the satiety achieved by the moistening of the upper portion of the digestive system is only limited.

In order to support the view that water intake is initiated by cellular dehydration rather than increased extracellular osmolarity *per se* Toates (1980, p. 92) and Rolles and Rolles (1982, p. 33) further referred to an experiment of Gilman (1937): Despite equal osmolarity of the two solutions, an injection of concentrated sodium chloride into the blood gave rise to sufficient drinking to normalize extracellular osmolarity, while a urea injection caused only little water intake being insufficient to restore normal osmolarity. The reason for the different effects is that the cell membrane is impermeable for Na^+ ions, but permeable for urea molecules. Consequently, extracellular osmolarity rises, when NaCl is injected, water moves out of the cells and the animal starts drinking. Water intake re-establishes extracellular osmolarity and water flows back into the cells. On the other hand, urea molecules set up equilibrium in both the cellular and extracellular compartment, because the cell walls are permeable for the molecules. Since equilibrium is adjusted by osmotic activity, urea does not cause cellular dehydration and stimulates little or no drinking.

“Although the amount of fluid in the extracellular compartment is less than in the cells, it is vital that the extracellular fluid balance be rigorously maintained to avoid debilitating changes in the vascular fluid volume and pressure which, if lowered, could lead to circulatory collapse”. A decrease in plasma volume (hypovolaemia) causes water conservation by the kidneys and stimulates water intake. Receptors in the vascular system elicit the discharge of antidiuretic hormone and consequently the renal preservation of water. Alike, alterations in blood volume and pressure in the heart can influence the secretion of antidiuretic hormone and there is credibility that receptors in this region stimulate hypovolaemic drinking. Putative cardiac receptors signal a reduction in blood volume and subsequently fluid intake and antidiuresis is initiated to conserve plasma volume (Rolles and Rolles 1982, pp. 41-42, 60).

Thus, it can be concluded that decisive thirst stimuli are cellular dehydration and extracellular fluid depletion both in a state with fluid deprivation and without fluid deprivation (Figure 3.4). Cellular dehydration mainly affects normal drinking. Receptors that stimulate the initiation of drinking are osmoreceptors. They are assumed to be located in a variety of body sites, such as stomach, alimentary canal and hepatic-portal circulation (Rolles and Rolles 1982, pp. 34-35, 40-41, 67). It is further suggested that osmoreceptors are widely distributed in the hypothalamic areas of the brain (Rolles and Rolles 1982, p. 36; McFarland 1993, p. 296). The stimulation of these receptors can give rise to, first, an increase in the tendency to search for water to drink, and second, an activation of different fluid saving mechanisms (McFarland 1993, p. 296).

Figure 3.5 Factors likely to be involved in the initiation of water intake after water deprivation



Modified from Rolls and Rolls (1981) cited by Rolles and Rolles (1982, p. 74)

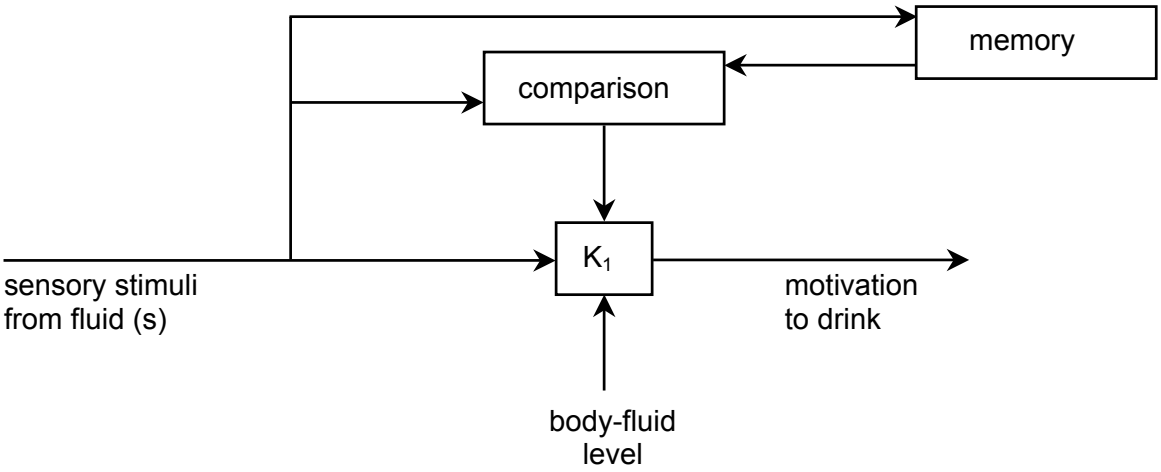
However, thirst and initiation of drinking is not only determined by physiological factors but also by psychological ones. Rolls and Rolls (1982, pp. 164-165) claimed that the involvement of cognitive processes in the initiation and termination of drinking it often ignored.

The concept of homeostasis should not be used to imply that an animal is like a simple thermostat that automatically switches on or off according to fixed bodily conditions. To assume that an animal always behaves in such an automatic fashion ignores the fact that it has a brain which makes it adaptable, able to benefit and learn from environmental change.

Rolles and Rolles (1982, pp. 76, 80-82) discussed the factor of oropharyngeal sensations for the maintenance of drinking and stated that oropharyngeal stimulation initiates drinking in the thirsty animal. The subjective sensation of drinking in a water-deprived state was investigated experimentally in humans. Human subjects asked for their sensations “gave a high rating (on a visual analogue scale) to the pleasantness of the taste of water immediately before drinking”. After thirst was satiated the taste of water was regarded as less pleasant in comparison to the previous state.

Toates (1986, pp. 70-71) provided a model for the motivation of drinking (Figure 3.5). According to this model sensory detection of fluid arouses motivation. The gain of the system is a function of the body-fluid state and the revived memory of the animal with regard to the drinking complex. Toates argued that an hour-by-hour drinking in close temporal association with food intake cannot solely be explained by displacement in body-fluid state. Kraly (1984) cited by Toates (1986, p. 71) postulated that motivation for water intake is closely related to food passage along the alimentary tract, where signals are aroused. Toates (1986, p. 71) further assumed that learning is involved in the initiation of drinking in relation to food intake.

Figure 3.6 Model for the initiation of drinking



Adapted from Toates (1986, p. 71)

Since the displacement in body fluid is still prevalent when drinking is terminated, it is supposed that also satiety is aroused by a variety of factors. There is evidence that satiety is "a complex function of (a) oral detection of water in passage (b) detection of the stretch of the stomach and (c) detection by osmoreceptors at various locations in the body (Toates 1986, pp. 72-73). Similarly to Rolls and Rolls (1982, pp. 164-165), Toates proposed to fundamentally change the simple homeostatic model of water intake and asked "[c]an animals, rather than responding to existing deficits, anticipate future deviations in fluid states and thereby take pre-emptive action?" There is some evidence that animals "can anticipate future fluid states and adjust fluid intake accordingly", in association to feeding and also by learning (Toates 1986, p. 76).

3.2.4.3 Body water balance

All farm animals underlie homeostatic mechanisms in order to maintain water balance. The concept of homeostasis was used first by W.B. Cannon (1932). According to this concept the internal state of the body is monitored by sensory processes, which initiate corrective action, "whenever the internal state deviates from a preset, or optimal, state". The interior milieu of the body is maintained constant within a range and independent of external or internal influences. To avoid water imbalance, a regulatory system is necessary to detect and compensate continuous water loss by excretion, evaporation etc. (Rolls and Rolls 1982, pp. 4-5; McFarland 1993, pp. 289-295). According to Toates (1980, p. 11) and McFarland (1993, p. 298) regulation of displacements from the normal involves various conservation mechanisms (e.g. kidneys) and drinking initiated by thirst that minimize the rate of water loss and maximize the rate of water gain. In order to achieve this goal the behaviour of the animal is essential.

Toates (p. 12) differentiated *broad* and *narrow* homeostatic interpretation of drinking behaviour. The broad interpretation holds that any form of water ingestion is attributed to homeostasis, because various processes (e.g. learning) are integrated in homeostatic regulation of water intake behaviour (Cannon 1947 cited by Toates 1980, p. 12). In contrast, the narrow interpretation maintains that only drinking based on a noticeable deficit of body-fluids is as-

cribed to homeostasis. Therefore, drinking is evoked when the body water content falls below a certain limit and proceeds until the fluid deficit is compensated. Toates argued that "[t]his view of motivation sees an otherwise passive organism being goaded into action only when the relevant physiological quantity had departed significantly from normal". The broader interpretation of homeostasis advocates that a deficiency of water causes drinking, but also maintains that not every act of water intake is caused by a deficit.

Both water losses and water gains contribute to water balance. Water loss is inevitable due to any form of excretion, because the kidneys remove waste products from the blood plasma and excrete them in urine. For the excretion of urine the presence of antidiuretic hormone in the blood is central. This hormone gives rise to a decrease in the quantity and an increase in the concentration of urine. A considerable amount of water is also lost by defecation and thermoregulation, which involves sweating, respiratory evaporation from the lungs or spreading of saliva over the coat (Toates 1980, p. 89; Squires 1988, pp. 219-221; McFarland 1993, pp. 295-296).

Water intake is initiated in order to restore the lost fluid volume. Apart from oral intake of drinking water and fluid in and on forage, the organism gains metabolic water by the oxidation of carbohydrates and fats, which releases water derived from metabolism. Over a period of time equilibrium between water input and output must be established (Toates 1980, p. 89; Toates 1986, p. 69; Squires 1988, pp. 219-221; McFarland 1993, pp. 295-296). The water balance of an organism is affected by food *per se*, because food contains water (Toates 1980, p. 119). Fluid losses and gains of the animal body are summarized in table 3.7.

Table 3.7 Sources of water losses and gains in animals

Water losses	Water gains
Urine	Drinking water
Sweat	Water content of food
Respiratory water	Water as a product of metabolism
Saliva spreading	
Faeces	

Adapted from Toates (1980, p. 89)

Water balance is affected by a variety of internal and external factors. Toates (1980, p. 9) claimed that the adjustment of the body-water content on a constant level is closely associated with the antidiuretic hormone (ADH), which controls the rate at which water is excreted from the body. The higher the ADH concentration in the blood the lower is the water excretion rate. If, for example, exposure to heat causes great water loss, the animal body produces high amount of ADH and consequently urine is formed on a lower rate. Receptors monitor fluid volumes and regulate the release of antidiuretic hormone. Thus, a detected increase in blood volume resulting from water intake or a swelling of cellular compartments inhibits the secretion of ADH and contributes to the excretion of urine. On the other hand, a detected water loss causes a reduction of excretion due to ADH release and additionally the animal ingests water. Increased reabsorption of water in the small intestine and a decrease of food intake can reduce water loss in the faeces (Squires 1988, p. 220; McFarland 1993, p. 296).

Alike, water can be conserved by behavioural changes (e.g. seeking shade) (McFarland 1993, p. 296). In this regard, Squires (1988, p. 220) maintained that

> [b]ecause of the large external component in the regulation of water intake and loss, behavioural avoidance of extreme climatic conditions plays a large part in water conservation. Internal or physiological processes support behavioural adaptations. The ability to endure harsh environments is made

possible by selection of milder conditions (microhabitats) which lessens the stress on animals and sometimes removes the need for physiological adaptations.

Water is also lost by the consumption of feed, which requires intake of water in close temporal proximity to meet the need for fluid in the gut. Feed in the digestive tract draws water from the body fluids (Toates 1980, pp. 132-133; Kamphues 2000, p. 298). According to Toates (1980, pp. 120-121, 132) the animal's minimum demand for water depends on its food intake, when food and water is *ad libitum*. Though, there is, according to Toates, „no evidence that a thirst signal is inhibited by the presence of a hunger signal".

Increased food intake and diets high in protein cause higher amount of renal loss (Toates 1980, p. 120). Protein rich feeds negatively influence the body water content, since they cause a high urine loss and at the same time yield a low amount of metabolic water. Water intake increases, if the protein content of the diet is high (Kirchgessner 1987, p. 40; Kamphues 2000, p. 299). Similarly, excessive intake of minerals, particularly sodium, increases the animal's water requirement (Kirchgessner 1987, p. 40; Webster 1994, p. 54; Kamphues 2000, p. 299). „If pure water or hypotonic solutions are in the intestine then water moves from the intestine to the blood. However, if a solution more concentrated in salts than the blood is ingested, the osmotic pull is in the opposite direction, and the blood is dehydrated" (Toates 1980, p. 89). A high content of mineral or toxic substances in the water generally reduces water intake (Kyriazakis and Savory 1997, p. 55).

High ambient temperatures and intense solar radiation not inconsiderably affect water gain and water loss (Squires 1988, p. 220; Kamphues 2000, pp. 298-299). Since water is an important thermoregulatory medium, in warm environments the organism loses water *via* respiratory tract and sweat glands in order to dissipate heat. The higher the ambient temperatures the higher is the evaporative and respiratory water loss and at the same time the demand for water (Kamphues 2000, pp. 298-299). Toates (1980, p. 119) supposed that increase of water intake in animals at high ambient temperatures might be controlled by temperature detectors or alternatively by excessive fluid loss which induces increased fluid intake.

3.2.4.4 Conservation of water and effects of water deprivation on animals in arid environments

"The rate at which an animal uses water in a given environment depends on the genetically-determined drives from the limbic cortex and hypothalamus". These initiate water intake, while the alimentary canal and the renal system regulate output. In ruminants indigenous to arid regions specific adaptations have evolved to conserve water (Squires 1988, pp. 219-220).

> Adaptation of domestic ruminants […] to arid conditions involves, of necessity, the regulation of rate of water loss from the body. An additional characteristic is that of being able to rehydrate rapidly. […] Animals with low water turnover rates, like the camel or goat, have a better chance of survival during water deprivation or drought than animals with high water turnover such as cattle. […] Dehydration does not reach a critical level in desert-adapted animals until they have lost 30% of the bodyweight (King 1983 cited by Squires 1988, p. 221). In general, ruminants can replace 15-20% of their body weight at the first drink and 20-25% within 1-2.5 h. The capacity and speed of fluid replacement appears to be higher in more desert-adapted animals. Under herded conditions in Africa or India, a three-day drinking cycle is common for cattle, sheep and goats. Camels can go for longer periods without drinking.
>
> (Squires 1988, pp. 220-221)

The arid and semi-arid zone is characterized by a prolonged dry season in which ruminants usually graze far away from their watering sites and thrive on low quality pastures with high

plant cell wall and low protein contents. Thus, animals encounter *ecophysiological problems* of obtaining an adequate amount of water and feed (Ahmed and Abdelatif 1994, pp. 147-148). In addition, drinking is avoided, when water sources are contaminated or fouled. Owing to efficient water saving mechanisms (e.g. the ability to concentrate urine) that affect the water balance of animals, indigenous breeds can withstand some degree of water deprivation.

Ahmed and Abdelatif (1994, pp. 150-152) investigated the effects of water restriction on water balance in Sudanese desert sheep (Table 3.8) and found a significant decrease in urine volume, faecal and evaporative water losses, water turnover rate and a lower dry matter intake in water-deprived sheep. The reduction of feed intake was interpreted as a means to save water during periods of water restriction. A decline in metabolic heat production was indicated by a significantly lower rectal temperature. Moreover, Ahmed and Abdelatif detected a decrease in the rumen pH of water restricted animals, which was ascribed to reduced saliva production, decline in rumen fluid volume and a considerably elevated concentration of volatile fatty acids (VFA). Ahmed and Abdelatif hypothesized that the "[a]djustment of energy metabolism during shortage of both water and food might be important in facing various degrees of stress imposed on desert sheep".

Table 3.8 Effects of water deprivation on water balance in desert sheep

	Water gain (l day-1)			Water loss (l day-1)			Water turnover (ml kg day-1)
	Drinking	Preformed	Metabolic	Urine	Faecal	Evaporative	
Ad lib. water and food	5.5 ± 1.29	0.36 ± 0.07	0.62 ± 0.11	1.21 ± 0.41	0.74 ± 0.23	4.5 ± 1.03	174.7 ± 2.93
Water restriction (to 46% ad lib. intake)	2.5 ± 0.56*	0.22 ± 0.01*	0.38 ± 0.07*	0.29 ± 0.12*	0.38 ± 0.05*	2.4 ± 0.43*	91.6 ± 8.91*

* Significantly ($p<0.01$) different from the control in the same column

Modified from Ahmed and Abdelatif (1994, p. 151)

Toates (1980, p. 126) described the effects of short-term and long-term water deprivation on the body structure of animals. First, if an animal's normal water intake is reduced on the short-term and *ad lib* food is provided, its food intake declines up to a percentage of normal. The body starts burning fat and lean mass, since metabolic demands cannot be met. As a consequence, weight stabilizes at a reduced level and decreases urine loss. Weight loss in animals owing to reduced food intake over a period of water deprivation is a well-known phenomenon under natural conditions (Toates 1980, pp. 126-127).

In pastoral animals long-term restriction of water may occur in the dry season, when water sources gradually dry up and the body condition of ruminants is poor. When restoring the body water content, animals drink less than the amount of water they have lost during short-term deprivation of water. Drinking the full amount would lead to over-hydration in the now smaller cells, because cells have shrunk and the concentration of cellular electrolyte has diminished. Water intake returns to normal, when the lean body mass is re-built and the level of cellular electrolytes is re-established by food intake (Toates 1980, p. 126).

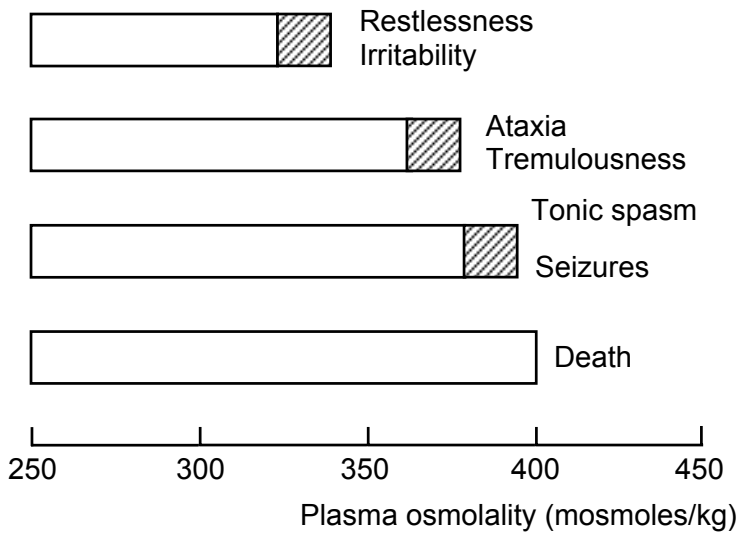
Total deprivation of water in animals can be equated with the practice of watering animals every third day, which is common under tropical conditions (Squires 1988, pp. 220-221). Kutscher (1972) cited by Toates (1980, p. 126) pointed out that after a period of complete restriction of fluid „animals will drink more if feed was available during deprivation than if it

was unavailable". In arid environments pastoralists and their animals are not only being faced with lack of water but also with shortage of feed. Toates (1980, pp. 126-127) maintained that if water and feed is deprived, loss of lean body mass and cellular electrolytes is higher than if food intake is restricted voluntarily due to shortage of water.

Nicholson and Sayers (1987, pp. 129, 133-134) in their experiment investigated the body condition of lactating and dry cows watered every 24 hours, 48 hours and 72 hours by scoring. While the dry cows in the Africa environment were almost unaffected by water restriction, lactating animals were faced with severe metabolic problems. The combined strains of lactation and water deprivation conspicuously affected body condition and the rate at which condition deteriorated, when pastures dried up. Although lactating cows watered daily were in a good body conformation at the beginning of the dry season, they linearly lost body weight up to the end of the dry season. Compared with frequently watered animals, lactating animals watered only every 72 hours were in a worse bodily state. The dramatic loss of condition in the early dry season gradually stabilized and even improved at the end of lactation.

The trial by Nicholson and Sayers revealed that despite effective water conservation mechanisms in tropical species, detrimental effects on body conformation cannot be eliminated. Thus, it is strongly supposed that during prolonged dry periods animals suffer from severe dehydration. Rolls and Rolls (1982, p. 148) maintained that in a dehydrated state hyperosmolality occurs, which is linked with elevated plasma concentrations of sodium, glucose, urea or ethanol. Acute hyperosmolality in animals is characterized by restlessness, irritability, ataxia, tremulousness, tonic spasm, seizures and can lead to death, as illustrated in figure 3.8. These symptoms clearly indicate that the welfare of animals is seriously affected.

Figure 3.7 Effects of acute hyperosmolality on experimental animals



Modified from Arieff *et al*. (1977) cited by Rolls and Rolls (1982, p. 148)

3.2.4.5 Assessing thirst in relation to animal welfare

In order to measure thirst in animals Kyriazakis and Savory (1997, p. 55) suggested methods in analogy to the measurement of hunger including

(1) measurements of water intake and drinker-directed activity, rate of drinking
(2) operant conditioning and
(3) aversion.

To assess welfare problems arising from water restriction, Kyriazakis and Savory (p. 57) proposed to direct attention to abnormal behaviour, physiological parameters related to stress and pathological indicators.

By novel techniques, such as positron-emission tomography (PET) and functional magnetic resonance imaging (fMRI), neuroimages of brain activity can be visualized in order to determine subjective states. Denton *et al*. (1999, pp. 1-14) investigated cortical processes in humans that subserve the consciousness or thirst by PET technique. They suggested that "the anterior and posterior cingulate, as well as the anterior wall of the third ventricle" are primarily involved in the genesis of consciousness of thirst. Awareness of thirst was found to be located in phylogenetically ancient areas of the brain. Denton *et al*. (1999, p. 14) maintained that in humans the emotion of thirst is likely to evoke memories and the enjoyment of gratification, and is thus a complex conscious experience.

Egan *et al*. (2003, pp. 1-2) produced images of the human neural system by fMRI after thirst was induced by infusion of hypertonic saline and had reached a maximum rate. The data indicated that the anterior wall of the third ventricle plays an important role in the initiation of thirst in humans and animals. According to Egan *et al*. (p. 10) the inhibition of antidiuretic hormone (ADH) secretion in the dehydrated animal takes place long before ingested water could reduce the high blood Na concentration and the osmotic pressure that triggered off the release of ADH. Hence, Egan *et al*. suggested that the "gratification may 'turn off' some areas that specifically subserve the consciousness of thirst and others that control neuroendocrine regulation of ADH secretion, which may be at a nonconscious level, and are topographically different from those controlling consciousness".

From both experiments discussed previously it may be inferred that the neural correlates of thirst are widely identical in humans and animals and that animals experience thirst consciously and thus suffer from dehydration not only in physiological, but also in psychological terms. When thirst can be detected in an animal by measuring its neural activity, the welfare of the individual is likely to be negatively affected. On the other hand, the absence of thirst can be termed as a prerequisite for well-being.

3.2.5 Example 2: Thermal stress affecting animal comfort and welfare in the Andean llama and alpaca breeding system

Aversive thermal conditions are wide-spread in tropical livestock production. In the Andean lamoid production system the adversity of aridity is coupled with the difficulties and dangers of the rugged high altitude landscape. Bianca (1976, pp. 142, 148) described settings at high elevation as complex multifactorial systems in which hypoxia, thermal discomfort through cold and dry air, intensive solar radiation, deficient feed and water supply that require pacing long distances in steep areas markedly influence the life of animals. High diurnal temperature fluctuations, snow and hail, night frost at more than 300 days per year with peaks of -15ºC (see Troll 1968, p. 22) and chilly winds can result in severe thermal effects that seriously affect animal welfare and health.

Llamas and alpacas are known for their excellent adaptation to the harsh Andean environment (Fowler 1989, pp. 169, 172). Nevertheless, they are frequently faced with thermal discomfort due to low temperatures and lack of shelter; especially neonates are very susceptible to hypothermia, frost bite and even death. Very scant information is available about both

the effects of cold on the lamoid organism and the well-being of the animals. In accordance, this section is devoted to a general scientific analysis of thermoregulatory mechanisms in homeotherms and the consequences of cold stress on animal comfort and welfare.

3.2.3.1 Thermal stress in homeotherms and mediation of thermal stimuli in the nervous system

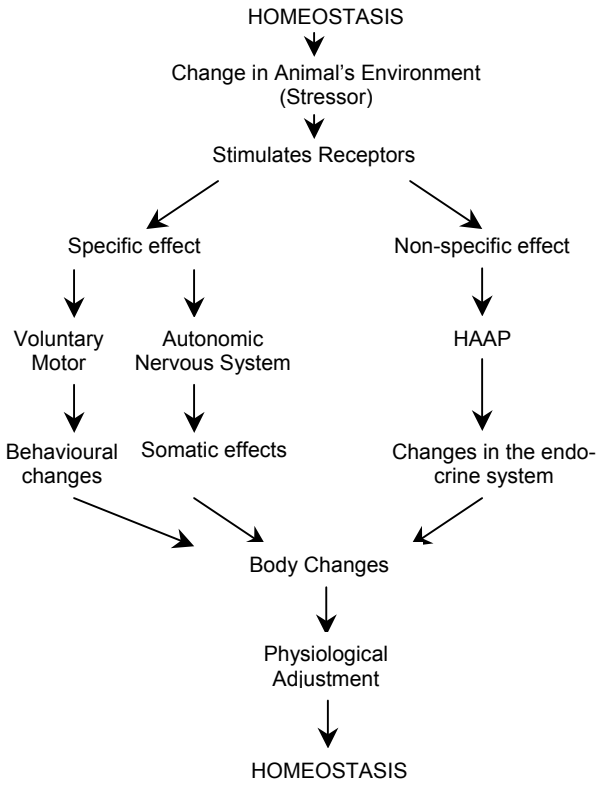
Despite wide variation in environmental temperature *homeotherm* animals maintain their body temperature within narrow limits constant (e.g. Mount 1979, p. 1; Curtis 1983, p. 25; McFarland 1993, p. 291; Clark and McArthur 1994, p. 108). Adult and neonate lamoids have rectal temperatures ranging from 37.5 to 38.6ºC and 37.2 to 38.9ºC, respectively (Fowler 1985 cited by Fowler 1989, p. 169). Minor variations in the body-core temperature depend on diurnal fluctuations, activity, environmental situation and food intake (Clark and McArthur 1994, p. 109). Body core temperature reaches a maximum in the mid- to late-afternoon (Cossins and Bowler 1987, pp. 100-101) and early evening. In addition, there is a temperature gradient between body core and periphery (Curtis 1983, p. 25).

The climatic environment of an animal is determined by factors, such as air temperature, humidity, air movement, solar radiation and air pressure (Bianca 1971, p. 158). In the inhospitable, pastoral setting of the Andean puna lamoids, usually missing any shelter, frequently suffer from cold stress. Moberg (2000, p. 1) defined stress as “the biological response elicited when an individual perceives a threat to its homeostasis. The threat is the ‘stressor’” or stress-producing agent. The animal’s reactions to stressors aim at adaptation to environmental effects. Although llama and alpaca are excellently adapted to the cool environment of the Andean highland, “intense or prolonged stimulation” may in some instances be fatal (Fowler 1989, pp. 167-172). Thermal stressors on llama and alpaca may be aggravated by hunger, thirst, fear etc. Stress can result in disease incidence and should therefore be taken seriously in the care of llamas and alpacas.

Stressors stimulate the animal via receptors (Fowler 1989, p. 167) (temperature-sensitive neurons), which are located at different sites in the body, such as the spinal cord, the walls of the gastrointestinal system and veins, the skin and the hypothalamus (Curtis 1983, p. 59). “The nervous system analyzes and processes impulses from receptors and feeds responses back through various components of the nervous system to effector organs, producing either a specific or nonspecific reaction or both” (Fowler 1989, p. 167). According to Mount (1979, p. 5) and Curtis (1983, p. 59) control of body temperature is mediated in the hypothalamus, where thermal information from receptors is compiled and thermoregulatory response is given.

Responses to the stimulation of receptors involve the voluntary motor, autonomic nervous system (adrenal medulla), or hypothalamic adenohypophyseal adrenal pathway (HAAP) pathway. The voluntary motor pathway elicits various specific responses including a variety of somatic and behavioural alterations to conserve and generate heat, when cold receptors are stimulated and the animal is adjusting to changed environmental conditions (homeostatic accommodation), as illustrated in figure 3.6 (Mount 1979, p. 5; Fowler 1989, p. 167). The hypothalamic adenohypophyseal adrenal pathway (HAAP) reacts by non-specific responses upon the stimulation of thermal receptors and causes changes in the biochemical and endocrine system of the organism. It is worth to be noted that permanent adrenal cortex stimulation and excessive release of cortisol elicits protein catabolism and antiimmunologic response with negative effects on the well-being of lamoids (Fowler 1989, pp. 167-168).

Figure 3.8 Homeostatic accommodation as a result of environmental change



Modified from Fowler (1989, p. 167)

3.2.3.2 Temperature balance equation

Alike the water balance, the control of the body temperature is linked with the physiological principle of homeostasis, i.e., the body temperature is within a narrow range constant and is returned to equilibrium, when, induced by environmental conditions, this equilibrium is threatened (Toates 1980, p. 7). Exchange of heat between animal and environment is progressive due to the difference in body temperature and ambient temperature (Clark and McArthur 1994, p. 109). In order to maintain homeothermy the animal organism balances the heat produced in metabolism against the heat lost to the environment (Mount 1979, p. 7; Cossins and Bowler 1987, p. 98; Clark and McArthur 1994, p. 109; Webster 1994, p. 65). This interrelation is formulated in the temperature balance equation:

$$M + G = L$$

Accordingly, "[h]omeothermy depends on equilibrium among the amounts of [metabolic heat production] (M), gains from the environment (G), and losses to the environment (L), during a given period" (Curtis 1983, p. 25).

Metabolic heat is produced by the oxidative metabolism of carbohydrates, proteins, and lipids (Clark and McArthur 1994, p. 109) and is therefore dependent on the rate of oxygen consumption (Mount 1979, p. 14). Heat is primarily produced in tissues of the gastro-intestinal tract, liver and in muscles (Mount 1979, p. 35). The amount of heat generated by interior cellular activity is determined by factors, such as body size, activity, ambient environmental temperature, and feeding regime (Mount 1979, pp. 7, 21-29; Cossins and Bowler 1987, pp. 104-105). An increasing level of feed intake usually increases heat production (Mount 1979,

p. 7). Insufficient feed intake decreases metabolic heat production (Fowler 1989, p. 172). "[W]hen metabolic rate is at a cold-induced maximum or a warm-induced minimum, further movement of environmental temperature away from the zone of regulation results in a change in body temperature which itself then determines the metabolism" (Mount 1979, pp. 7; 32-35).

Heat transfer from the animal body to the environment pursues two major routes: 1. Non-evaporative heat transport *via* radiation, conduction and convection prevailing under cold conditions. 2. Evaporative heat transfer including loss of water vapour by sweating and respiration particularly under warm conditions (Mount 1979, pp. 9, 40; Clark and McArthur 1994, p. 109). Clark and McArthur (1994, p. 109) in their temperature balance equation specified modes of heat transfer:

$M = C + G_k + L_n + \lambda E$

M Rate of metabolic heat production
C, G_k and L_n Rates of non-evaporative heat loss including convection, conduction and radiation
λE Rate of evaporative heat loss

3.2.3.3 Mechanisms of thermoregulatory control

Balance of heat loss and heat gain in homeotherms including lamoids involves various thermoregulatory processes (Cossins and Bowler 1987, p. 98) to keep body temperature within the optimal range through two principal paths: (1) adjusting the rate of heat exchange with the environment and (2) changing the rate of (metabolic) heat production (Toates 1980, p. 137). The huge majority of corrective thermoregulatory action embraces initially behavioural and thereafter physiological control mechanisms (Toates 1980, pp. 7, 11; McFarland 1993, p. 291).

In the harsh climate of the Andean highland llamas and alpacas are primarily affected by cold. In the cold the animal's heat exchange with the environment is directed to heat conservation (Mount 1979, p. 7) and thus to reduction of heat loss and enhancement of insulation (Bianca 1977, p. 109). Behavioural thermoregulation adopts postural adjustments and selection of a suitable microclimate (Boulant *et al.* 1989, p. 121). Posture can be altered in order to reduce the morphological body surface (Bianca 1977, pp. 109-110; Curtis 1983, p. 62). Rolling themselves up by putting the legs under and the head narrow to the trunk reduces the heat dissipating surface. If the weather is cold and windy, livestock also direct the narrow side of their body to the wind, and thus reduce heat loss by convection (Bianca 1977, p. 110). Alternatively, change of heat transfer to the environment can be realized, when animals seek shelter and sometimes animals relieve the effect of low air temperatures by exposing themselves to solar radiation (Bianca 1977, p. 110; Webster 1994, pp. 62-63). Webster (p. 63) emphasized that behavioural responses to heat and cold, such as seeking shade or a wind-protected corner, include an animal's conscious decision.

Certain circumstances evoke animals to modify their thermal conditions by social behavioural response (Clark and McArthur 1994, p. 109), such as huddling with groupmates (Curtis 1983, p. 62). It is assumed that some sort of social thermoregulation is also adopted in lamoids. Although the heat production rate in animals can be increased by voluntarily skeletal-muscle activity, domestic animals suffering from cold have often been observed to stand motionless. An explanation for this behaviour could be that standing still avoids loss of energy associated with body movement and enables the animal to sustain body functions more effectively, especially under conditions of food scarcity (Bianca 1977, p. 109).

In addition, physical and physiological response directed to thermal insulation is crucial to decrease heat loss in cold environments. Removing the fibre in sheep or lamoids by shearing reduces thermal insulation substantially and affects thermal comfort negatively. Heat flow between the body core and the surrounding of the animal is resisted by thermal insulation consisting of tissue insulation, cover insulation and boundary insulation. Tissue insulation resists heat transfer between core and surface of the skin. Cover and boundary insulations constitute surface insulation. While the former resists heat flow "between the skin surface and the outer edge of the cover", the later "resists heat flow through the boundary layer" (Curtis 1983, p. 38).

Tissue insulation chiefly relies on the thickness of subcutaneous fat. Additionally, peripheral vasoconstriction – a physiological control mechanism – contributes to thermal insulation of tissues (Mount 1979, p. 79). Heat flow from the core or visceral organs to the periphery of the body *via* blood and *via* conduction leads to dissipation of heat to the environment. Therefore, changing the rate of blood flow in central and peripheral parts of the body, which reduces the "circulatory convection of heat to the periphery", influences the heat loss of an animal. Vasoconstriction in peripheral blood vessels increases thermal insulation of subcutaneous fat by around three times, while an unrestricted rate of blood flow has a negligible effect on tissue insulation (Curtis 1983, pp. 39, 49).

Skin surface of farm animals is generally covered by pelage whose thermal resistance is of vital importance in terms of insulation. The insulative effect of the cover layer is mainly formed by the air amongst the hairs. Enclosed air constitutes over 90 percent of the total cover volume. Cover insulation can be improved by altering the cover depth by piloerection, which is provoked by arrector pili and regulated by sympathetic nerves (Curtis 1983, pp. 41-44, 61). Rain and wind reduce cover insulation. Water decreases cover depth and substitutes still air for less insulative water. Alike, wind reduces the magnitude of the boundary-layer and promotes convective heat transfer (Curtis 1983, pp. 41-44; Webster 1994, p. 66). The lamoid's fibrous coat is fairly resistant to moisture penetration. However, wet head and limbs may cause considerable heat loss in these animals (Fowler 1989, p. 173). Apart from an animal's behaviour and physiology, its anatomy and morphology play an important role in terms of heat loss control. A compact body and a small proportion between surface and body mass are suitable to conserve heat. The long neck of the llama and alpaca considerably reduces the compactness of their body.

There are several ways to change the rate of heat production. Response to cold stress invokes voluntary muscular activity, shivering (involuntary, rhythmic contractions of skeletal muscles), non-shivering thermogenesis and increase of the metabolic rate in almost all body tissues in order to generate additional heat (Bianca 1977, p. 109; Curtis 1983, p. 61; Cossins and Bowler 1987, p. 106; Boulant *et al.* 1989, p. 120). Enhancement of muscular activity or food intake increases the rate of metabolic heat production (Mount 1979, p. 7; McFarland 1993, p. 291). A passive strategy in response to cold is shivering. This "synchronous contraction of small groups of motor units" is initiated by a decrease of the body temperature and is controlled by somatic motor nerves. Shivering can increase the rate of heat production two to five times that of basal metabolic production. Although voluntary locomotion can gain a 20-fold rise, it is disadvantageous, because the insulative effect of the pelage is reduced and peripheral vasodilatation is increased (Cossins and Bowler 1987, pp. 106-107).

In contrast, non-shivering thermogenesis (NST) does not involve muscle contraction. Triggered by noradrenalin NST represents the cold-induced mobilization of brown adipose tissue (BAT) to generate metabolic heat in the new-born mammal. BAT "is a specialized thermogenic tissue which differs from depot fat in appearance and function". It is unclear whether liver and muscles also contribute to this thermal response (Mount 1979, p. 7; Curtis 1983, pp. 111-115; Cossins and Bowler 1987, pp. 107-110; Webster 1994, pp. 62-63). According to Curtis (1983, pp. 61-62) chronic cold stress is countered by general metabolic reaction in which glucocorticoids, thyroid hormone, and growth hormone are likely to participate. Cate-

cholamines support the thermoregulatory response to acute and chronic cold stress. They mobilize fatty acids and glucose from lipid depots to produce metabolic fuels. In addition, catecholamines in combination with thyroid hormone enhance the metabolic rate during chronic cold stress. Spasm and tonus in skeletal muscles are responses to acute cold stress (Curtis 1983, pp. 61-62).

Mount (1979, p. 8) summarized behavioural and physiological thermoregulatory mechanisms of heat production and heat loss (Table 3.9).

Table 3.9 Factors of thermoregulatory control contributing to the maintenance of heat balance

Heat loss	Heat production
Conservation of heat:	Minimal metabolism
Peripheral vasoconstriction	Feeding resulting in heat increment
Pilo-erection	Non-shivering thermogenesis
Subcutaneous fat	Shivering
Compact posture	Muscular activity
Dissipation of heat:	
Peripheral vasodilation	
Sweating	
Panting	
Extended posture	

Modified from Mount (1979, p. 8)

3.2.3.4 Thermoregulatory response in neonates and implications for their welfare

Special attention is placed to neonates and young animals, because high mortality rates in young llama and alpaca must at least partly be attributed to thermal stress under the harsh Andean climate. Birth of mammals is associated with an abrupt thermal change. While the uterine environment is characterized by thermal stability, after delivery the neonate is faced with fluctuating, comparatively low environmental temperatures that require prenatal adjustments in the young. However, the newborn animal can tolerate lower body temperatures than adult animals of the same species (Mount 1979, p. 129; Curtis 1983, pp. 111-115), because for the immediate postnatal period neonates possess deposits of energy. These deposits consist of brown adipose tissue, which is very important for metabolic heat production by non-shivering thermogenesis. There is still doubt whether glycogen stores in the liver and skeletal muscles are also involved in this process (Mount 1979, p. 135; Curtis 1983, pp. 111-115; Cossins and Bowler 1987, pp. 107-110).

In the newborn animal the percentage of body surface area per unit of body mass is high and "[t]heir relatively greater proportion of skin surface allows for rapid dissipation of heat" (Bianca 1976, p. 154; Curtis 1983, pp. 113, 116; Fowler 1989, p. 172). Additionally, in calves, lambs, piglets, chicks and this may also be true for llama fowls the absolute level of thermal insulation is poor, although they exhibit the common thermal-insulative response in cold ambient environments (Bianca 1976, p. 154; Curtis 1983, pp. 113; Fowler 1989, p. 172). Compared with adult animals they possess little hair or fibre and coat length (Bianca 1968, p. 440; Curtis 1983, p. 113) and little subcutaneous fat that can serve as an energy reserve (Bianca 1976, p. 154; Curtis 1983, p. 113). Because of the relatively larger proportion of body surface

to body mass and the relatively small thermal insulation, the lower critical temperature is higher in neonates than in elder animals (Curtis 1983, p. 113), as shown in table 3.10.

Table 3.10 Estimates of lower critical temperature in newborn and adult farm animals

	Lower critical temperature (ºC)		
	Bianca (1976)	Mount (1979)	Young (1981)
Sheep			
Newborn	29	30 (long-hair sheep)	
Adult	-3	-20 (long-hair sheep)	
Cattle			
Newborn	13		8
Adult	5 (dry)		18 (dry)
Pig			
Newborn	33	34	25
Adult	0	10	2 (lactating)

Sources: Bianca 1976, Mount 1979, Young 1981

Another reason why newborn lamoids are very susceptible to hypothermia is that they have a weak thermoregulatory response and a high metabolic rate compared to adult animals. Further, according to Fowler (1989, p. 172) llama and alpaca neonates do not have a shivering reflex. Heat loss and suffering from low environmental temperatures is enhanced, when fibres and fleeces are wet. Ousey *et al*. (1991) cited by Clark and McArthur (1994, p. 116) found that "the metabolic rates of newborn foals (horse foals) were above 200 Wm^{-2} during the first hour postpartum when they were wet with amniotic fluid and shivering". According to McArthur and Ousey (1994) cited by Clark and McArthur (1994, p. 116) these metabolic rates are two to three times those of dry foals. They estimated that the lower critical temperature of the wet foals was close to 30ºC being about ten degrees above the temperature of dry animals.

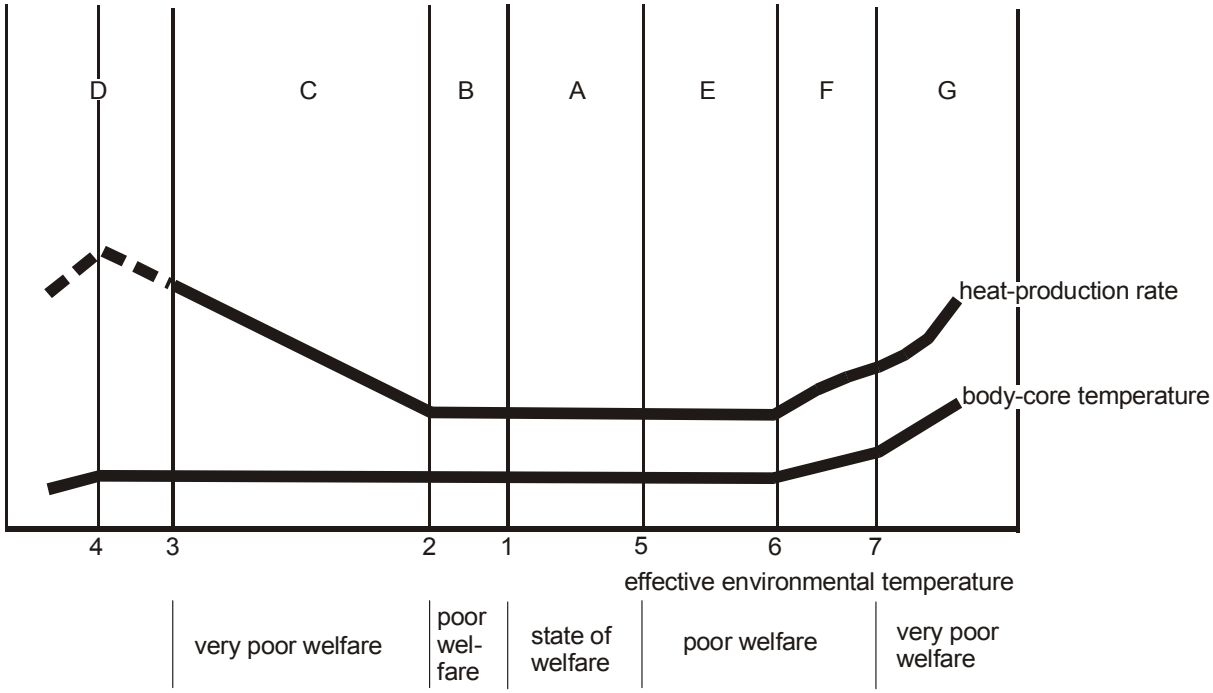
In view of the high level of lower critical temperature in all newborn farm animals compared with mature animals of the same species, the effect of temperature on animal welfare is marked in neonates. In the Andean pastoral production system the lower critical temperature is rapidly reached in newborns postpartum, especially, when births take place during night time without shelter and shivering and non-shivering thermogenesis is inevitable to maintain body temperature. The situation is aggravated through the animal's wet condition after delivery. As expounded earlier, the welfare of an animal is very poor, when shivering is initiated by the organism to encounter a decrease in body temperature. Thus, observation of births including management practices that remove amniotic fluid immediately after birth and the supply of the young with colostrum is a useful measure to improve animal welfare and health of neonates.

3.2.3.5 Effects of varying ambient temperatures and animal welfare

In his energetic scheme Curtis (1983, pp. 62, 89) reflected on the effects of ambient temperature on body temperature and metabolic rate. The scheme is based on the concept of *effective environmental temperature*, which reflects "an animal's total thermal environment in terms of environmental heat demand" and depends on various meteorological elements. The concept is based on the assumption that the environmental heat demand characterizes the heat flow from "a given animal to a particular environment" and that the demand for heat

rises, if ambient environmental temperature drops. In a comparison of two settings with equal temperatures, but different air movements, the setting with the higher air speed would have the lower *effective environmental temperature*. If the environmental heat demand increases to an extent that normal body temperature can only be maintained by the adoption of one or several thermoregulatory mechanisms, the animal undergoes cold stress. The varying intensity of cold stress and heat stress in relation to an animal's heat production and body core temperature and added states of welfare is illustrated in figure 3.7.

Figure 3.9 Development of heat production rate and body core temperature in different zones of effective environmental temperature and ascribed levels of animal welfare



A thermal-comfort zone
B cool zone
C cold zone
D intolerably cold zone
E warm zone
F hot zone
G intolerably hot zone

2 lower critical temperature
3 absolute lower critical temperature
4 point of maximal metabolic rate
7 upper critical temperature

Modified from Curtis (1983, p. 89)

In the thermal-comfort zone (A) the heat production is at a minimal or thermoneutral rate and the body temperature of the animal is maintained without heat-conserving or -dissipating mechanisms (Curtis 1983, pp. 62-63). Thus, within the zone of thermal comfort the animal is regarded to be in a state of welfare.

The cool zone (B) is reached, when the effective environmental temperature drops "below the lower limit of the thermal-comfort zone". In this zone physical-thermoregulatory processes are necessary in order to maintain metabolic heat. Although with a further decrease in temperature the metabolic rate sustains at the thermoneutral level, the "animal's requirement for maintenance-energy increases, since heat-conserving processes need energy (Curtis 1983, p. 63). In the cool zone the animal maintains its body temperature by innate thermo-

regulatory processes, such as vasoconstriction, or by conscious behavioural changes. For example, the animal's motivation to alternate its laying posture is an indication that the animal feels discomfort at the particular body site. Going on the assumption that welfare demands freedom from discomfort, as claimed in the *five freedoms*, the welfare of the animal is evidently affected. However, the impairment remains on a moderate level, because the organism is endowed with appropriate tools to counteract minor alterations in effective environmental temperature. Therefore, within the cool zone the welfare of animals is regarded to be poor.

At the lower end of the cool zone the lower critical temperature is reached. It is the effective environmental temperature "at which the heat emission from an animal with fully vasoconstricted skin, and with the skin and lungs losing minimal amounts of water vapour, is equal to its heat production in the thermoneutral zone" (Blaxter 1989 cited by Clark and McArthur 1994, p. 115). Thus, all mechanisms of heat loss control are maximally effective. Lower critical temperatures in lamoids can be expected to be similar to those in sheep. The values of lower critical temperature given in table 3.11 clearly indicate high susceptibility to cold in shorn and feed-restricted *ovines*. At an effective environmental temperature below the lower critical temperature animals are in a state of very poor welfare.

Table 3.11 Estimates of lower critical temperature (ºC) in sheep

	Lower critical temperature (ºC)
Sheep	
1 mm fleece	
maintenance	28
5 mm fleece	
fasting	31
full-fed	18
100 mm fleece	
maintenance	-3

Modified from Curtis (1983, p. 88)

Below the lower critical temperature in the cold zone (C) normal body temperature (or homeothermy) can only be maintained by increasing the rate of metabolic heat production, because heat conservation has reached a maximum (Mount 1979, p. 7; Curtis 1983, p. 63; Cossins and Bowler 1987, p. 103). In the cold zone the animal's rate of productivity is impaired (Curtis 1983, p. 63). Cold stress is aggravated, when metabolic rate cannot be increased due to scarcity of forage. This is clearly the case in the Andean llama breeding system where periods of low ambient temperature coincide with shortness of feed supply. Additionally, at the end of the dry season (September-October) body fat deposits are minimal and therefore cannot play a significant role in metabolic heat production.

In this zone active heat gain including shivering and non-shivering thermogenesis is invoked and in a progressed state body mass will be mobilized to maintain the body temperature within a constant range. The termination of thermoregulatory heat conservation and the mobilization of fat reserves indicate substantial changes in the body interior and the production efficiency decreases. Webster (1994, p. 68) alleged that animals begin to suffer from cold, when they start to shiver to maintain body temperature, especially if food is scarce or restricted. However, in view of the behavioural reactions observed under mild cold stress, it must be argued that unpleasant sensations related to suffering even occur before shivering sets on. In the cold zone the welfare of animals can be termed to be very poor.

Since maximal metabolic rate can only be sustained for a short time, heat loss cannot be compensated by heat production, when the effective environmental temperature continues to fall. Thus, in the intolerably cold zone (D) the animal dies (Curtis 1983, p. 63). In warm envi-

ronments similar inferences in relation to thermal comfort and the well-being of animals can be made.

The enormous restrictions animals are being imposed on in cold environments seriously affect their physical and psychological well-being. Therefore, it is inferred that within the cold zone the welfare of animals is very poor and is, particularly at the lower end of the zone, associated with extreme suffering and death throes. Fowler (1978) cited by Fowler (1989, p. 172) reported that lamoids below a body temperature of -30ºC show "slow and shallow breathing, metabolic acidosis, 'sludging' in the microcirculation, ventricular arrhythmias leading to fibrillation, and coagulation disorders".

To conclude, there is evidence that animals are in a state of well-being only within the zone of thermal comfort. Therefore, it might be in the interest of the livestock keeper to maintain a thermal environment within the range of thermal comfort. In tropical livestock production discomfort in farm animals may often be induced by scarcity of resources including lack of shelter. If the animal is given the chance to compensate the additional demand for energy through feed intake, the strains of the organism could be lowered and the welfare of the animal stabilized. In addition, exposure to cold could be counteracted by the provision of shelter (e.g. wind protected corals) during night or management practices, like observation of births. Active heat gain requires additional energy and therefore has an impact on body condition, reproduction, health and well-being of animals. Compensatory measures, such as grooming to keep the parasite burden low can be valuable to counteract the often unchangeable food scarcity in the pastoral system and mitigate nutritional stress.

3.2.6 Example 2: Animal disease and its impact on animal welfare in the Andean llama and alpaca breeding system

Freedom from pain, injury and disease is regarded as a major constituent to ensure welfare in farm animals. In industrial countries diseases are almost under control, but "the mastering of the animal's environment had a major impact on production. However, it also introduced new constraints the animals have to cope with which could ultimately decrease their welfare" (Le Neindre *et al*. 2004, p. 135). On the other hand, in low input systems in agrarian countries disease outbreaks often constitute enormous problems. Harsh climate, lack of adequate shelter and veterinary treatment in combination with poor sanitary conditions and unhygienic practices result in high prevalence of infectious diseases. In addition, infestation of external and internal parasites is a source of impaired health and low production. Micro-organisms and parasites not only induce serious illnesses and weakness but also cause tremendous suffering of livestock. Potential threats of llama and alpaca well-being in the Andean husbandry system are peripheral tissue damage (e.g. ear) due to frost, injuries and predators. This subsection aims to explore the relation between health/disease and welfare.

3.2.6.1 Concepts of health and disease and its relation to animal welfare

The World Health Organization (WHO) (1948, p. 1) defined (human) health as "a state of complete bodily, mental and social well-being and not only the absence of disease or infirmity". Equalizing health and well-being in this definition is somewhat confusing. In this regard, Hughes and Curtis (1997, p. 109) alleged that it is important to differentiate that "welfare includes health, though health on its own does not necessarily imply welfare". The concept of the WHO implies that health has an impact on the physiological, psychological and social state of an individual. Particularly in herd animals with elaborate social relations (lamoids, sheep etc) social conditions may be an important factor for the maintenance of

health. According to The New Encyclopaedia Britannica health is “the extent of an individual’s continuing physical, emotional, mental, and social ability to cope with his environment”. This concept of health avoids the term well-being and includes a time factor. Managing the severities of life for a prolonged period implies living a long life. Being capable to cope with environmental conditions does neither mean that the individual is permanently in a state of well-being nor in a state of health. Thus, this definition aims more at the sustaining of life.

Veterinary science and animal science in their assessment of health generally rely on physical and psychological signs (Table 3.12). However, the involvement of mental states in the measurement of health creates problems, because there is a lack of information about subjective emotional states in animals. As a consequence, health is defined in terms of what is measurable. Physical body conditions are interpreted numerically on the basis of the normal functioning of the organism and measures out of a certain range are considered as indicators of illness. In practice inferences about mental processes are made by studying bodily states. (Hughes and Curtis 1997, p. 110; The New Encyclopaedia Britannica). Further difficulties in defining health arise, because health is at a continuum to the subclinical and clinical state of disease and finally to death (Hughes and Curtis 1997, p. 110). The condition at a continuum characterizes both the concept of health and the concept of welfare. Both good health and good welfare are ends of a continuum.

Table 3.12 Physical and mental signs of health

Physical signs of health	Mental signs of health
Good appetite	Alertness
Activity	Responsiveness
Bright eyes	Showing interest in its surrounding
Shiny coat	
Pricked ears	

Based on Hughes and Curtis (1997, p. 110)

Spranger (2002, p. 1) in his interpretation of domestic animal health identified three major features:

1. Freedom of physical affliction, wounds and injuries
2. Undisturbed physiological functions
3. Maintenance of well-being, absence of suffering

Tyler (1999, p. 24) provided a concept of animal health which is particularly directed to tropical livestock production: Health is “the condition of an animal that enables it to attain acceptable levels of production within the farming system in which it is maintained”. Tyler explained that *health* is relative, dependent on producer and production conditions. While a pastoralist may find a certain animal in a healthy and good bodily state at the end of the dry season, a commercial livestock owner may not. *Healthy* does not necessarily imply disease agents to be totally absent in livestock. Low infestation of internal parasites may be tolerable in pastoral systems. Thus, Tyler’s system-related view draws attention to the point that the availability of natural and monetary resources has a role to play in the assessment of animal health.

Though health is not solely characterized by the absence of disease (Hughes and Curtis 1997, p. 110) freedom from disease is decisive precondition of health. Disease was defined as “an impairment of the normal state of an organism that interrupts or modifies its vital functions” (The New Encyclopaedia Britannica). According to Ibrahim (1998, p. 47) disease denotes “a change in the normal condition of the animal caused by any invading living organism

including parasites, bacteria, viruses, protozoa and fungi". Tyler (1999, p. 28) pointed out that the development of a disease is a complex process

[m]any diseases are, however, the result of a complex interrelationship of the animal with its environment. The term 'web of causation' has been used to highlight the interaction of the components leading to a disease process. Disease determinants affect the frequency of disease occurrence. Intrinsic determinants include the genotype, the immune status and the behaviour of the animal, while extrinsic determinants include animate and inanimate components of its environment.

Poor welfare can result in increased susceptibility to disease (Fraser and Broom 1997, p. 294). On the other hand, disease, which affects not only an animal's body but also its mind, has an impact on an animal's welfare (Hughes and Curtis 1997, p. 110). According to Tyler (1999, p. 25) it is reasonable to assume that ill farm animals suffer and, in some disease states, are in severe pain. In comparison to healthy animals, those in pain are also expected to be less productive. However, the relationship between health/disease and welfare is not always clear cut. According to the concept of feelings it is only the animal's mental state that determines its welfare, because physical needs will be covered, when psychological needs are met (Duncan and Petherick 1991, pp. 5017-5018).

Based on this concept Duncan and Dawkins (1983, pp. 15-16) considered two cases: Firstly, an individual who is sick usually also feels sick. However, there may be instances, for example in early, undetected stages of cancer, in which the presence of disease causes no suffering. Duncan and Dawkins emphasized that despite the importance of subjective feelings, "a reduction in health should take precedence as an indicator of suffering". Thus, an animal's welfare is impaired, if it is diseased. However, it is recognized that incidence of disease (e.g. painless growth of tumours) does not necessarily depress an animal's welfare (Hughes and Curtis 1997, p. 110). Secondly, an animal may suffer, although it appears to be in good health. Duncan and Dawkins concluded that absence of a detectable disease does not indicate that the animal is in a state of well-being or inversely: health is not necessarily a prerequisite for welfare (Duncan and Petherick 1991, pp. 5017-5018). Since to date merely little information is available about subjective mental experiences in animals', studies in health and welfare will continue to depend on pathological, physiological and behavioural indicators (Hughes and Curtis 1997, p. 110).

3.2.6.2 Assessing animal welfare in relation to health and disease

There are several ways to approach the animal's state of welfare. Suffering, for example, can be quantified by careful visual observation of signs of sickness. Signs of disease are in general more prone to the observer than signs of health, because they deviate from normal. Inferences of the effects of a particular illness on welfare can be drawn by visual inspection of its nature, its development and behavioural changes of the animal. However, there is a lot of uncertainty and the study is not done in a systematic way (Hughes and Curtis 1997, pp. 111-112).

Sainsbury (1998, pp. 70-72) argued that the maintenance of health is an essential criteria to ensure good welfare in farm animals. Since there is still scientific controversy about what constitutes good welfare, Sainsbury proposed an assessment based on the expertise of stockpersons and veterinary advisers who interpret appearance and behaviour of sick animals in relation to their health status by close observation. Sainsbury emphasized that "[t]he key to good welfare is a high standard of stockmanship […]". Sainsbury (pp. 67-70) enumerated a variety of signs used by livestock owners and veterinarians in order to determine sickness in farm animals including

1. Lacking interest in feed
2. Separation from the group
3. Abnormal excretions (e.g. diarrhoea) and urine (e.g. presence of blood)
4. Atypical posture (e.g. arching of the back)
5. Appearance (e.g. droopy head, dull eyes and coat, dry muzzle)
6. Occurrence of coughing and discharge from the nose
7. Specific vocalization (groans, crying or squealing) induced by painful events
8. Temperature, respiration and pulse rate without the normal range

Starting from Hughes and Curtis' assumption that welfare comprises health, but health does not necessarily entail welfare, signs of disease and health can merely represent a range of all animal welfare constituting elements.

Hughes and Curtis (1997, p. 109) suggested to employ the concept of analogy in order to assess animal welfare in relation to health. According to the notion of analogy human beings can recognize animals' mental experiences because of the principal similarity of human and animal feelings.

Understanding relationships between health and welfare depends on drawing inferences about subjective feelings such as pain, discomfort and distress. Zoonotic diseases where symptoms, lesions, behavioural responses and outcomes are similar in humans and animals help to clarify the relationship between ill health and well-being. Quantifying suffering requires careful observation and consideration of a broad range of indicators, including changes in physiology, behaviour and production.

A problem arising from the analogy concept is that analogy of humans and animals is not all-embracing.

Further, prepathological states in animals have been discussed to discern and assess their welfare associated with health and disease. McGlone (1993, pp. 27-28) identified health as "the critical trait that characterizes well-being"; though he conceded that this approach has weaknesses. According to Moberg (1985, pp. 44-45) animals develop pathologies in response to the effects of stress on their well-being. These pathologies only occur "after the individual has entered a state of vulnerability, the prepathological state". For McGlone "an animal is in a state of poor welfare *only* when physiological systems are disturbed to the point that survival or reproduction are impaired". Adopting Moberg's (1985) concept of a prepathological state, McGlone suggested that welfare is poor only, when animals are in a prepathological state. He argued that feeling poorly "cannot be the critical measure of well-being", since it is like feeling hungry – a normal experience. If welfare is impaired, physiological changes, for example, in "reproductive health, immune function or brain function" can be measured.

McGlone (1993, pp. 28-29) developed the following theoretical framework:

1. The brain controls the state of mental health in an animal.
2. Stress has an impact on the brain and many physiological systems.
3. If a graded stressor (e.g. contagious organisms, cold) is imposed on the animal, it responds by behavioural and physiological changes, which are controlled by the brain.
4. The brain is activated, when the environmental conditions are inadequate to maintain normal physical and mental health. A depression of reproductive and immune function may occur and if the situation persists the animal will die an early death. Only in this state the animal's fitness and thus welfare is impaired.

Although McGlone's approach is valuable for the measurable parameter it offers, it poses some contradictions. First, freedom from pain as a welfare constituting factor is widely accepted. Second, the fact that humans and animals experience feelings like pain or hunger from time to time does not provide evidence that pain or hunger do not depress welfare. Ex-

periencing pain (e.g. from surgical measures without anaesthetics) has an impact on the animal's well-being not only when the animal has developed a prepathological state but also at the moment pain is inflicted on the animal. If a particular sensation of pain has an effect on an animal's welfare in the future, this effect should also be present, when the feeling is acute. Thus, McGlone's model primarily aims at long-term effects on animal welfare.

Simonsen (1996, pp. 91-95) in his "holistic approach" for the assessment of animal welfare addressed health, behavioural and physiological indicators. Simonsen's approach, which is based on the assumption that animal welfare results positive and negative experiences, includes objective scientific and practical information about animals and their environment. Thus, the concept embraces objectively measurable indicators of animal health, behaviour and physiology as well as the human observer's point of view on these parameters. The evaluation scheme (Table 3.13) associates a single factor or combined factors of ethology and health with a subjective decision about the animal's mental state. Finally, the welfare status is assessed on a scale from 0 to 10 in which low scores indicate poor welfare. Simonsen's scheme recognizes the importance of physiological and psychological parameters for the assessment of the well-being of animals. However, the selection and weighing of individual indicators has no objective foundation.

Table 3.13 Evaluation scheme for the assessment of animal welfare related to health

Behaviour	Health	Welfare
Normal ethogram	Clinical health	Maximum
Play	Constitution	
Fear	Physiology	
Conflict behaviour	Laboratory tests	
Sterotypies	Morbidity	
Apathy	Mortality	Minimum
Scientific measures		Measured opinion

Based on Simonsen (1996, p. 92)

3.2.6.3 Health problems and implications for welfare in animals under pastoral conditions

Hughes and Curtis (1997, p. 109) maintained that "[u]nder extensive conditions climatic changes, habitat degradation and overstocking can result in ill health through malnutrition and excessive parasite burdens". Tyler (1999, p. 29) confirmed that environmental determinants are significant predisposing factors in relation to the onset of sickness. The incidence of infectious respiratory diseases, for example, is favoured by rapid alterations in ambient temperature and humidity. Major threats of animal health and welfare in the pastoral Andean environment are the incidence of contagious diseases, the infestation of parasites, immunosupression and tissue damage.

Firstly, the effects of infectious diseases on the well-being of animals will be considered. According to Hughes and Curtis (1997, pp. 109, 117) pathological conditions can be distinguished with regard to the distress they cause. Distress is experienced by the animal, if the stress response has a deleterious impact on its welfare (Moberg 2000, pp. 1-2). While by some acute disorders (e.g. contagious bovine pleuropneumonia, infectious foot-rot in sheep) intense suffering is imposed on the animal, some other progressive disease processes cause chronic suffering (e.g. lameness). Both severely depress welfare. Some disorders, however,

are believed barely to affect welfare, although they impair health and productive traits (e.g. egg drop syndrome 76) (Curtis 1990 cited by Hughes and Curtis 1997, p. 117).

Fowler (1989, p. 118) reported that in the Peruvian lamoid breeding system enterotoxemia is "the most serious disease of neonate alpacas". The illness is caused by the anaerobic, spore-forming bacterium *C. perfringens*, which forms five variations (type A-E). The spores of *C. perfringens* commonly inhabit the soil, and reinfections tend to occur every year. Epidemic of this economically important infectious disease is associated with the birth season, prolonged rainy periods or poor sanitary conditions. In Peru enterotoxemia causes mortality rates in alpaca fowls from 10 to 70%. Paradoxically, the young animals "in the best condition were most likely to be affected" from about 3 to 80 days of age.

Fowler reviewed clinical signs of infected cria or alpaca fowl:

> Sudden death may be the only overt manifestation […]. The cria soon becomes recumbent, with the head stretched forward […] Movement and vocalizations are indicative of colic. The abdomen is frequently distended, with gas tympany in the intestinal tract. The cria is anorectic and dyspneic. Diarrhea is not a sign of type A enterotoxemia but may be seen in mixed infections with Escherichia coli or other microorganisms.

From analogy in symptoms and pathologies in human-beings and animals it can be inferred that alpacas, which are being infected with enterotoxemia, undergo immense suffering. Analogous experiences in humans indicate that colics are extremely painful and it is very likely that the physical debilitating process is accompanied by psychological suffering in the alpaca fowl as well. Fear and distress in diseased animals may arise as a result of the bodily effects of colics and pulmonary edema. Thus, there is reason to suggest that not only the lamoid's state of health but also its state of welfare is seriously impaired by enterotoxemia. The avoidance of areas contaminated with contagious agents is appropriate to counteract the detrimental influences of infectious diseases on the well-being of animals. However, Tyler (1999, p. 36) pointed out that apart from moving the herd away from the region of disease outbreak, under traditional management little can be done to avoid the animals to come into contact with endemic organisms.

Secondly, the impact of parasitism on the welfare of animals will be addressed. Hughes and Curtis (1997, p. 119) discussed this issue with reference to parasitic gastro-enteritis (PGE). PGE is caused by high stocking rates where grazing animals suffer from high reinfections. The internal parasites destroy the epithelium of both the abomasums and small intestine; they lower the enzyme production and the absorption of nutrients. Finally, the infestation of parasites results in "loss of plasma proteins, anaemia and ionic imbalances". Control of parasitism requires the removal of wetness from the grazing ground, because water is crucial in the lifecycle of many parasites. According to Tyler (1999, p. 35) the cultivation of pastures inhibits parasite development and reduces the number of infectious helminth larvae on the ground. Effects can also be achieved by taking the grazing stock away from periodically wet grazing lands.

Especially under natural pasture conditions in the tropics a complete avoidance of parasite infestations cannot be realized. Hence, it is important to establish a balance between the infestation of parasites on the one hand and the health status of the farm animal on the other hand. In this context, Hughes and Curtis (1997, p. 119) pointed out that

> [m]ost parasitic conditions cover a spectrum from inapparent infection at one extreme to severe morbidity/death at the other and the health of the host is dependent on a dynamic equilibrium. For most parasitic diseases, the initial entry and continued presence of the parasite triggers an immune response. Provided the host is healthy, nutrition is adequate, level of challenge is containable and immune response is functional and not impaired by immunosuppressive agents such as stress or certain virus infections, then a balance is achieved and the effects on welfare are minimal.

However, the well-being of animals is not only affected by contagious and parasitic diseases but also by nutritional deficits and metabolic disorders. Limited availability and low quality of forage and concentrates in short supply are main constraints in tropical livestock production. Adequate nutrition has a major impact on the maintenance of the immune status and therefore on animal health. Compared with the poorly nourished farm animal the well-nourished one is more resistant to disease, because it possesses a more effective immune system and body reserves that help to overcome sickness. Both undernutrition and malnutrition can result in an increased susceptibility to disease (Hughes and Curtis 1997, p. 121; Tyler 1999, p. 34).

Moreover, poor macro- and microenvironments, which exert multifactorial stresses, strongly influence the animal's states of health and welfare. Major stress-causing factors in the lamoid breeding system in the Andes are the harsh climate, the scarcity of fodder and the load of infectious agents and parasites. Hughes and Curtis (1997, pp. 114-115) stated that stress induced by adverse environmental effects may result in immunosuppression. Inhibition of the immune reaction in animals was found to be closely associated with increased adrenal cortical activity resulting in high blood levels of corticosteroid. Depression of the immune function is related to a low bodily production of antibodies or immunoglobulins (protein molecules assigned to different gamma and beta fractions) (Seifert 1992, p. 37; Broom and Johnson 1993, p. 123). A stressful environment generally lowers the farm animal's capacity to produce antibodies in response to the antigen challenge (Broom and Johnson 1993, p. 123).

Blecha and Kelley (1981, p. 597) ascertained that exposure to cold stress significantly affected the immune system of newborn animals. Their blood gamma globulin concentration was reduced and therefore their susceptibility to infectious diseases was increased (Kelley 1980, pp. 453-454). According to Fowler (2000, p. 179) blood immunoglobulin G (IgG) concentrations in mortal alpaca fowls were significantly lower than those of living fowls. Fowler (pp. 175-176, 179) attributed the high mortality rates in neonates to the low IgG level in fowls before they ingest colostrum. As in other farm animals (Seifert 1992, p. 42), the lamoid placenta is almost impermeable to IgG and there is no passage from the dam to the embryo. Hence, the newborn solely depends on colostrums in order to attain the required antibody level in the serum (Fowler pp. 175-176, 179).

Alike, injury and damage of tissues contributes to a poor health status. Although llamas and alpacas are excellently adapted to the harsh Andean climate, they show susceptibility to hypothermia, when exposed to low ambient temperatures and increased air movement. Prolonged hypothermia gives rise to frostbite, particularly in newborn llamas. Intense, long-term vasoconstriction in peripheral body areas may cause ischemic necrosis and gangrene; the primarily affected ears become devitalized and finally slough (Fowler 1989, pp. 173, 327). Wounds arising from tissue necroses have to be treated.

3.2.6.4 Perspectives in the assessment of animal health and welfare

In summary, both the concept of health and the concept of welfare involve quantitative and qualitative elements. Though, the concept of welfare is more complex. Veterinary science traditionally assesses health and disease, which are like welfare not entirely amenable to scientific measurement, by visual inspection and the interpretation of physiological and behavioural indicators. While parameters of body physiology and behaviour have also been used in the assessment of animal welfare, the examination of the general appearance of animals and its explanation in terms of well-being has been omitted with few exceptions. However, exploring the potential of empathy in the assessment of animal welfare could be promising to advance the issue of animal welfare. Veterinarians rely on these measures and their application is widely accepted. Similarly, livestock keepers are experienced to assess animal welfare by observing and interpreting visual signs and animal behaviour.

Subsequent to the great foot-and-mouth disease outbreak in Great Britain some year ago a governmental animal health and welfare strategy was initiated that indicates a new view on animal health and welfare. This strategy places emphasis on the livestock keepers' responsibility for animal health and welfare and the adoption of best practices in the care of animals. In addition, the practice of veterinary surgeons should stress the prevention of disease rather than the control and cure of diseases (Anonymous 2004, p. 678). According to Wensley (2004, p. 95) this initiative is founded on the insight that good welfare in animals is not only a result of physical health. He maintained that in future there should be a shift from "'How can we treat or prevent disease in this animal?'" to "'How can we improve this animal's welfare?'"

The situation of llamas and alpacas in the Andean husbandry system completely differs from industrialized animal production in Europe and North America. The Andean system is characterized by extreme poorness of resources; preventive and curative treatment is only sporadically applied and shelter to protect animals from climatic rigors is commonly absent. In order to prevent animals from suffering, slaughter of those diseased, weak or not to be expected to survive the next dry season is practiced. Additionally, various forms of alleviating measures against external parasites are regularly applied (Nuernberg and Valle Zárate 2001, p. 31). Therefore, the gradual establishment of veterinary services in the highland and possibly the preserving of local knowledge of llama and alpaca breeders on local medicine and the application of cheap, locally available plant remedies may be suitable to advance animal health and welfare in South American camelids.

3.2.7 Example 3: Impact of pain on farm animals with reference to the Indian smallholder crop-livestock production system and scientific approaches to measure pain from an animal welfare point of view

Pain in farm animals is a main source of suffering and distress. According to Mellor *et al*. (2000, pp. 172-173) the term *distress* refers to "the emotional content of noxious experiences [such as pain] that elicit physiological stress responses in animals […]". Painful events can be imposed on livestock by inadequate housing standards and equipment, by surgical interventions (e.g. castration) and by metabolic disorders (Duncan 2004, p. 164). Though, suffering from pain is diverse. Veterinary treatment of wounds or vaccination, for example, causes the draught ox temporary pain, but is beneficial on the long-term, because non-treatment would lead to much more pain owing to likely inflammation of the hurt tissue or the incidence of infectious disease. Thus, the infliction of short-term pain is imperative in order to avoid more intense pain in the future (see Webster 1994, p. 88). In some instances, however, pain cannot be entirely eliminated due to the nature of animal use.

As pointed out earlier, draught oxen in India often suffer from injury, which is inflicted on them not only by poor management practices and devices but also by deliberate cruelty of their owners. Infliction of injury usually causes pain from the damaged tissues and incapacitates the animal for work (Flecknell and Molony 1997, p. 63). "Injury to tissues results in local biochemical changes (and autonomic reflex responses) intended to be protective. Release of intracellular substances from damaged tissue into the extracellular fluid induces local pain, tenderness, and hyperalgesia" (e.g. Bonica 1990, p. 159 cited by Benson 2004, p. 68). At the same time pain serves as a negative feedback signal that governs the animal to take care of the injured area and thus accelerates curing (Algers 2004, p. 180).

Duncan (2004, p. 164) claimed that pain directly lessens animal welfare. Freedom from pain is regarded as one of the desirable conditions to ensure the well-being of farm animals formulated by the British Farm Animal Welfare Council. Hence, prevention and control of pain and the immediate diagnoses and proper treatment of injuries and diseases are compulsory to promote fitness and mental well-being in livestock (see Webster 1994, p. 89). In this sec-

tion it will primarily be focused on the perception and measurement of pain in animals. Scientific findings are compiled about the definition of the term, the underlying neural mechanisms of pain and (new) ideas concerning the assessment of pain and are discussed in relation to animal welfare.

3.2.7.1 Pain – a conceptual frame

The Collins English Dictionary cited by Bateson (1991, p. 828) offers two different meanings of pain: "'1. the sensation of acute physical hurt or discomfort caused by injury, illness, etc. 2. emotional suffering or mental distress'". According to the International Association for the Study of Pain (IASP) pain in humans is defined as „'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage'" (Iggo 1984 cited by Webster 1994, p. 90). Benson (2004, p. 61), who placed particular emphasis on neurophysiological aspects, suggested: "Pain is a perception of unpleasant sensation arising from the activation of a discrete set of neural receptors and pathways by noxious stimuli. A noxious stimulus is mechanical, chemical, or thermal activity that is actually or potentially damaging to tissues".

According to Duncan (2004, p. 164) pain as a negative motivational affective state is a subjective experience that governs the welfare of farm animals. Kitchell and Johnson (1985, p. 113) maintained that pain is a perception that "has no definitive physical dimensions". Zayan (1986, pp. 2-3) claimed that the term *pain* designates an objective, measurable connotation in relation to nociception resulting from noxious stimulation as well as a subjective connotation associated with the cognitive-emotional sensation of pain. Thus, the concept of pain comprises a sensory physiological and a mental subjective dimension. These components are also part and parcel of the concept of animal welfare.

In relation to the assessment of pain, Zimmermann (1986, p. 16) interpreted the perception of pain in terms of behavioural alteration: „Pain in animals is an aversive sensory experience caused by actual or potential injury that elicits protective motor and vegetative reaction, results in learned avoidance behaviour, and may modify species specific behaviour, including social behaviour". Zimmermann stated that this definition is not comprehensive either, because the changes in behaviour may not inevitably be a consequence of pain but also of other effects (e.g. noises). Benson (2004, p. 64) alleged that pain in animals is not always clearly visible, since changes in behaviour or posture are only subtle. When pain is intense (e.g. by loss of limbs), pain perception is blocked by the release of analgesic opioid peptides (endorphins, enkephalins), which occur naturally in the body and it generates no apparent behavioural signs of distress (Hughes *et al*., 1975 cited by Fraser and Broom 1997, p. 270). According to Fraser and Broom (1997, pp. 270-271) injuries that are accompanied by the secretion of analgesia "must result in poor welfare". However, the harmed animal is not in pain, because of the analgesic effect.

The sensation of pain itself is heterogeneous as it is implicit in the distinction of acute and chronic pain. Acute pain is short in duration (Kitchell and Johnson 1985, p. 114) and caused by traumatic, surgical, or infectious events. Acute pain in farm animals often derives from management practices, such as castration (Benson 2004, p. 70) or rough handling. In draught animals acute pain may particularly be a result of body lesions inflicted by ill-fitting equipment or beatings. Acute pain is basically directed to the removal and avoidance of harmful stimuli and leads to behavioural changes in favour of a speedy recovery from injury. Pain is not adaptive because of the necessity to safe the body tissues from further harm. It is important to note that acutely injured (prey) animals (e.g. ruminants) commonly exhibit few or no signs of pain in order to be protected from attacks of predators. In this situation the temporary inhibition of acute pain by endogenous analgesic peptides is conducive to survival

and escape is given priority to the prevention of additional harm (Webster 1994, pp. 95-96, 98; Benson 2004, p. 70).

Chronic pain is associated with progressing damage and release of noxious substances at an injured site or a chronic pathologic process that continues for a long time (Webster 1994, p. 96; Benson 2004, p. 77). In addition, in a chronic state of pain hypersensitivity to pain can arise, when the processing of pain signals in the CNS alters and signals from tough receptors are reinterpreted (Webster 1994, p. 96). In farm animals chronic pain mainly occurs as a result of infections (e.g. abscesses) and/or trauma to their feet (Benson 2004, p. 77). Suffering from chronic pain is generally attended by irritability, reduced appetite and weight loss, low libido, loss of sleep (Kitchell and Johnson 1985, p. 114) and reduced performance. In draught animals yoke galls can cause chronic pain. While acute pain is a symptom of disease, chronic pain is a disease itself (Benson 2004, p. 70).

3.2.7.2 Transmission of pain within the nervous system

The sensation of pain is induced by noxious stimuli and results in motor (e.g. flight, withdrawal) and vegetative (e.g. pulse rate) responses (Webster 1994, p. 90; Sneddon and Gentle 2002, p. 9). Nociception is the reception, conduction, and processing of nerve signals in the central nervous system (CNS) caused by the stimulation of nociceptors (free nerve ending receptors that are receptive to noxious stimuli) (Benson 2004, p. 65). Body tissues contain a great deal of nociceptors, which respond to strong mechanical, thermal, and chemical stimuli. Nociceptors are also sensitized by chemicals released in damaged or inflamed skin, and mediate slow pain. Perception of acute pain is linked to A-delta and C fiber nociceptors. The activation of nociceptors generates impulses that are transmitted to the central nervous system either in afferent A-delta (thin myelinated, conduct at from 3 to 30 metres/sec) and C (unmyelinated, conduct at less than 3 metres/sec) nerve fibers (Universities Federation for Animal Welfare 1989, pp. 8-9; Benson 2004, p. 66). Impulses generated by nociceptors are transmitted by afferent fibres via the spinal cord and terminate in the dorsal horn of the grey matter (Coggeshall *et al*., 1975; Willis, 1985 cited by Benson 2004, p. 66). Apart from supporting the fast response of A-delta fibres, C fibres signal damage or inflammation in tissues and initiate protection of the affected area (Benson 2004, p. 66).

Nociception is determined by a not fully known “complex series of modulating processes” including conscious and subconscious (reflexive) responses of the body (Webster 1994, p. 90). Three different ascending pathways of nociception are connected with different dimensions of pain experience: The sensory-discriminative dimension, the motivational-affective dimension, and the cognitive-evaluative dimension. Sensory discrimination includes transmission of nociceptive activity from thalamic nuclei to the somatosensory cortex and other parts of the cerebral cortex (Universities Federation for Animal Welfare 1989, p. 12; Benson 2004, pp. 64-65). Nociceptive activity in this area is directed to the site, onset, intensity and duration of a noxious stimulus (Kitchell and Johnson 1985, p. 114; Webster 1994, pp. 90, 95; Benson 2004, pp. 64-65).

In the motivational-affective dimension ascending nociceptive activity affects the avoidance of the stimulation, the severity of injury and suffering and involves feedback from the autonomic nervous system to the stimuli (Kitchell and Johnson 1985, p. 114). Autonomic control causes modification in the cardiovascular system, respiratory rate, gastrointestinal motility, peripheral vasoconstriction, and sweating. Nociception is particularly associated with ascending transmission from the thalamic nuclei to the cerebral cortex and the limbic system (Universities Federation for Animal Welfare 1989, p. 12; Benson 2004, pp. 66-67). Activities in the somatic motor systems induce alterations in muscle tone, spinal reflex sensitivity and coordinated locomotion. “Emotional reactions and affective experiences generated within this dimension are expressed in behaviour patterns such as crying out, attack or defence, co-

ordinated autonomic activity and endocrine responses“ (Universities Federation for Animal Welfare 1989, pp. 11-12).

Finally, the cognitive-evaluative dimension involves prior experience, anxiety, and conditioning. Nociceptive ascending impulses are closely related to cerebrocortical activity (Melzack 1986 cited by Benson 2004, pp. 64-65). According to Webster (1994, pp. 90, 95) there is conscious processing of pain within the sensory cortex. The suffering produced by the experience of pain is affected by a person's mood and cognitive awareness. Descending systems in the brainstem can modulate the nociceptive activity in ascending pathways through neuroactive chemical agents, such as opioid peptides, dopamine, noradrenaline and serotonin (Universities Federation for Animal Welfare 1989, p. 11).

According to Benson (2004, p. 65) the spinal and brain structures underlying nociception are equal in humans and animals and therefore give credibility that animals experience pain similar to humans. However, there is a notable difference in the nociception of pain between humans and animals. While in humans the lateral spinal tracts and the thalamocortical areas related to the sensory-discriminative dimension of pain possess more nerve fibres compared with other mammals, in animals the medial spinal tracts, reticular and limbic systems related to the motivational-affective dimension are similar or larger than those of humans (Dennis and Melzack 1983 cited by Benson 2004, p. 65). In accordance, animals “may experience a greater degree of suffering and stronger motivational drive from noxious stimuli while being less able to precisely locate and characterize the type of pain” (Benson 2004, p. 65).

The transmission of pain is closely related to the issue of pain tolerance. In terms of animal welfare it is interesting to know what amount of pain an animal can detect and tolerate. Information in this respect can be gathered by considering the pain detection threshold (“least amount of pain that a subject can recognize”) and the pain-tolerance threshold, which designates “the greatest level of pain that a subject will tolerate”. In addition, the nociceptor threshold or “minimum strength of stimulus that will cause a nociceptor to generate a nerve impulse” provides understanding about the severity of pain. The pain detection threshold is rather equal among individuals and species (Zimmermann 1984 cited by Benson 2004, pp. 65-66): However, in pain tolerance a wide variety was observed between individuals in all species. Pain tolerance is significantly affected by the individual's former experience, environment and provision of analgesics. The nociceptor threshold is essentially identical humans and animals (Benson 2004, p. 65). Thus, it can be inferred that animals are as sensitive as people, when responding to noxious stimuli (Breazile *et al*., 1963 cited by Benson 2004, pp. 65-66). Kitchell and Johnson (1985, p. 114) drew attention to the point that it is unavoidable in managing farm animals to exceed the pain detection threshold occasionally, but most possible care should be provided not to go beyond the pain-tolerance threshold.

3.2.7.3 Assessing pain by analogy of pain perception between humans and animals

While knowledge about feelings in humans is conveyed by experience and communication, pain perception in animals can only be known by analogy and therefore remains a likely inference (Kitchell *et al*., 1962 cited by Kitchell and Johnson 1985, p. 114). However, a complete denial of animals being susceptible to pain is both logically and empirically unfounded (Kitchell 1980 cited by Kitchell and Johnson 1985, p. 114). Verbal description is not the only means for mediating the experience of pain, but can also be accomplished by observing behavioural (e.g. screaming) or physiological reactions to noxious stimuli in another individual. Therefore, analogy in anatomy, behaviour and physiology of different species including human can indicate similarity in the perception of pain in animals and humans (Breazile *et al*., 1963 cited by Kitchell and Johnson 1985, p. 114).

Comparative studies have shown that neuroanatomical structures and neurophysiological processes in the reception, transmission and processing of nerve impulses deriving from noxious stimuli are largely the same in all vertebrates (Bonica 1990 cited by Benson 2004, pp. 62-63; Webster 1994, p. 91). Conclusions drawn from analogue nociception postulate the similarity of sensation in animals and humans and provide evidence of animals' perceiving pain (Zayan 1986, p. 4; Webster 1994, p. 98; Flecknell and Molony 1997, p. 63; Benson 2004, p. 64). Zayan (1986, p. 5) further argued that neural homology, "a genuine analogy between both the composition and the structure of a system and those of another system, even if it is of a different natural kind (e.g. bat wig - ape hand)" is present, when two individuals have similar sensory receptors, neural networks and transmission of signals to the CNS.

Stimuli that actually or potentially damage tissues can be supposed to be painful to the animal (Rowan and Tannenbaum 1986 cited by Benson 2004, p. 63). The facts that animals display signs of distress, learn avoidance behaviour and call in response to painful stimuli give much credibility that animals are capable to suffer from pain (Benson 2004, p. 63). Bateson (1991, p. 832) pointed out that the use of non-verbal behavioural and physiological indications to recognize pain in animals is problematic even if the neural system is comparable to humans, because there is a wide variety of reactions to negative stimulation arising from injury or disease and interaction with other factors (e.g. provision of analgesics) between the species. Flecknell and Molony (1997, pp. 64-65) maintained that in the assessment and recognition of pain in animals there is danger of making assumptions arising from anthropomorphism, on the one hand, and denying the presence of pain, because no behavioural signs are apparent, on the other hand.

Bateson (1991, p. 834) suggested that all the criteria of similar anatomy and physiology in humans and animals provide evidence that the experience of pain largely corresponds among the species:

1. Presence of receptors sensitive to painful stimuli
2. Analogy between the anatomy of the CNS in humans and animals
3. Transmission of noxious stimuli from the receptors to the brain
4. Presence of receptors for opioid peptites in the CNS
5. Effects of administered analgesics to noxious stimuli
6. Painful stimulation induces aversion
7. Avoidance of painful stimuli is relatively inelastic
8. Animal learns to cope with persisting noxious stimuli

On the other hand, Zayan (1986, pp. 1,8) emphasized that from a scientific point of view the assumption that animals perceive pain in the same way as humans is merely a postulate, because it can neither be asserted nor denied simply by analogy of the neural system.

> All that can be demonstrated is the existence and degree of analogy, and thus that the existence of pain sensations is plausible in animals. […] Neural analogies are a necessary but insufficient condition for inferring that animals suffer, especially if it is also assumed that animals are in all cases aware of the stimuli which are normally detected by nociceptors and which should evoke pain sensations. Accordingly, a convincing indication that animals actually feel pain in a similar way to humans calls for additional kinds of analogies.

3.2.7.4 Assessing subjective states scientifically and arising problems

Additional bewilderment arises because of the difficulty to quantify the subjective connotation of pain with scientific methods (Zayan 1986, p. 4). Therefore, assessing pain in animals poses similar questions as assessing their welfare; the underlying subjective concepts of pain and welfare are not amenable to objective or scientific measurement (Bath 1998, p. 148;

Sneddon and Gentle 2002, pp. 9-10; Duncan 2004, p. 164). Bath (1998, pp. 148-149) stated that problems that evolve from the perception of pain and animal welfare are interrelated with problems that derive from how the term pain is conceived and what types of pain are distinguished.

> If it is accepted that pain in its broadest sense is a perceptual concept arising from a complex interaction of factors then it follows that we must accept that it cannot be measured in the usual ways which scientists prefer. […] we do have to bear in mind that those measurable physiological, pathological and chemical processes which are described are only the underlying event which give rise to the perception of subjective feelings we call pain. The quality of subjective feelings is dependent on the level of consciousness and awareness of the animal, its psychology arising from its mental processes and emotions. An initial lesion has to lead to subjective feelings to qualify as pain. Further consequences of these feelings are memory, fear, association, anticipation, avoidance, distress and discomfort.

According to Zayan (1986, p. 2) assessing pain in a scientific way requires to formulate the problem precisely, to develop a comprehensible concept and to select appropriate methods to either reject or confirm the hypotheses. „Ideally, a context or conceptual framework should be both semantically clear and logically consistent, as in the case of a theoretical model, in which explicit definitions and postulates make it possible to deduce testable propositions“. The experience of pain in animals is measurable only indirectly by indicators that are accessible to scientific inquiry. Measurement must be based on a lawful association between the set of observable indicators (e.g. blood concentrations of opioid peptides, abnormal behaviour) and the unobservable variable (sensation of the strength of pain) in order to make scientific, mathematically proved inferences. In this context, pain is a “hypothetical construct” that is associated to a set of descriptive data which are tested empirically and give indirect evidence of an animal’s experience of pain (Zayan 1986, p. 12).

Against this background a number of suggestions have been made to indirectly assess the phenomenon of pain in animals by measuring of behavioural changes, neuroendocrine responses and brain states:

Firstly, behavioural responses to acute pain include escape or withdrawal from a noxious stimulus, which operates subconsciously (reflex), and vocal or facial signs of distress (Webster 1994, p. 93). Chronic pain causes behavioural signs, such as failure to turn up, reduced feed intake and modification of regular habits (Bateson 1991, p. 828). Mellor *et al*. (2000, p. 181) identified four reasons for behavioural responses to painful stimuli:

> (i) those often automatic responses that protect the whole animal or parts of it (e.g. withdrawal reflexes); (ii) those that minimize pain and assist healing (e.g. lying and standing still); (iii) those that are designed to elicit help or stop other animals (including people) from inflicting more pain (e.g. communicating vocally, by posture or by other means including smell); and (iv) those that induce learning and, by modifying an animal’s behaviour, enable it to avoid recurrence of the noxious experience.

Studying behavioural changes in animals is a widely established method to detect and assess disorders accompanied by pain. Algers (2004, p. 179) alleged that when attempting to put a diagnosis to a case, mostly behavioural signs or symptoms are used. Lester *et al*. (1996) and Dinniss *et al*. (1999) cited by Mellor *et al*. (2000, p. 182) suggested that a behaviour is likely to indicate painful sensory input, if it can be observed only in treated animals but not in control animals. This hypothesis is supported, when effectively locally anaesthetized animals in the treatment group show a similar behaviour than those in the control group. Sneddon and Gentle (2002, pp. 9-10) pointed out that observing an animal’s behaviour in response to a noxious stimulus can provide information about the detrimental nature of the stimulus and the subjective state of the animal. It cannot offer, however, a conclusive proof of an animal being in pain, since the performance of behavioural patterns can be influenced by a huge variety of factors.

Loeffler (1986, p. 49) and von Mickwitz (1986, p. 59) discussed the clinical assessment of pain based on visual behavioural inspection in veterinary practice. Acute painful conditions, such as disorders in the limbs, usually can easily be diagnosed due to abnormalities in function and posture (e.g. impairment of the locomotor system) (Fraser 1974 and Becker 1983 cited by Loeffler 1986, pp. 49-50). Pain that arises from inner organs can be detected by comparing the animal's normal behaviour with the (abnormal) behaviour in a state of pain. Posture, bearing of the head and movement of the ears are chief criteria in this regard. Furthermore, pain can be indicated by deviations in the behaviour of an individual from the behaviour of fellow animals and with some diseases (e.g. Aujeszky's disease in cattle) the changed facial expression of the animal (von Mickwitz 1986, p. 59).

Wiepkema (1986, p. 62) investigated two groups of veal calves in order to affirm the relationship between pain and stereotypies. Although „wild behaviour" was found as an expression of acute abomasal pain, this positive correlation could not be confirmed for tongueplaying and severity of ulceration. Chronic pathologic states, which are characterized by less severe but persistent pain, usually cannot be identified by clinical or ethological examination rather than by depression of activity and reactions to stimuli, reduction of feed intake and a loss of body weight (Becker 1983 cited by Loeffler 1986, pp. 50-51). Loeffler (1986, pp. 52-53) designed a *pain behaviour scale* to evaluate barely visible signs of chronic pain that follows a scale for the assessment of chronic pain in man by Richards *et al*. (1982) (Table 3.14).

Table 3.14 *Pain behaviour scale* for the evaluation of chronic pain in animals

Cries of pain	None Sometimes Often
Groaning	None Sometimes Often
Resting a limb Leaning head against something Arched back Hiding	Not present Sometimes, unclear often, clear
Lameness Rigid neck and/or back Chewing affected	None Slight Severe
Feed consumption	Normal Slightly decreased None
Body weight	Normal Slightly reduced Clearly reduced
Nutritional state	Good Average Very poor (cachectic)
Atrophic muscles	None Unclear Clear
Symptoms of pain Detected by palpation	None Unclear Clear
Sweating and/or Salivation	No Yes
Breathing rate and/or Heart rate	Normal Slightly increased Greatly increased

Based on Loeffler (1986 pp. 52-53)

Mellor *et al*. (2000, p. 175) provided behavioural indices of the animal's reactions to noxious challenges without differentiating between acute and chronic pain. These indices include vocalization (e.g. squeals, grunts, howls), posture (e.g. cowers, lying with extended legs, lift up a leg), locomotion (e.g. reluctant to move, escape), temperament (e.g. depressed, frightened, aggressive). Von Mickwitz (1986, p. 60) concluded that the assessment of pain in farm animals is tied to a variety of parameters that describe the animal's responses to noxious stimuli and the associations between them. Loeffler (1986, pp. 52-53) drew attention to the point that visual veterinary inspection of behaviour and posture is mainly intended to detect the presence or absence of pain in animals, only in a few instances the degree of deviation in posture or behaviour may indicate the intensity of pain. However, it is important to realize that even careful observation of behavioural pattern cannot provide proof beyond doubt about a painful state in an animal (Smidt 1983 cited by Loeffler 1986, pp. 52-53).

Secondly, neuroendocrine responses to acute and chronic pain involves the sympathetic adrenomedullary system ('fight-fright-flight' responses) and the hypothalamic-pituitary-adrenocortical (HPA) system (metabolic and anti-inflammatory responses). Animals exposed to noxious events, for example, react by increased heart rate and respiration rate, dilation of the pupils, sweating and the release of adrenal hormones and analgesics (Bateson 1991, p. 828; Webster 1994, p. 93; Mellor *et al*. 2000, pp. 174-175; Sneddon and Gentle 2002, pp. 9-10), as provided in table 3.15. Being an integral part of the sensation of pain, anxiety and fear significantly increase the hypothalamic responses through stimulation of cortical hormones (Hume 1969 cited by Benson 2004, p. 69). Webster (1994, p. 93) assumed that these physiological parameters are inappropriate to indicate the intensity of the pain an animal feels, because it has been found in humans that the correlation between the autonomic responses and the conscious perception of pain is weak.

Table 3.15 Physiological parameters of responses to pain-induced distress[1] in animals

Blood hormone concentrations	Blood metabolite concentrations	Other indices
Adrenaline	Glucose	Heart rate
Noradrenaline	Lactic acid	Breating (rate and depth)
Corticotrophin-releasing factor	Free fatty acids	Packed cell volume
Adrenocorticotropic hormone	β-hydroxybutyrate	Sweat production
Glucocorticoids (e.g. cortisol)		Muscle tremor
Prolactin		Body temperature
		Plasma α-acid glycoprotein levels
		Blood leukocyte levels
		Cellular immune responses
		Humoral immune responses

Modified from Mellor *et al*. (2000, pp. 175)

[1] Mellor *et al*. (p. 173) used the term 'pain-induced distress' "to indicate that the physiological responses reflect the interacting emotional and physical facets of the noxious experience".

Dantzer (1986, pp. 39-40) investigated neuroendocrine responses in relation to plasma corticosteroid and analgesic concentrations. Although catecholamine and cortisol discharge cause physiological symptoms, when an animal is in acute pain, Dantzer denied that the experience of pain can firmly be deduced by increased plasma levels of cortisol and catecholamines, because the release of cortisol may also be induced by stress or fear. No unique relation can be determined between corticosteroid levels and the expression of pain in any species and thus measuring neuroendocrine parameters can merely be an approximation to pain measurement.

Mellor *et al*. (2000, pp. 175-177) claimed that measuring of plasma cortisol concentrations is particularly useful to indicate acute pain-related distress, since the response of the hypothalamic-pituitary-adrenocortical axis often increases gradually subsequent to the noxious event. In view of the non-specificity of the HPA system, it is important to draw attention to two points:

> First, changes in plasma cortisol concentrations do not measure pain as such, but they do provide an indication of the overall noxiousness of the experience which, in the case of pain-induced distress, includes both physical and emotional components. Second, the relatively slow response time of the HPA axis may make it insensitive as a means of discriminating different levels of distress elicited within the first few minutes of a noxious stimulus.
>
> (Mellor and Stafford 1997 cited by Mellor *et al*. 2000, pp. 176-177)

Physiological response to painful stimuli also results in the release of analgesics, which counteract pain. Analgesic products, such as endorphins and enkephalins, affect the sensation of pain and therefore measuring the blood concentration of analgesics could provide quantitative information of pain in animals and humans (Dantzer 1986, pp. 40-43). However, the interpretation of these parameters is critical too. The effects of opioids on the perception of pain cannot be established beyond doubt, since endogenous analgesic mechanisms may be activated not only by noxious stimuli but also by stress factors. Moreover, endorphins are not only involved in pain response but also in thermoregulation, feeding and drinking behaviour, and feelings (Berger, 1982 cited by Dantzer 1986, p. 43).

Although pain cannot be measured directly, an informed judgement as to whether an animal experiences pain and attempts to minimize suffering and improve welfare can be made by investigating a wide variety of behavioural, physiological and biochemical parameters in response to a noxious event (Sneddon and Gentle 2002, p. 10). Universities Federation for Animal Welfare (1989, pp. 13-18) proposed a systematic *schema* as a guide to assess pain in animals. This *schema* evaluates data on the animal and its environment, clinical examination, physiological and biochemical signs, mental status, abnormal activity, posture, facial expression, gait, reluctance to accept handling, vocalisation, and response to analgesics.

Thirdly, the measurement of pain by brain activity is based on the assumption that the experience of pain is reflected in the functional states of the brain. In the 1980s Molony (1986, pp. 79-80) reviewed various methods for the analysis of brain states including electroencephalograms (EEGs), cerebral evoked potentials (CEPs) and magnetoencephalography. The examination of the cerebro-cortical response attempts to find out patterns of activity in the cerebral cortex, which are unique to the sensation of pain. However, Molony concluded that current knowledge of brain states and the sensitivity of available techniques for analysing them do not permit direct assessment of pain.

More than ten years later Berndt (1999, p. 35) reported on the development of a new method at the State University of New York that is intended to enable scientists to measure the subjective feeling of pain in an objective way – the functional magnetic resonance imaging (fMRI). This method aims at the direct measurement of physical and psychological pain by monitoring the cerebro-cortical activity in individuals and comparing the intensity of pain between individuals. In order to establish a quantitative measure, fMRI technique relies on the verbal communication of the person under observation who communicates the (subjective) level of pain he or she feels at a certain time on a scale from 1 to 10. The subjectivity of pain will be equalized through a large number of patient observations.

The novel technology depends on a sort of roentgen machine with magnets being its most important component. When the head of the person in pain is placed in the machine, activities in the living brain can be shown due to the different magnetic properties of the blood. An induced magnetic field guides the oxygen molecules of the haemoglobin in a certain direction

and radio waves visualize whether the blood is rich or poor in oxygen. Since active nerve cells utilize more oxygen than inactive cells, the signals produced by fMRI indicate, which parts of the brain are being active. The new technique can not only produce static pictures but can also record brain activity continuously with a temporal resolution of about one second, i.e., comparable to a film.

It is stated by Berndt that also psychological processes can be visualized by the fMRI technique. Brain signals, which are a result of cognitive tasks or feelings, such as fear or sadness, are reproduced on the screen. Though, a high temporal resolution is necessary to identify activity in the cerebral cortex and to gain reliable results. Hans Georg Kress in Berndt's article alleged that the entity of pain and consciousness is more the synchronized resonance of neurons than the state of individual nerve cells. Hence, in the experiment at the State University of New York the intensity of pain was highly correlated with the extent of the resonance of neurons. However, Kress maintained that only extensive epidemiological studies allow scientists to make precise statements and drew attention to the point that the variability of chronic pain is enormous.

Various aspects have been illuminated in functional magnetic resonance imaging studies. For example, Apkarian *et al*. (1999, pp. 2956-2957) in their experiment differentiated brain areas related to nociceptive activity, which was generated by thermal, vibrotactile or motor stimuli. Bornhövd *et al*. (2002, p. 1326) investigated the effects of different stimulus severities on individual cortical zones. Chen *et al*. (2002, pp. 464-465) in their study identified temporal differences in the response of somatosensory cortices to distinct noxious stimuli. Finally, Porro (2003, p. 354) addressed pain intensity-related changes in the brain system and found specific activity patterns for chronic pain and hyperalgesic conditions. Indeed, this novel technique appears to be very encouraging to recognize the subjective experience of pain in humans in a *scientific* or measurable way.

3.2.7.5 Functional magnetic resonance imaging (fMRI): a tool to assess subjective experiences including animal welfare?

Despite the successful application of functional magnetic resonance imaging (fMRI) in pain research in humans, some scepticism remains whether functional MRI can be a meaningful implement to measure subjectivity. Doubt mainly arises because of the vast complexity of subjective states in humans and animals.

In view of the structural similarities between pain and well-being especially in terms of subjectivity, the fMRI technique in an adapted form could be an interesting method to assess the welfare of animals. However, applying this technique to the assessment of animal welfare poses numerous other problems. For example, a necessary precondition for using fMRI in the assessment of animal welfare would be to locate respective cortical areas for well-being in animals. Since the measurement of pain states is currently based on humans communicating the intensity of their pain and animals cannot communicate their subjective sensations, another mode of investigation must be set up. The use of this technique in animals is also doubtful, since the unknown location of measurement may induce discomfort and fear in farm animals and thus distort the experimental results. Finally, at present the costs of such a procedure would go far beyond the scope of any budget of animal agriculture.

Other fundamental issues to be raised in this regard are whether the expression of subjective sensations in mathematical terms is meaningful at all, whether science is as objective as it is assumed to be and whether Cartesian science is appropriate to assess subjective states in animals?

3.2.8 Example 4: The importance of behavioural indicators in the assessment of animal welfare in large-scale commercial swine and poultry production in Thailand

In Thailand industrialized pig production systems are widely established. These systems, which are characterized by extreme restriction of space and environmental bareness, considerably inhibit the performance of normal behaviour and are strongly supposed to lead to the development of abnormal behaviour in animals. As a consequence, commercial pig production has been blamed for their negative implications on the welfare status of animals; one essential reason being the animal's prevention from expressing innate, natural behaviour. Although it is widely established to apply a range of indicators (e.g. physiological and behavioural indicators, level of stockmanship) in the measurement of animal welfare, the conspicuous signs of behavioural disorders that occur in intensive livestock production have drawn special attention to the behavioural complex.

Animals reared in large-scale pig and poultry production units in Thailand are breeds from temperate environments and are therefore poorly adapted to the local, tropical climate. Temperate breeds at least temporarily suffer from heat stress in the hot-humid environment of Thailand where the mean annual ambient temperature reaches about 27ºC (Rivas-Martinez 2005). Heat-dissipation is aggravated through the high humidity of the air in the region. Under these climatic conditions the allowance of behavioural thermoregulation being the first internal mechanisms elicited to counteract heat stress is essential for the animal. Thus, in this section emphasis is placed on behaviour with reference to animal welfare in large-scale pig production systems including a interpretation of the term, the swine's normal and abnormal behaviour, the relation between behavioural response and animal welfare and the adaptation of European and North American breeds to tropical environments.

3.2.8.1 Interpretation and motivational basis of behaviour

Animal welfare is determined by the physical and mental well-being of animals. According to Curtis (1983, p. 61)

> [m]ental activities still cannot be measured directly in either humans or the lower animals, and any languages via which the animals might communicate their own mental experiences remain undeciphered. […] we simply must assume for present purposes that farm animals are at least to some extent consciously aware of their surroundings. At the same time, the limits of experiences which gave pleasure or displeasure, comfort or discomfort, pain or the absence thereof, remain enigmas.

Psychological processes in animals are not amenable to direct investigation but observing behavioural patterns in farm animals is assumed to be appropriate to receive insight in their feelings (Nicol 1994, p. 69).

The behavioural repertoire of an individual can be ascribed to genetic factors and experience. While a genetic disposition or trait is passed from one generation to the next, certain experiences in an animal's life can initiate learning behavioural pattern. Behavioural study is closely linked with the evolutionary biology of Charles Darwin (1809-1882). His theory of natural selection suggests that "any inherited trait is determined by the breeding success of the parent generation and the value of the trait in enabling the animals to survive natural hazards such as food shortage, predators and sexual rivals". Darwinian view further emphasizes the evolutionary continuity of human and non-human animals in relation to feelings and emotions (McFarland 1993, pp. 3, 7).

For interpreting behaviour the animal's underlying motivation is central. Motivation is constituted by "[t]he internal state of the animal, which is the net result of stimuli arising from both inside and outside its body (Manning and Dawkins, 1998 cited by Jensen 2002b, p. 31) or by a complex of internal and external sources (Nicol 1994, p. 76; Petherick and Rushen 1997, p. 91). Nicol (1994, p. 76) alleged that "some behaviours may very rarely be elicited by anything other than internal factors, while others may be almost totally dependent on external factors for their appearance". Petherick and Rushen (1997, p. 93) highlighted the likelihood that both motivation to display behaviour and motivation to receive a particular feedback operate entirely or at least partly in different motivational systems.

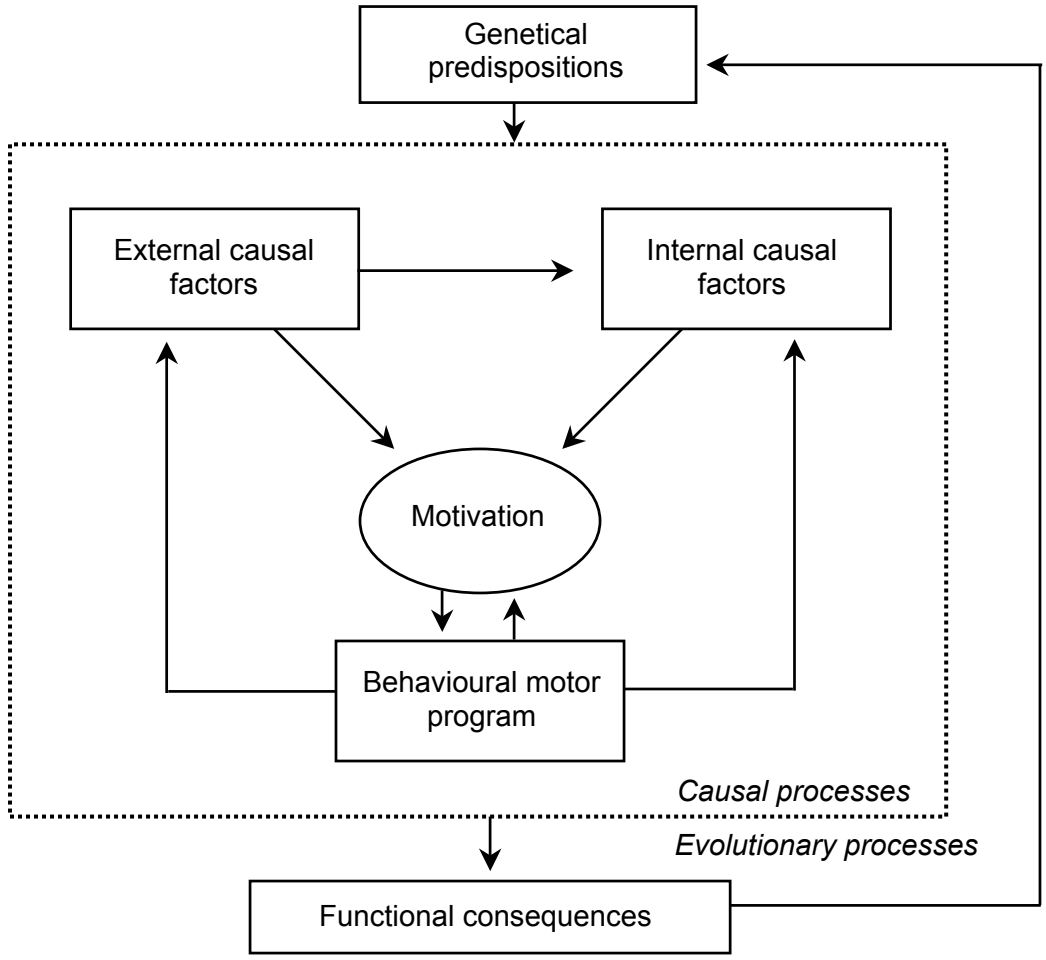
According to Fraser and Broom (1997, pp. 31-34) "[m]otivation is the process within the brain controlling which behaviours and physiological changes occur and when". Initiation of activity in pigs or other farm animals is determined by various factors. These factors may include "*sensory input to the brain*" (e.g. food odour), "*internal input from* body monitors" (e.g. blood glucose levels), "*internal input from oscillators* within the body which produce an output after a particular time and can indicate normal feeding time" or "*input about the presence of a potential mate, rival or predator* which […] leads to some other activity being given priority over food-searching". All these factors are affected by an animal's previous experience. Those inputs be it external factors or internal bodily states, which are actually involved in decision-making, are called *causal factors*. Fraser and Broom concluded that "*the motivational state of an animal is a combination of the levels of all causal factors*".

In the course of time scientists have developed different models of motivation (an overview is given, for example, by Toates 1987, pp. 158-177 and Fraser and Broom 1997, pp. 34-35). Jensen and Toates (1997) cited by Jensen (2002b, p. 32) provided a conceptual model of motivation that is based on homeostatic considerations (Figure 3.8). Encompassing various possible pathways, this model is appropriate for the analysis of particular behavioural patterns. It reveals different causal and feedback paths, evolutionary processes and the functional consequences of behaviour. According to this concept the effects of behaviour have no immediate implications on causal events, but the entire causal system is a result of evolution.

Nicol (1994, p. 70) expounded that both hens and sows were found to be strongly motivated to construct a nest even, if they were offered a ready nest. She argued that these observations contradict other views that attach major importance to the environmental endpoint of behavioural patterns and not to the displaying of the behaviour itself. Though, Nicol conceded that initiation of "*some* behaviours" may cease, if their consequences are made available. Motivational models that assign the performance of behaviour solely to the behavioural endpoint clearly underlie a mechanistic view, they negate the animal's ability to make conscious decisions.

Petherick and Rushen (1997, p. 105) pointed out that motivational systems are enormously diverse and that "[i]t is necessity to investigate the motivational systems underlying each separate behaviour to reach firm conclusions about the influence of behavioural restriction on animal welfare". Owing to the complexity the animal's motivational state is not easily accessible to scientific enquiry and, therefore, indirect ways to determine motivation are applied. Fraser and Broom (1997, p. 36) pointed out that information on an animal's motivational state can be obtained by indirect measurements of behaviour, physiological indicators and to some extent from brain recording. Nicol (1994, pp. 77-78) proposed the observations of an animal's behaviour subsequent to a period of restriction and deprivation, the socalled rebound behaviour, in order to investigate an animal's internal motivational state.

Figure 3.10 Conceptual model of motivation



Modified from Jensen and Toates (1997) cited by Jensen (2002b, p. 32)

3.2.8.2 Pig behavioural patterns in natural environments and modern housing systems

Although "[g]ood stockmen and animal managers have always used animals' behaviour as a guide to their health and welfare" (Mench and Mason 1997, p. 128), behavioural studies in domestic animals lately experienced a revival particularly in the context of intensive animal farming. Many scientists (e.g. M. Dawkins and D.M. Broom) have described behaviour as an indicator of animal welfare. However, there is still controversy about this matter; the key question being: how are behaviour and welfare associated? Mench and Mason (1997, p. 128) stressed the importance of a comprehensive knowledge about the complete behavioural repertoire of a species or its *ethogram*, in order to establish a connection between (normal) behaviour and the welfare of animals.

Behaviour, in this regard, refers to normal or natural behaviour. Normal behaviour "has developed during evolutionary adaptation" encompassing "any learnt behaviour that serves the function of promoting the health, survival and reproduction of an animal in a certain environment". Normal behaviour that "has evolved in the natural habitats of the species" is specific to species, sex and age. However, an exact determination of a normal range is critical, because a huge variety of behavioural patterns is performed in different environments. In ex-

tremely confined husbandry systems even abnormal behaviour may be the norm. It is therefore important to understand which behaviour is typical to the species in a particular environment. The norm refers to the behaviour that has arisen under natural conditions (Keeling and Jensen 2002, pp. 79-80).

Information about normal behaviour in domesticated animals can be obtained by observing the behaviour of wild ancestors, feral animals (domestic animals living without human contact), and domestic animals living in natural environments (Keeling and Jensen 2002, pp. 79-80). Difficulties in behavioural studies have arisen, because the deprived environments in modern livestock production systems usually provide little opportunity to exhibit the diverse behavioural repertoire that animals show under natural conditions. Hence, observations of behaviour have preferably been carried out in domestic or feral animals, which were placed in richly structured natural settings (Mench and Mason 1997, p. 128).

Fraser and Broom (1997, p. 305) asserted that recognizing abnormal behaviour requires familiarity with the overall range of normal behaviour in the particular species. To establish the norm necessitates studying the behavioural repertoire in a possibly complex environment, where the animal is able to display the full range of its behaviour. In this study not the full ethogram of the pig is presented but only those behavioural patterns that are particularly important in view of industrialized animal production systems in hot environments. Thus, only the complexes of maternal behaviour, social behaviour, ingestive behaviour and thermoregulatory behaviour are enclosed in the subsequent discussion.

In free ranging pigs' farrowing takes place in the periphery of the group. In the last few days of pregnancy free ranging sows explore the surroundings and separate from the group in order to select a nest site (Stolba 1984, p. 110; Jensen 2002a, p. 165). Stolba and Wood-Gush (1983, p. 290) found that sows have a marked tendency to select forests and forests edges habitats for constructing their nest. Preferred farrowing sites were characterized by one side protection and overhanging branches of trees or bushes (Stolba and Wood-Gush 1983, p. 290; Jensen 2002a, p. 165). Fully sheltered sites, such as densely bushed areas, were rarely chosen by the sows. Instead the nests were often placed at ridges and this confirmed the hypotheses that pigs seek not only for shelter but also for open view from their farrowing sites. In addition, a significant number of nests were protected against wind (Stolba and Wood-Gush 1983, pp. 290, 292).

The most obvious maternal behaviour in the sow is the construction of a nest. Four to six hours before parturition (Stolba 1984, p. 110) the sow starts nest building by

> rooting and digging a shallow hollow in the ground. Thereafter, soft material is ripped off from the edges of the hollow and, with pawing movements of the forelegs, the material is placed in the nest. The next phase consists of the sow collecting nest material – grass, ferns and twigs – from distances up to 50 m from the nest site, carrying it back and placing and arranging it in the nest. Arranging is done by rooting and pawing in the material so it becomes accumulated along the edges of the nest and gradually piles up in the middle.
>
> (Jensen 2002a, p. 165)

In modern livestock production systems worldwide in which sows are kept in farrowing crates nest seeking and nest building behaviour is deprived. Van Putten (1978, pp. 183-184) reported that during the last three to four days before parturition the sow is restless, loses appetite and attempts to separate. She is looking for a nest site and eventually begins nest building activities. However, these activities must remain incomplete owing to the inappropriate environment and the lacking nesting material. Widowski and Curtis (1990) cited by Curtis and Stricklin (1991, p. 5005) maintained that sows spend a considerable amount of time in nest building, although there is neither sufficient space nor necessary substrate to build a nest in confinement. They concluded that "nestbuilding behavior in itself is rewarding". Jensen (2002a, p. 165) claimed that female pigs try to perform nest building in any surrounding.

Moreover, he found that deprivation of nest construction results in poor maternal qualities of the sow.

Arguments that sows will not engage in nest building activities without stimulation by external stimuli or when a ready-made nest is provided were refuted by experimental evidence by Jensen (1993) and Haskell and Hutson (1994) cited by Jensen (2002b, p. 32). Likewise, assumptions that merely the performance of motor patterns of nest building, as displayed in confined and tethered sows, is sufficient to reduce motivation to build a nest have been criticised, because in tethered sows higher cortisol levels have been found prior to parturition than in loose animals. Therefore, "the behavioural needs of sows during the last day before farrowing appear to consist of a combination of being able to carry out the motion patterns involved in nest building, but also to receive feedback from the activities" (Jensen 2002b, pp. 32-33).

Pigs have a marked interest in social contact (van Putten 1978, p. 170). According to Graves (1984) cited by Jensen (2002a, p. 160) herds of wild and feral pigs typically consist on about 2-6 female individuals, while males live single or in pure male groups. Stolba (1984, p. 108) ascertained that also male members adhere to the female herd. Van Putten (1978, p. 170) confirmed that in wild boars the sow and her newborns form a primary unit. When the litter is about two weeks old several sows and their young come together and constitute a secondary group of about 20 animals. Social behaviour and interaction in swine was reviewed by Gonyou (2002, p. 147):

> Studies on wild, feral and free-ranging pigs reveal that the most common social grouping is that of several sows and their juvenile offspring, living within a home range. Within this group avoidance behaviour is used to maintain the social organization. Males exist in small groups of young boars, or as solitary males when older, except during the breeding season when they join the sow and offspring groups. Another social group is the sow and newborn litter, which exists for approximately 10 days following parturition.

Social interaction in swine is mainly based on olfactory stimuli, which have been identified to be responsible for individual recognition. Additionally, in both wild and domestic pigs visual signals including ear, tail and body postures have been described, although these signs are considerably lower in significance in domesticated animals. "Ears that are held back along the neck signal fearfulness, tail erect and upwards signals danger, whereas a depressed tail is typical of a submissive pig" (Jensen 2002, p. 160). Swine in human care also perform a variety of vocal signals, such as warning calls, submissive squeals, or lactation grunts of the sow (Kiley 1972 cited by Jensen 2002, p. 161).

The social organization of grouped pigs is based on a social hierarchy (Jensen and Wood-Gush 1984 cited by Fraser and Broom 1997, p. 159). Dominance and avoidance behaviour in different animals of the herd is a precondition for a stable hierarchy (Jensen 1994 cited by Jensen 2002, p. 160). Van Putten (1978, p. 172) and Fraser and Broom (1997, pp. 133-134) maintained that the driving force in the social interaction of pigs is avoidance not aggression, as generally supposed. Commonly an animal lower in hierarchy avoids or rapidly terminates an encounter with an animal higher in hierarchy. Avoidance behaviour is a response to agonistic behaviour that controls agonistic attack and engenders social stabilisation. It is important to note that avoidance also occurs in the absence of any aggressive encounter. Regrouping of animals in a production unit often ensue aggressive acts until a new social order has re-established (van Putten 1978, p. 173; Gonyou 2002, p. 156).

Major factors affecting the social hierarchy in swine are group size and the space allocated to the animals (Jensen 1982 cited by Jensen 2002, p. 160). According to van Putten (1978, p. 171) numbers for optimal group sizes vary from 5 to 250. Though, he proposed a "natural group size" of about 20 animals in order to minimize agonistic behaviour motivated by hierarchy. Fraser and Broom (1997, p. 133) pointed out that in growing pigs allocation of only about 0.75 m^2 of pen size for each animal increases the severity of social encounters. At any

higher stocking densities individuals, which are low in the social hierarchy, are incapable to avoid aggressive attacks. The prevention of submissive behaviour has adverse effects on the productivity of a pig unit. Van Putten (1978, p. 171) claimed that a sow and her newborn litter require a pen of at least 4 m^2 and a fattening pig a space of 3 m^3 (Lindquist 1974 cited by van Putten 1978, p. 171). The productivity of fattening pigs is positively correlated with the size of lying area per animal. Lower space allowance results in increased morbidity including diseases of the respiratory tract and tail biting in animals (van Putten 1978, p. 171).

Ingestive behaviour in pigs has an important role to play in the development of abnormal behavioural patterns. Pigs are omnivorous and under natural conditions their diets contain both vegetable items (grass, herbs, leaves, roots, seeds, tubers, fruits, mushrooms etc.) and animals (e.g. insects and their larvae, frogs, young birds, and ill larger animals). Rooting - turning the grass mat or soil with the snout in order to discover food - is a main feature of feeding behaviour in domestic swine (van Putten 1978, p. 194; Stolba and Wood-Gush 1983, p. 292; von Zerboni and Grauvogl 1984, pp. 264-265; Fraser and Broom 1997, pp. 95-97; Jensen 2002, p. 162). According to Stolba and Wood-Gush (1983, p. 292) about 40% of the total foraging activity in pig is rooting. Signs of rooting behaviour are even exhibited in pigs that are fed with milled foodstuffs (Fraser and Broom 1997, p. 95). However, pigs also engage in grazing and browsing (Jensen 2002, p. 162). Foraging behaviour in pigs is closely related to explorative behaviour. Pigs persistently engage in investigating their surroundings by nosing, rooting and biting at objects they discover (Schmidt 1982, p. 117).

At free range domestic pigs spent up to 9 hours a day, i.e., more than half of daytime foraging and spend 1-6 hours a day rooting (Stolba 1984, p. 107; von Zerboni and Grauvogl 1984, p. 265). Food intake mainly occurs from 6.00 to 9.00 h and from 15.00 to 18.00 h (von Zerboni and Grauvogl 1984, p. 264). In contrast, pigs in modern housing systems consume their ration based on “compounded feedstuffs”, in only 15 min each day (Fraser and Broom 1997, p. 96). Van Putten (1978, pp. 195-196) reported that sows fed two times daily a limited ration, require about 10 minutes to eat each meal dependent on the composition of the feed. Interestingly, van Putten observed that pigs throw up food particles in the trough with their snout comparable to rooting behaviour, when they are not in a competitive situation. After a short meal particularly fattening pigs show rooting activities on concrete or slated floors without bedding. In this regard, van Putten maintained that the animal’s motivation for rooting and mastication remains unsatisfied in present-day pig production with two, very short feeding periods.

Comfort behaviour in swine has special importance for pig production in hot environments. The pig is the domestic animal with the worst thermoregulation (von Zerboni and Grauvogl 1984, p. 271), because pigs possess very few sweat glands (solely on the snout) and respiratory heat loss is negligible. Hence, they strongly depend on behavioural thermoregulation, particularly wallowing (von Zerboni and Grauvogl 1984, p. 271; Curtis and Stricklin 1991, p. 5003; Fraser and Broom 1997, p. 107; Jensen 2002a, p. 162). The comparatively sparse coat (von Zerboni and Grauvogl 1984, p. 271) makes the swine body very susceptible to direct solar radiation (Mount 1979 cited by Fraser and Broom 1997, p. 107). Although water effectively relieves hyperthermia, pigs preferentially wallow in mud (Fraser and Broom 1997, pp. 105, 107; Jensen 2002a, p. 162). In the wallow a thick mud coat is acquired, which, after being dried, forms a protecting body layer against sun rays. Additionally, the layer absorbs body heat and thus has a cooling effect (Fraser and Broom 1997, p. 107).

According to Jensen (2002, p. 162) free ranging pigs in temperate environments wallow in mud or water only, when the ambient temperature exceeds 20ºC. Observing domestic pigs in an outdoor enclosure in Scotland, Stolba (1984, p. 107) found that the animals have wallowed regularly at temperatures above 18ºC. In the wallowing process pigs normally dig and root in the mud before they enter the wallow with the forebody. Then, the animals move the body back and forth until the entire body surface is covered with mud. After the termination of the mud bath, rubbing against a tree or a stone next to the wallow may occur (Jensen 2002,

p. 162). Van Putten (1978, p. 207) maintained that both single animals and groups of animals may stay in a wallow for hours.

In intensive pig production units, where adequate sites to wallow are absent, at high temperatures animals attempt to alleviate hyperthermia on wet, dung covered floors or splash water from drinking facilities (van Putten 1978, p. 206; von Zerboni and Grauvogl 1984, p. 271; Jensen 2002, p. 162). Von Zerboni and Grauvogl (1984, p. 271) alleged that pigs weighing about 100 kg have a temperature optimum of 20ºC, while at higher weights the optimum is at 15-10ºC. High humidity further aggravates heat stress in animals, because evaporation from the animal's skin surface decreases, when the ambient relative humidity increases. Sprinkling equipments have positive effects on evaporative cooling in swine. Mayer and Hauser (2000, p. 129) suggested that for fattening pigs in housing systems with straw bedding temperatures within a range of 9ºC and 23ºC are animal-friendly.

The industrial pig production in Thailand to a large extent relies on breeds (e.g. Landrace, Duroc) that originate from Europe and North America, but ethological investigations conducted in the Thai pig industry in both exotic and indigenous breeds are unknown. Stolba (1984, pp. 111-113), who observed domestic pigs in an open-air enclosure, provided a qualitative proof that in pigs behavioural patterns and their sequences changed merely minimal through domestication, although he detected fine differences in the motor coordination between wild boars and domestic swine. Stolba's investigations further implied that all animals performed a rich variety of behavioural patterns, even those who were grown up in intensive production systems.

Similarly, Mench and Mason (1997, p. 129) argued that the behavioural studies by Stolba and Wood-Gush (1989, pp. 423-424) give evidence that neither rearing conditions nor domestication affected the pigs potential to display a rich behavioural repertoire. In natural or semi-natural environments the behaviour of domestic pigs resembled that of the European wild boar. Thus, it can be supposed that Western breeds are motivated to display their genetically programmed behavioural repertoire also under different climatic conditions. Acclimatization and adaptation to the hot-humid environment in Thailand might have minor importance in the light of the apparently powerful inner motivational state that has undergone largely intact the drastic alterations from the wild boar living in forest areas to domestic pigs kept in protected, but deprived settings.

3.2.8.3 The inadequacy of industrialized production systems and the resulting development of abnormal behaviour in pigs

Stolba (1981) cited by Curtis and Stricklin (1991, p. 5003) stated that the behavioural repertoire of pigs in natural environments is richer than in intensive systems. Alike, Nicol (1994, p. 71) held that animals in modern housing systems do not perform the complete range of behaviours that is shown in animals in natural or semi-natural environments in which these behaviours have evolved. In this context, it is interesting to view back to the beginning of intensive animal production.

Fraser and Broom (1997, p. 366) reviewed: When intensification in livestock agriculture took place in Europe a couple of decades ago, pen size was lowered and straw was removed from the pig stall to reduce labour costs. As a consequence, piglet mortality increased significantly. The subsequent introduction of farrowing crates stopped the rise of offspring mortality through bars on the crate that prevented piglets to move under the sow. However, the problem of overlying could not be entirely eliminated due to the inability of the sow to lie down carefully within the crate where the animal hastily drops the hindquarters. The sow herself was extremely restricted in her movements by the new technique, which caused serious frus-

tration and abnormal behaviour in the animal. Therefore, farrowing crates are “far from ideal for the sow”.

In modern pig housing systems space is extremely limited and therefore space-related behavioural patterns (e.g. of the exploring and foraging complex) are almost entirely prevented. Sows are tethered or confined in minimal areas and fattening pigs in crowded pens cannot lie in a comfortable side-position (Jensen 2002, p. 168). The space size available to a fattening pig has an influence on the animal’s locomotion, its resting behaviour and social behaviour (Fraser and Broom 1997, p. 368). Sufficient lying area is particularly important in hot environments, because at high temperatures pigs preferably lie on their side and stretch their legs (van Putten 1978, p. 171). However, not only lack of space but also lack of stimuli has detrimental effects on animals in modern pig production. For example, constructing a nest in farrowing sows is largely inhibited, when they are kept on slatted floors without straw (Jensen 2002, p. 168).

An extreme form of behavioural restriction and inadequate treatment of animals was reported in slaughter animals by the Regional Office for Asia and the Pacific of the Food and Agriculture Organization of the United Nations (FAO):

> One tormenting method of immobilizing pigs is practised in some Asian countries. Pigs, when moving them from the farms to the slaughterhouses, are forced into crates made of steel bars. These crates can accommodate one pig but do practically not allow any movements upon arrival at the abattoir; the crates are piled one on top of each other. Pigs are kept waiting inside the crate for hours without water and ventilation. Finally the bleeding without stunning is carried out with the pig still in this position.
>
> (FAO 2001, p. 71)

It is widely accepted that restriction or deprivation of behavioural patterns gives rise to suffering in farm animals. In addition, farm livestock develop abnormal behaviour that is irrelevant or directed to inappropriate objects. Such behaviour is displayed even if the functional consequences of the behaviour (e.g. a nest) are provided (Petherick and Rushen 1997, pp. 89-90). Abnormal behaviour is a deviation from normal behaviour (Keeling and Jensen 2002, p. 79). According to Buchenauer (1981) cited by Schmidt (1982, p. 115) disturbed behaviour includes “all behavioural patterns which differ from the norm for a species”. The norm refers to the behaviour of free or under naturalistic conditions living animals and abnormal behaviour commonly occurs in animals which are kept in captivity (Mench and Mason 1997, p. 134). Behavioural disturbances may include “frequency of the movements, the intensity of the actions, or the context in which the behaviour occurs is different from the normal” (Fraser and Broom 1997, p. 305). Abnormal behaviour was found to be harmful for the performing animal itself and for pen mates (Schmidt 1982, p. 115).

A frequently occurring abnormal behaviour is the stereotypy. “A stereotypy is a repeated, relatively invariate sequence of movements which has no obvious purpose”. The term “relatively invariate” refers to the fact that some variation may be shown in the repeated movements. However, they are to be regarded as stereotypies even if the behavioural patterns were not displayed in a strict sequence (absolutely invariate) but in an inconstant sequence (relatively invariate) (Fraser and Broom 1997, p. 307). According to Ödberg (1989) cited by Nicol (1994, p. 85) there is controversy about whether stereotypies assist the animal in coping with deprived conditions, because stereotypic individuals become less aware of their environment. Therefore, an unpleasant situation may be perceived as less aversive (Nicol 1994, p. 85).

Stereotyped behaviour was mainly detected in animals that had experienced social deprivation at an early age and/or a restricted environment (e.g. cages, small pens) (Broom 1981, pp. 98-99; Hinde 1970 cited by Schmidt 1982, p. 118; Rushen *et al*., 1993a cited by Petherick and Rushen 1997, p. 103). Broom (1981, pp. 98-100) alleged that preconditions for

stereotypies to occur are little alteration of “sensory stimulation” and “high unpredictability of important future events”. Such disturbances are likely to increase the occurrence of stereotypies in an individual. A situation of high unpredictability of events might elicit huge fluctuations in the motivational state and unpredictability might require a response that entails reduced efficiency of action. “Stereotyped behaviour might therefore be used as a regulator of motivational state. […] [T]he performance of stereotyped behaviour would increase the mean predictability of sensory input more than would remaining immobile”.

Rushen *et al*., (1993a) cited by Petherick and Rushen (1997, p. 103) assumed that stereotypies “result from the frustration of specific motivational systems”. Houpt (1987, p. 363) and Keeling and Jensen (2002, p. 81) pointed out that stereotypies are induced in stimulus-poor environments, when an animal is prevented from exhibiting its normal behaviour. Schmidt (1982, pp. 117-118) argued that “[t]he lack of possibility to indulge in the investigative behaviour for which pigs are very highly motivated, and the lack of necessity to do 6-7 hours work to obtain food, make them restless and they develop abnormal oral movements”. Bar biting, vacuum chewing and to some extent tail and ear-biting resemble explorative movements in the natural environment. Snout-rubbing imitates rooting activities in the ground.

Bar biting and related stereotypies as well as sham chewing are wide-spread in sows, which are kept individually under confined or tethered conditions. Biting the bars of the enclosure is an oral stereotypy and often exhibited by sows in farrowing crates. At parturition the frequency of bar-biting decreases (Houpt 1987, p. 363). “When engaged in bar-biting […] the sow takes into its mouth one of the cross bars at the front of the crate and bites it, rubs it with the body of the tongue or slides the mouth across the bar in rhythmic side to side motions (whetting)”. Instead of bar-biting sows sometimes rub their snout repetitively underneath the bar from side to side, which may result in injuries. Tether-biting is carried out in a similar way (Fraser and Broom 1997, pp. 315-316). This abnormal behaviour has been found to be more frequent in the absence of bedding material, such as straw (Fraser 1975 cited by Fraser and Broom 1997, pp. 315-316).

Sows affected in sham-chewing or vacuum chewing (Schmidt 1982, p. 116) perform jaw movements without having any food in their mouth. By the vigorous periodic chewing of saliva a considerable amount of foam is produced. Additionally, mouth gaping is displayed. Sham-chewing sows often achieve unsatisfactory weight gains (Fraser and Broom 1997, pp. 312-313) and show delayed oestrus or anoestrus after weaning (Sambraus 1985 cited by Fraser and Broom 1997, p. 313). According to Fraser and Broom (p. 313) housing of animals in groups and the provision of straw is an appropriate means to reduce this abnormal behaviour.

Although the underlying mechanisms are still not fully recognized, stereotypies are common in industrialized animal production systems and are regarded as a sign of poor welfare (Fraser and Broom 1997, p. 363). It is widely agreed upon that a high incidence of stereotypies indicates depressed welfare in farm animals (Lawrence and Rushen 1993 cited by Jensen 2002, p. 170). “However, if the stereotypies are an adaptive mechanism to an inadequate environment, one may aggravate the mental health of the animal by suppressing motor stereotypies” (Ödberg 1978 cited by Schmidt 1982, p. 119). The optimal strategy to counteract these disturbances is to eliminate their causes and, therefore, the provision of an environment that permits the expression of an animal’s normal behavioural repertoire is most suitable to avoid abnormal behaviour in pigs (Schmidt 1982, p. 119).

Behavioural disorders other than stereotypies, which are abnormal with regard to the object to which they are directed, have mainly been detected in fattening pigs. Growing pigs often display tail biting, belly nosing and anal massage. Especially tail-biting is a serious problem in the modern pig industry (Houpt 1987, p. 358). In most instances fattening pigs are affected (Schmidt 1982, pp. 116-117), but this abnormal oral behaviour also occurs in early weaned piglets (e.g. Algers 1981 cited by Schmidt 1982, pp. 116-117). According to Fraser and

Broom (1997, p. 327) the initial light chewing on the tail of an individual by a pen mate becomes successively more severe and results in wounds and haemorrhage. Increased intensity of biting may lead to a complete loss of the tail. At an advanced stage, biting-activities are directed to other parts of the injured animal, such as ears, vulva and limbs. Other group members may also engage in biting, while afflicted pigs behave submissive and respond only sound on the bits. Primary infection of wounds and ensuing abscesses of the hindquarters and the spinal column and secondary infection in the lungs, kidneys, joints may occur.

Predisposing factors to tail-biting are believed to be breed (e.g. Landrace), rapid growth of animals, high group size and stocking density, insufficient trough length and drinking facility, lack of stimuli as well as high levels of temperature, humidity, noxious gas and noise (Gadd 1967 cited by Fraser and Broom 1997, p. 327, Keeling and Jensen 2002, pp. 82-83). Such detrimental environmental conditions or combinations of it generate unrest and subsequently "irritability, over-excitability and increased activity" in the animals, which motivates tail-biting (Fraser and Broom 1997, pp. 327-328). Houpt (1987, p. 358) highlighted the impact of depressed foraging behaviour: "Confined pigs will attempt to root on concrete floors and, encountering a recumbent pig's tail while rooting, may release prey-catching behaviour that, in the wild, may facilitate the capture of worms and other small animals". Fraser and Broom (1997, p. 328) confirmed that pigs show greater oral activity than other farm animals and thus attempt to explore objects in their surrounding by rooting and chewing it in their mouth.

According to Keeling and Jensen (2002, pp. 82-83) the understanding of the cannibalistic behaviour in farm animals is poor. However, it is denied that the behaviour is derived from aggression. Pigs exhibit aggressive behaviour in order to form a social hierarchy and it is therefore a normal behaviour. Aggression usually ceases, when the relationship between the group mates is established (van Putten 1978, p. 172; Keeling and Jensen 2002, pp. 82-83). Moreover, a nutritional background of cannibalistic behaviour is supposed, because nutritional deficiencies (in particular of salt) were found to be positively correlated with the occurrence of tail biting (Keeling and Jensen 2002, pp. 82-83).

It is common to shorten the tails of a few weeks old piglets as a preventing measure against tail biting. Though, done without anaesthesia this measure is another pain-causing factor that reduces animal welfare (Jensen 2002, pp. 169-170). On the other hand, Fraser and Broom (1997, p. 328) maintained that the removal of the distal half of the tail is appropriate, because this part is "sufficiently sensitive that pigs react effectively when a tail-biting attempt is made on them". When affected animals are removed from the group and kept together they generally restrain from biting. Straw bedding and the opportunity to root in earth has been found to be useful in controlling this abnormal condition.

Alike, belly-nosing is an abnormal behaviour with respect to the object to which it is directed and is mainly displayed by early weaned piglets (Schmidt 1982, p. 116). Belly-nosing piglets move their snout up and down on the belly of litter mates similar to "the massaging movements directed by piglets towards the udder" of the mother (van Putten 1978, p. 192; Fraser 1978b cited by Fraser and Broom 1997, pp. 330-331). This abnormal behaviour does not occur before weaning, but frequently in early weaned piglets at 3-5 weeks of age (Fraser 1978b cited by Fraser and Broom 1997, pp. 330-331). The incidence of belly-nosing is much less in animals weaned later than 6 weeks of age and piglets provided with straw. Thus, an adequate sucking period and straw bedding is an appropriate means to restrict this undesirable behaviour. Belly-nosing may cause inflammation in nipples, umbilicus, penis or scrotum (Fraser and Broom 1997, pp. 330-331). In addition, a negative correlation between high levels of belly-nosing and weight gain was noticed (Fraser 1978b cited by Fraser and Broom 1997, p. 331). Von Zerboni and Grauvogl (1984, p. 263) observed belly-nosing in early weaned piglets too, but did not detect notable injuries.

The abnormal behaviour of anal massage is typically displayed among growing pigs, which are grouped densely. Affected "animals move from one animal to another, nosing the anal

regions with upward massaging motions of the snout". The snout-rubbing causes reflex defaecation in the tolerating animal and subsequent ingestion of faeces in the performing animal. Inflicted wounds of the anus and the surrounding area lead to difficulty in standing, reduced feed intake resulting in a bad physical condition, and even death in the submissive pig. In order to control this behavioural disorder, avoidance of crowding and provision of chewing and rooting material is regarded to be helpful (Sambraus 1985 cited by Houpt 1987, p. 363; Fraser and Broom 1997, pp. 326-327).

Dog-sitting is an abnormal behavioural pattern that represents a failure of function and occurs in both breeding sows and fattening pigs. In this posture the animal is sitting on the haunches, while the forelegs are stretched and the head is in a lowered position (van Putten 1978, p. 193; Fraser and Broom 1997, p. 344). When kept on solid, permanently soiled floors dog-sitting sows may develop infections of the urinary tract. Spreading of the inflammatory conditions can result in abortion and even in rapid death. Since dog-sitting is closely related to slippery slatted floors, such detrimental housing conditions should be avoided (Fraser and Broom 1997, p. 344). In pens with straw bedding dog-sitting was rarely observed (van Putten 1978, p. 193). According to Sambraus (1981) cited by Fraser and Broom (1997, p. 344) dog-sitting is one of several indicators of poor welfare.

Anomalous reactivity including prolonged inactivity and unresponsiveness has also been identified as abnormal behaviour, which is also called apathetic behaviour. Motionless sitting, standing or lying has been observed to occur in confined sows for much longer periods than for free-ranging pigs (Fraser and Broom 1997, pp. 345). Referring to experiments of Jensen (1981) and Wood-Gush (1988), Fraser and Broom pointed out that tethered sows spend 68% of the day-time lying, while free-ranging pigs under natural conditions were rooting for 50% of the day and resting only for a short period. Long-lasting lying in sows can give rise to urinary tract disorders (Tillon and Madec 1984 cited by Fraser and Broom 1997, p. 345). However, prolonged inactivity in pigs can be counteracted by enriched environments that tolerate movement and the exhibition of various normal behavioural patterns. Although levels of activity or inactivity can be measured accurately, their consequences with respect to poor welfare are still unknown (Fraser and Broom 1997, pp. 345, 348).

Another important problem occurring in commercialized swine production is a high level of abnormal aggression in animals. As mentioned earlier, normal aggression is performed by dominant animals to establish a social order in the herd. Anomalous aggressive behaviour is caused by unfamiliarity of animals and high stocking densities (Keeling and Jensen 2002, pp. 83-84). "[A]n aggressive interaction may persist if a submissive individual is not able to signal its submission effectively because there is insufficient space for it to remove itself from the aggressor" (van Putten 1978, p. 172; Keeling and Jensen 2002, pp. 83-84). Thus, abnormal aggressive acts in pigs can be reduced, when a mixing of groups is avoided and the group structure remains intact. Low group densities that permit submissive behaviour of animals may also be very effective.

3.2.8.4 How is animal welfare related to the behavioural response of animals?

During the last few decades a huge number of behavioural experiments have been conducted. As a result, enormous progress has been made not only in the understanding of farm animals, their motivational state, preferences, and behavioural disturbances but also in the development of animal-friendly livestock housing systems. Animal behaviour is regarded as a key factor in the assessment of animal welfare. However, despite all the successful work the association between the well-being of animals and behavioural indicators has remained vague (Keeling and Jensen 2002, p. 89). What inference can be drawn from the behaviour an animal displays for its welfare?

Observations carried out under natural conditions have provided valuable information about the animal's normal behavioural repertoire. The behaviour exhibited in nature forms the basis for comparisons with behaviour displayed in artificial environments. A farm animal's performance of a large variety of behavioural patterns that is almost identical to those of their wild ancestors is commonly regarded as positively correlated with its welfare. In modern livestock production the exhibition of natural behaviour is clearly limited due to monotone environments, social organization etc. (Nicol 1994, p. 71; Mench and Mason 1997, p. 129; Petherick and Rushen 1997, p. 89). In addition, it is widely accepted that animals suffer when the displaying of their full behavioural repertoire is depressed as they suffer when their physical needs (e.g. food) are not met (Petherick and Rushen 1997, p. 90).

Curtis and Stricklin (1991, p. 5004) alleged that it might be expected, "because animals in richer natural or artificial environments behave differently from those in more barren surroundings, that they also experience an enhanced sense of well-being in the richer places". However, this is still an assumption that is not scientifically verified. Crucial for an animal's well-being are not only rich housing conditions, but the animal's perception of its environment, i.e., cognitive processes. From studies in abnormal behaviour inferences have been made about the inadequacy of housing conditions dependent on the level of incidence of abnormalities. Though, it is incorrect to assume that good welfare is merely the absence of behavioural disturbances (Keeling and Jensen 2002, p. 89).

Mench and Mason (1997, p. 136) maintained that it is important to recognize the motivational basis of abnormal behaviour. In this regard, Petherick and Rushen (1997, p. 89) identified circumstances that jeopardize welfare. According to Petherick and Rushen the well-being of animals is more likely to be affected, when behavioural patterns that are largely internally motivated are depressed, when "motivation remains high if the behaviour cannot be performed and when it is the performance of the behaviour itself which reduces motivation".

Fraser and Broom (1997, p. 358) maintained that swine exhibit an elaborate behaviour, which is controlled by complex brain mechanisms.

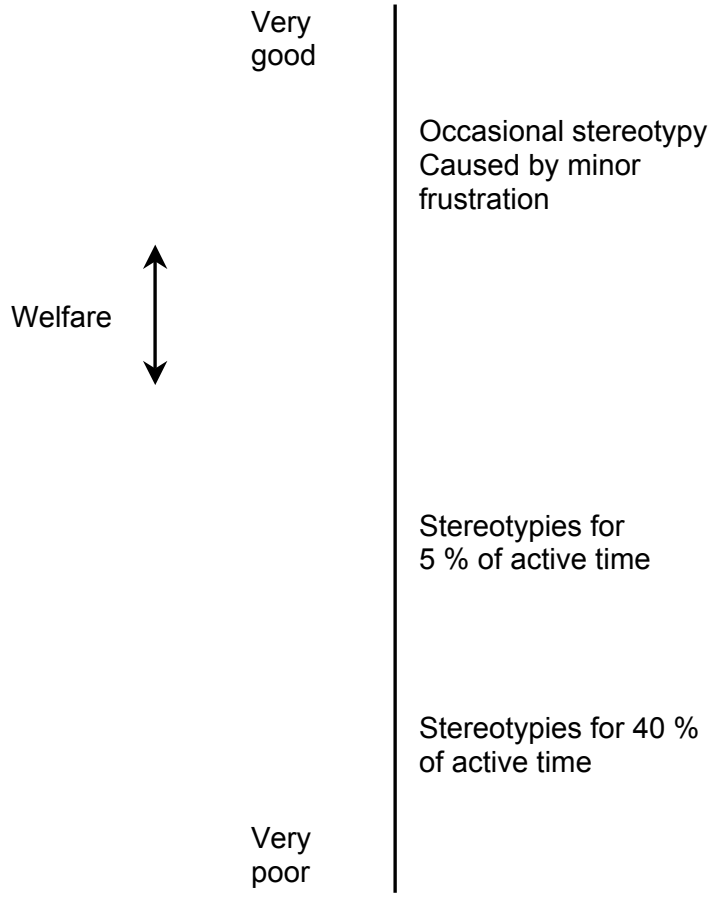
> […] welfare problems arise for pigs if they are unable to control events in their environment, if they are frustrated or if they are subjected to unpredictable situations. For example, inability to prevent attack by another pig, to regulate body temperature, or to groom adequately can all lead to poor welfare. Such effects are additional to those which are a result of injury, disease or other pain and physical discomfort.

Mench and Mason (1997, pp. 138-139) explained the connection between abnormal behaviour and poor welfare. The assumption that abnormal behaviour and especially stereotypy indicates poor welfare is based on three findings: (1) Abnormal behaviour is frequently performed in situations that are judged to be poor; (2) it is often a result of frustrated motivation and (3) is sometimes correlated with other parameters of poor welfare. In this line it may be postulated that the welfare of animals that show low levels of stereotypy is better than of those with high and that environmental conditions that induce high levels of stereotypy are worse than those that generate few or no behavioural disorders.

Broom and Johnson (1993, pp. 77-79) maintained that the frequency of stereotypies or other abnormal behavioural patterns reveals that an animal has difficulty to cope with its environment and that the welfare of an individual, which displays abnormal behaviour is poorer than the welfare of an animal that does not. Broom and Johnson held that abnormal behaviour that was developed by the animals in the past as a result of aversive environments will disappear, if present conditions are adequate. This is contradictory to Mason (1991) cited by Broom and Johnson (1993, p. 77) who stated that if a stereotypy once was developed it may appear in various circumstances and may rather be a consequence of past than of present experience. Though, for Mason the animal's welfare is not necessarily being poor in the present situation.

Broom and Johnson offered a diagram that illustrates the significance of the frequency of stereotypies in relation to animal welfare (Figure 3.9). Stereotypies are analyzed among other possible measures for the assessment of animal welfare including glucocorticoid production or pathologies. No explanation was given for the selection of the turning points in the figure, which represent levels of stereotypies for 5% and 40% of active time.

Figure 3.11 The occurrence of distinct levels of stereotypies related to animal welfare



Modified from Broom and Johnson (1993, p. 79)

Mench and Mason (1997, pp. 139-140) identified some problems that arise, when welfare is assessed by abnormal behaviour. They claimed that the levels of abnormal behaviour may vary widely in individuals because of the range of influencing internal (physical fitness, hormone levels etc.) and external factors (environmental stressors). Cooper and Nicol (1994) cited by Mench and Mason (1997, p. 139) argued that those animals are more likely to display stereotypies whose pen mates exhibit them. Cronin *et al*. (1985, p. 530) cited by Mench and Mason (1997, p. 140) pointed out that the performance of stereotypies is closely related to the release of endorphins, which have a calming effect. Therefore, performing stereotypies may be effective in the animal's attempt to cope with aversive environments and for survival. However, the fact that stereotypies are a strategy to survive does not mean that the animal is well-off.

Keeling and Jensen (2002, p. 82) share Mench and Mason's view that establishing a relation between abnormal behaviour and animal welfare is problematic, but emphasized that the incidence of stereotypies indicates that the housing conditions do not allow animals to perform their normal behaviour. Moreover, changes in the animal's behaviour are assumed to

be the first responses to unfavourable environmental conditions (Keeling and Jensen 2002, p. 92), long before physiological adjustments take place.

The previous brief overview revealed that the study of animal behaviour is, at least to some extent, appropriate to approach the welfare of farm animals and its subjective state. Behavioural patterns may be regarded as perceivable signs of welfare, which are characteristic to an individual and/or a species. The vast variety of interacting factors that were found to induce abnormal behaviour in animals underlines the complexity of animal welfare. As far as the assessment of animal welfare is concerned, there is no consensus that the sole consideration of animal behaviour is a sufficient measure to result in meaningful statements. Therefore, Fraser and Broom (1997, p. 358) stated that ideally a range of different measures is combined.

The concept of animal welfare provided by the British farm animal welfare council implies that livestock has an inner motivation to display normal/natural behaviour and that this motivation is crucial for their welfare. Numerous ethological experiments have contributed to the understanding of animal behaviour. However, important questions are still open: Is behaviour an expression of sensations that are visible, that can be *read* in the behaviour as in a book and can behaviour therefore be an indicator of subjective experience? How does an animal's *telos* or what it is determined to do by its nature correspond with its behaviour? Is it necessary for the animal to fully realize its *telos* or its natural behavioural repertoire to be in a state of well-being? What factors do interfere in the complex phenomenon of animal welfare and how do they interfere?

3.2.8.5 Behavioural adaptation of pure bred exotic pigs in tropical environments and implications for their welfare

Rearing of exotic breeds in modern animal production units in Thailand raises questions about the adaptation of animals to environments in which they do not have evolved. According to Hafez (1968, p. 3) adaptation "refers to the morphological, anatomical, physiological, biochemical and behavioural characteristics of the animal which promote welfare and favour survival in a specific environment". Adaptation in animals involves genetic and physiological alterations that occur in response to internal and external stimuli. Genetic adaptation is based on "the heritable animal characteristics which favour survival of a population in a particular environment. This may involve evolutionary changes over many generations (selection by nature) or acquiring specific genetic properties (selection by man)". Physiological adaptation "is the capacity and process of adjustment of the animal to itself, to other living material and to its external physical environment".

Broom (2005, p. 4) confirmed that adaptive changes in animals occur in individuals and on the evolutionary level. He added alterations in cells and organs, which is not extended in this study. Adaptive behaviours and bodily adjustments generally increase the fitness of organisms. Broom emphasized that in higher animals feedforward control is applied, i.e., individuals foresee difficulties arising from their surroundings and react to environmental changes before the effects are substantial. The nervous system elicits adaptive regulations that are related to a set of needs that are vital for animals. These needs include resources, such as food, but also activities that are exercised to get these resources, such as rooting.

Imported temperate zone animals are not adapted to the local, tropical climate. In the course of their life the individuals can acquire at least some, though little adaptation. In some instances the imported parent generation becomes integrated in a local breeding system. Adaptation to the local environmental conditions takes place in the individuals of the filial stock and on the long-term in future generations. However, experiments give evidence that the gradual adaptation of a genotype to hot climates results in a reduced level of production (e.g.

growth rate). This issue is discussed in more detail by Mathur and Horst (1994, pp. 1777-1784) and Deeb and Cahaner (2001, pp. 541-548 and 695-702) in their contributions to genotype-by-environment interaction in chicken.

There is a general consensus that the adaptation of exotic breeds to tropical environments has failed in the large majority of instances owing to severe thermoregulatory problems, inadequate feed supply and the prevalence of contagious organisms (e.g. Pagot 1992, pp. 334-336; Tyler 1999, p. 33). In this regard, Tyler (1999, p. 33) claimed that

> [t]he history of livestock development includes numerous examples of failure due to the oversimplistic solution of introducing stock that were productive in one environment into a new and quite different environment to which they are poorly adapted. The adverse effects of climate, nutrition, management and disease in the new environment then exacted a terrible toll. It should now be clear that the introduction of exotic animals into tropical countries can only lead to useful sustainable increases in production levels if this measure is accompanied by profound changes in attitude to the importance of genotype and correct management.

Pagot (1992, p. 336) maintained that the conditions in large-scale pig and poultry operations substantially differ from traditional animal husbandry in the tropics, since intensive livestock units are standardized and largely independent of the natural environment. Pagot alleged that under these circumstances imported breeds can withstand the severity of tropical climate and their use is conceivable. He drew attention to the point that the Large White pig "is widely distributed in the tropics with excellent technical results". In contrast, Wanapat (1995, pp. 192-193) reported that in the Thai pig industry productive output remained low as a result of thermal stress, poor feeding regimes and infestation of parasites, while investments for pure bred exotic breeds are high.

If the animal's productive status is massively impaired, there can virtually be no prospect that the welfare of exotic animals in tropical environments is at a satisfactory level. Nevertheless, it may be valuable to describe the underlying mechanisms of behavioural adaptation to heat stress in exotic pigs under common loose house conditions and the implications for their welfare. Macfarlane (1968, p. 164) pointed out that "[d]omestic animals exposed to [tropical] environments react adversely to the impact of uniformly warm temperatures and of nearly saturated air which does not readily accept further water secreted to cool the animal". Thus, a temperate zone animal's thermal situation aggravates dramatically, when introduced in hot climates. Being a poor sweater, the swine particularly depends on behavioural thermoregulation, such as wallowing, to adapt to high ambient temperatures (see von Zerboni and Grauvogl 1984, p. 271). However, in modern Thai swine production systems performing thermoregulatory behaviour is thwarted, because of lack of substrate. The animals can relieve hyperthermia only by lying and turning themselves on wet, soiled floors.

Price (1997) cited by Jensen (2002b, p. 31) claimed that during domestication genetic alterations between wild ancestors and domestic pigs were established, which had an impact on the adaptive traits of farm animals. Krebs and Davies (1991) cited by Jensen (2002b, p. 31) identified *flexible behavioural programs* or strategies in animals that have evolved in the course of evolution. These *behavioural programs* should provide the animal with the greatest amount of fitness in terms of reproductive success (Jensen 2002b, p. 31). Many comparative investigations in domestic animals and their wild counterparts provide credible evidence that behaviour is very little affected by genetic changes. Significant new behavioural patterns have neither appeared nor have behavioural patterns totally disappeared from the gene pool. Innate natural behaviour and related motivational systems were inherited over the generations (Jensen 2002b, p. 31).

Under natural conditions European domestic pigs were found to engage in wallowing at ambient temperatures of approximately 20ºC (see Stolba 1984, p. 107 and Jensen 2002a, p. 162). It is therefore evident that the internal motivation to exhibit wallowing behaviour is prevalent in the present-day domestic pig and therefore remained unaffected in the process

of domestication. Thus, it can be concluded that adequate wallowing sites are necessary to provide external stimuli that enable the animal to fulfil its behavioural needs, which has positive effects on its welfare. This is particularly true for animal housing systems in tropical settings in Thailand, where average annual ambient temperatures of 27ºC (Rivas-Martinez 2005) elicit behavioural thermoregulation at many days of the year.

Although wallowing in domestic pigs was found to be a vital component of their behavioural repertoire and not merely a relic performed in wild boars, it is worth to be noted that not all behavioural patterns remained entirely unchanged during domestication. Schütz and Jensen (1999) cited by Jensen (2002b, p. 33), for example, observed that in terms of feeding given the opportunity White Leghorn laying hens selected freely available food, while the wild jungle fowl preferred food that was mixed with sawdust and required selective picking.

In the light of the rather limited opportunity for behavioural thermoregulation in industrialized animal production systems and the pig's poorly effective physiological heat-dissipation, it is very likely that adaptation to heat is unsuccessful in pure bred exotic breeds in tropical environments. According to Broom (2005, p. 4) failure of adaptation causes harm in individuals, disturbed reproduction or even death. He maintained that "[w]elfare varies over a range from very good, when adaptation is effective and there are feelings of pleasure or contentment, to very poor".

A key point concerning the concept of individual adaptation in relation to welfare is that welfare may be good or poor while adaptation is occurring. Some adaptation is very easy and energetically cheap and as it occurs, welfare can be good. Other adaptation is difficult and may involve lower or higher level emergency physiological response or abnormal behaviour, often with bad feelings such as pain or fear. In that case, welfare is poor or very poor even if complete adaptation eventually occurs and there is no long term threat to the life of the individual. In some circumstances, adaptation may be unsuccessful, the individual is not able to cope, stress occurs and welfare is then ultimately very poor.

3.2.9 Fear in relation to animal welfare in industrial poultry production in Thailand

In commercialized production systems the advances made in genetics, nutrition and housing have led to considerably increased growth and productivity. However, the normal functioning process of the body has suffered. Broiler chickens, for example, show high growth rates, low mortalities and infectious diseases can be effectively controlled, but a great number of so-called metabolic diseases as locomotor disorders, degeneration of the liver and kidney and heart attacks as result of excess fatty deposition have appeared (Sainsbury 1998, pp. 1-2).

3.2.9.1 What constitutes fear?

According to Jones (1997, p. 77) fear is an emotional response to a perceived threat, which guides human and animal behaviour in relation to their physical and social environment. "Ideally fear is an adaptive state with fear behaviour serving to protect the animal from injury" (Jones, 1987a, 1996 cited by Jones 1997, p. 77). Jones (1987a, p. 40) further maintained that "[f]ear is a complex concept which is usually listed among the emotions, (e.g. love, hate, anger, shame, gilt, joy, etc.). However, apart from various descriptions of the effects of fear there is no generally accepted definition of it".

Gray (1971) cited by Jones (1987a, p. 41) conceptualized fear as "'a hypothetical state of the brain, or neuro-endocrine system, arising under certain conditions and eventuating in certain forms of behaviour'". In accordance, Salzen (1979) cited by Jones (1987a, p. 41) alleged that

the term fear integrates two different concepts, namely *fear behaviour* and *fear state*. Independent of being accompanied by a fear state, fear behaviour serves as a protective measure the animal from acute or potential physical damage. Jones (1987a, p. 41) concluded that

> [f]ear behaviour may be best regarded as consisting of a large repertoire of responses which can be altered and integrated with each other to provide the most appropriate strategy for coping with a particular danger, with the underlying fear state as a controlling factor. Fear can thus be defined in concise, though general, terms as an adaptive psychophysiological response to perceived danger.

According to Webster (1994, p. 112) "[f]ear is a conscious, rational and emotional response to a perceived threat that acts as a powerful motivator to action designed, where possible, to evade that threat". Webster (p. 113) described origins of fear in human beings including

1. novelty (strange objects, sudden movements)
2. innate fears (fear of the dark, isolation)
3. fears learned by experience (anticipated pain, ridicule)
4. signs of fear in others
5. fear of the future (death)

and compared responses of fear in humans with those of animals in similar situations. Jones (1997, p. 76) maintained that fear in animals may arise by mixing of social groups, transport to the slaughterhouse and pre-slaughter handling of birds. The appearance of fear depends on the bird's genetic disposition, housing and management systems and the quality of stockmanship.

Jones (1996) cited by Jones (1997, p. 77) differentiated 5 stages of fear:

> (i) The first stage necessarily involves exposure to frightening stimulation; (ii) This may activate the brain and neuroendocrine system and thereby generate a flexible, internal fear state; (iii) The animal may then show one or more of a number of fear responses, such as cautious investigation, fight, flight or immobility. These may be altered and integrated according to changes in the perceived potency of the threatening stimulus and in the consequent intensity of the internal fear state; (iv) The level of underlying fearfulness (inherent and/or acquired propensity to be easily frightened) is crucial because fearful animals are more likely to show exaggerated fear responses than are their less fearful counterparts, regardless of the nature of the threatening stimulus.

3.2.9.2 Impact of fear on animal welfare

Jones (1997, p. 75) stated that both acute and chronic fear can significantly impair the welfare and performance of animals. Fear may be adaptive, but if it is unpredictable, unavoidable or prolonged it may severely impair the psychological and physiological well-being as well as the productive performance of livestock (Jones and Waddington 1992, p. 1021 cited by Jones 1997, p. 75). Fearful chicken have difficulty to cope with environmental challenges, are difficult to manage. They show low egg production, weight gains and food conversion efficiency. Improper fear responses in the birds may cause injury, pain or even death (Jones 1997, pp. 75-76). Alike, intense fear can seriously harm the animal's health and welfare. For example broiler chickens in panic walk on and inflict damages on each other from bruising to broken legs. Moreover, fear can inhibit feeding, sexual and exploratory behaviours (Jones 1997, pp. 80-81).

Although large-scale, intensive production systems provide shelter from weather extremes, predation and contagious organisms, these stimuli-poor environments are detrimental for animals, since they may lead to physical debilitation, depression (Kendrick, 1992 cited by Jones 1997, p. 76) and overreaction in relation to certain stimuli. Thus, a moderate level of fear is desirable (Zulkifli and Siegel, 1995 cited by Jones 1997, p. 76). Fearfulness in birds

can be counteracted by regular calm handling and environmental enrichment. Fear of humans can be reduced by picking the birds up and/or stroking it. However, this method may not be practicable in large-scale commercial systems. In such systems daily visual contact with people will be helpful (Jones 1997, pp. 83-85).

3.2.9.3 Assessment of fear by behavioural responses

“Neither the fear state nor fearfulness can be measured directly in any species, including man” (Jones 1997, p. 78). There are two types of behavioural indicators of fear: Animals may show avoidance behaviour, which may range from moving slowly to stampeding away from the frightening stimulus or immobility (Archer 1979 cited by Duncan 2004, pp. 166-167). Methods to measure fear in chicken are open-field, emergence, approach/avoidance and tonic immobility tests (see Jones 1987b, 1996 cited by Jones 1997, p. 78). Additionally, physiological indicators, such as increased heart rate and elevated blood concentrations of catecholamines and corticosterone, are measured in relation to the observation of behaviour in order to assess fear in farm animals (Jones 1997, pp. 78-79).

3.2.10 Essential aspects to be developed in the scientific study of animal welfare

Guided by the *five freedoms* the previous analysis illuminated a variety of aspects, which all together contribute to the state of well-being in farm animals world-wide. The complex phenomenon of animal welfare was divided into individual components including hunger, thirst, pain, thermoregulation, disease, expression of behaviour and fear in order to make it more accessible to scientific study. Although the investigation of these aspects has produced valuable experimental results and meaningful statements, it is necessary to keep in mind that the well-being of animals does not embody partial inferences but a large spectrum of interacting factors. For example, being in a state of welfare requires not only the provision of sufficient and balanced food or the absence of pain, but also the chance to express their natural behaviour. Other preconditions not taken into account in the *five freedoms* may also be essential to maintain the well-being of animals.

Tropical animals are kept under ecological conditions that sharply differ from those of animals in temperate environments and therefore welfare-relevant problems arising in these environments differ too. In unfavourable tropical climates farm animals have developed coping strategies, such as enhanced heat or thirst tolerance. The level of capital input in the production system has also an influence on which set of problems is most relevant. In the tropics emphasis may primarily be on strains derived from resource-poor environments. Though, amazingly the problem of hunger still persists in highly intensified production systems in industrial countries. While tropical farm animals suffer from hunger and infectious diseases as a result of shortage of feed, shelter and medical treatment, in highly commercialized production systems dairy cows suffer from probably not less intensive metabolic hunger and metabolic diseases. Despite the differences the effective physiological control mechanisms of animals that counteract threats to their welfare are more or less identical in farm animals in the tropics and the temperate zone.

3.2.10.1 The importance of physiological and psychological features in the assessment of animal welfare

All welfare constituting factors examined share that they involve both physical and mental features. The onset of the unpleasant sensations of hunger and thirst in which many internal and external stimuli are evoked can be identified physiologically, when a hunger or thirst signal is sent to the brain *via* the neural system. Negative emotions may arise almost simultaneously with the cortical processing of the signal. Gratification or satiety depends on negative feedback control and is accompanied by a positive emotional experience. Thus, suffering from undernutrition and dehydration is not only tied to life-sustaining, biochemical processes but also to animal psychology. Alike welfare, these factors are not entirely amenable to scientific measurement.

Further, in the previous analysis the physiological principle of homeostasis was associated with the well-being of animals. Constancy of the internal bodily environment within a narrow range is maintained independent of external conditions (McFarland 1993, p. 289; Toates 1980, p. 7), for example, in terms of body temperature or water balance. It is postulated that a deviation from equilibrium results in a reduction of welfare and a negative affective state. In the case of thermoregulation, it was ascertained that biochemical processes in animals are only effective within a limited range of body temperature (see Toates 1980, p. 135) and when the animal's metabolic capacity is exceeded hypothermia or hyperthermia and ultimately death occur (see Mount 1979, p. 6).

The concept of effective environmental temperature by Curtis (1983, p. 89) permits to distinguish stages of thermal discomfort that can be related to states of welfare. According to this scheme welfare is good within the zone of thermal-comfort. If control mechanisms are evoked to maintain body core temperature, the animal is supposed to be in a negative mental state and a poor state of welfare. In this regard, Webster (1994, p. 68) claimed that feeling poor and suffering occur even before shivering begins. Ambient temperatures beyond the lower or upper critical temperature require active thermoregulation, such as shivering or sweating, and result in very poor welfare.

Pain involves a sensation arising from acute tissue damage and mental distress. Painful events have an immediate effect on the animal's state and directly reduce its welfare (see Duncan 2004, p. 164). However, the relationship between pain and well-being is not always simple and cannot be fully explained. For example, painless tumours at an early stage may not affect the well-being of an individual, although the animal is in a very bad state of health. The subjective concepts of pain and welfare are not amenable to objective study (see e.g. Sneddon and Gentle 2002, pp. 9-10).

The assumption that animals suffer, when they are deprived from expressing their full behavioural repertoire (see Petherick and Rushen 1997, p. 90) or when they show stereotypies lacks ultimate scientific proof. Curtis and Stricklin (1991, p. 5004) argued that the animal's perception of its environment including cognitive processes are crucial for being in a state of well-being. When imported exotic breeds kept in modern housing facilities in the tropics they are not only required to adapt to poor housing conditions behaviourally but also to massive climatic change. Behavioural and physiological strategies to counteract thermal stress that have evolved phylogenetically in a temperate environment were found to be inadequate under tropical climatic conditions. Unsuccessful adaptation is very likely to result in very poor welfare.

A major problem in the assessment of animal welfare is that subjectivity is not amenable to scientific study. In this regard, the observation of behaviour has been claimed to be a perceivable sign that allows receiving insight into psychological states of farm animals, which are not open to direct investigation (see Nicol 1994, p. 69). While, for example, acute pain induces behavioural reactions that involve withdrawal from a noxious stimulus by reflex (see

Webster 1994, p. 93), chronic pain causes behavioural signs, such as decrease of food intake or difficulty to turn up (see Bateson 1991, p. 828). Both acute and chronic pain induces autonomic responses including increase of heart rate, release of corticosteroids, sweating etc. Similarly, disease is assessed by visual inspection that aims at behavioural change and by interpretation of physiological indicators.

However, there is no consensus that the sole analysis of animal behaviour or of neuroendocrine responses is appropriate to obtain true inferences about animal welfare. At least in the near future the assessment of animal well-being will depend on a combination of different measures including behavioural, physiological and pathological indicators. Measuring of brain states in humans gained encouraging results in terms of a quantitative assessment of feelings, like pain or fear. The recording of cortical activities by novel technique can be expected to result in a better understanding of mental processes in humans and animals. In addition, employing human empathy and interpretation of subjective states in animals may be an interesting way to progress in the assessment of animal welfare.

3.2.10.2 A continuum at a scale? - Attempts to grade animal welfare

Measures that are amenable to statistical analysis are crucial for scientific scrutiny of animal welfare. Quantitative statements are also required in terms of the degree of welfare or where to draw the line between good and poor welfare. According to Broom (1999, p. 130) welfare refers to the state of the individual on a scale from very good to very poor. In this regard, again individual states, such as hunger, pain, fear etc. are considered. McGlone (1993, pp. 28-29) argued that “feeling poorly is much like feeling hungry (something we all *normally* experience from time to time), this cannot be the critical measure of well-being”. According to McGlone an animal’s welfare is only reduced, when it shows reproductive disorders and pathological states, which result in poor fitness. Prolonged health problems lead to an early death.

Although McGlone’s approach has the merit of being practicable, it is criticized, because in his conception apparently the criterion what is measurable makes up what welfare is. However, to provide a proper explanation of an individual’s well-being, the underlying analysis should take place in an open field in which all results are equally likely. A restriction of the range of possible results from the outset cannot lead to true, but leads to false hypotheses. It is further doubtful whether a concept of animal welfare that holds that well-being is poor only, if the animal shows marked health problems or even wrestle with death, can be useful in view of the improvement of animal welfare, because in such a condition countermeasures are little effective. In order to counteract negative environmental effects on animal health and welfare, it is desirable to detect little disturbances of well-being at an early stage.

Thus, in this study a different approach is followed: Hunger, thirst or pain is present, when corresponding signals are sent to the brain. Accordingly, a discrete begin of such unpleasant sensations can be identified in the CNS and be measured, for example, by functional MRI. In this context, two fundamental questions arise: 1. Is an animal’s welfare poor, if an animal feels, for example, hunger? 2. What is the degree of the unpleasant feeling? To be in a state of welfare requires *per definitionem* freedom from hunger as well as freedom from discomfort, disease, fear etc. Therefore, if, for example, hunger is signalled *via* neural transmission, an animal’s welfare is impaired. Being subjected to distinct cases of mild hunger or short-term pain (by injections) will not result in physiological disorders, although suffering may occur.

Little is known about long-term implications of mild stressors on the well-being and health of animals. High frequency and/or long duration of unpleasant feelings is expected to reduce an animal’s state of welfare. For example, long-term discomfort in the resting area may give rise

to abnormal behaviour and therefore has cumulative negative effect on an animal's welfare. Thus, when the total of discrete threats to welfare during lifetime cannot be balanced by positive effects on welfare, the animal's situation will gradually deteriorate. Overtaxing of physiological control mechanisms or catabolic processes in the animal organism as a consequence of shortage of feed and water as well as prevalence of disease must be expected to have massive detrimental effects on the balance. Additional detrimental effects arise from the conscious experience of negative sensations. Continued stress leads to a decrease in performance (e.g. daily milk yield) and/or a premature death. In this context, it is noteworthy that high performance in animals does not always correspond with animal welfare.

Particularly acute deprivation of water rapidly leads to complete failure of the body function. When watering intervals of three days must be followed owing to scarcity of water in arid environments, suffering from thirst and reduction of welfare is inevitable. Livestock closely approach the lethal state and weak animals may not survive. Apart from short-term goals, there are also internal, genetically determined control mechanisms that meet long-term requirements for food and water during growth or pregnancy and lactation. Webster (1994, pp. 42, 44) maintained that "the thinner the (healthy) animal is at the time of an acute nutrient demand, the greater will be it's appetite and the more likely it will be to suffer if this appetite is not satisfied".

There is reason to suggest that also short-term impairment of welfare has consequences for the future life of animals. Many cases of welfare depressing events, such as acute or chronic pain or disease in a given period may contribute to a poor health and welfare status in the future. Physiological changes in blood hormones, immune or reproductive function are accompanied by detrimental psychological effects. Harmful effects on health and sustenance of life time may only occur, if physiological control mechanisms are overstretched and organs are damaged. Intense or prolonged stimulation of stressors is an important factor contributing to ill health and may in some instances be fatal.

It is strongly supposed that every poor physiological and/or psychological state results in poor welfare independent of its duration. Sometimes it is inevitable to impose minor suffering on animals (e.g. pain-causing injections) to prevent more intense suffering in the future born by disease. Nevertheless, every poor state might have an effect and emerges in a fictitious lifetime balance of poor and good states in an individual. Thus, human endeavour arising from respect for animals should support positive events in an animal's life. To fully understand animal welfare, an overall consideration requires a more complex inspection and investigative instruments than permitted by those currently available. Therefore, it is supposed that it should also be looked out for new methodological approaches to assess complex phenomena, such as animal welfare.

3.3 Constituting elements of the moral status of farm animals in different cultures

The recent study of animal welfare has attained knowledge of the complexity of the matter and the dualism of the term. It is widely accepted that the assessment of animal welfare implies ethical as well as scientific issues. While animal ethics emphasizes moral standards regarding the human treatment of farm animals, animal welfare science aims at the explanation of the animals' subjective experiences including factual information about physiological, behavioural and production measures. Ethical concepts are commonly interwoven with the history of a society, their religious traditions and legal standards. Open questions especially concern the animals' moral status or how animals ought to be treated.

More sophisticated research approaches in this context are: does the treatment of farm animals raise ethical questions at all? If animals do not fall within the scope of moral concern then human beings can treat animals in any way (DeGrazia 1996, p. 1). Furthermore, do humans have a duty to treat animals humanely and not to be cruel to them (see Davis and Cheeke 1998, p. 2075)? Should animals not to be subjected to unnecessary pain, although they are regarded as less valuable than humans (see Tannenbaum 1995, pp. 23-24)? Should management systems "be designed to allow the animals to exhibit their species-specific needs and (or) behaviours"? Finally, do animals possess rights that forbid humans to kill animals for food (see Davis and Cheeke 1998, p. 2075)?

3.3.1 Animal ethics in a non-European context

Although the well-being of farm animals is a decisive factor in view of their performance and is therefore particularly interesting for low input livestock production systems in agrarian countries, scientific study of animal welfare is mainly restricted to industrialized countries. Due to increasing activities to incorporate animal welfare concerns in international trade agreements, animal ethics and consumer preferences of potential livestock produce importing Western countries receive growing importance for export-orientated, developing nations, too. However, the adoption of foreign moral norms may pose problems. In order to respond to this challenge, information is required about the moral status of farm animals in different philosophical and religious traditions.

Therefore, the objective of this section is to illustrate and compare ethical conceptions with reference to the treatment of livestock from a multicultural perspective. Central will be the constituting elements of the moral status of animals. First of all, some background will be provided about terminology, the cultural impact on ethics and methodology. Then, in four exemplary cases, including the Fulbe pastoral system, the llama and alpaca system in the Andes, the smallholder crop-livestock production system in India and the commercial pig and poultry production systems in Thailand, constituents of the local ethics and animal protection legislation will be presented. Finally, in a comparative overview issues of ethical concern for animals, moral obligations to animals and the killing of livestock for food will be discussed. The implementation of norms will be elaborated in the context of world-views and ethical relativism.

3.3.1.1 What does the moral status refer to?

Ethical debates concerning the treatment of animals often refer to the equality of the moral status between humans and animals. DeGrazia (1991, pp. 74-75) defined the moral status as "the degree (relative to other beings) of moral resistance to having one's interests - especially one's most important interests – thwarted". Equal moral status means that two beings (A and B) have equal moral status in the sense that they deserve equal treatment. This can be made clear by an example: If it is morally imperative that either A's or B's interests are thwarted (e.g. impairment of freedom), it is assumed that A's interests are thwarted. In this case the moral status of B is greater than of A, since the moral resistance of the interests of B (against being thwarted), is greater than the resistance of the interests of A. Consequently, A has lower moral status.

However, ethical decisions about animals depend not only on the moral status, but also on the moral weight identical interests have. Exploitation of animals in animal experiments, for example, would be morally justified, if animal interests have little weight in comparison to the equal interests of humans. On the other hand, exploitation of animals would be morally un-

justified, if animal and human interests count equal (principle of equal consideration). If, conversely, the interest one being has in X are not judged equal as the interest another being has in X, there must be a morally relevant difference between both beings, because "[i]f A judges that the interests of being B have weight W, A must judge that the interests of beings relevantly similar to B have W" (DeGrazia 1991, pp. 74, 76).

In this regard, DeGrazia (pp. 75-76) came to the conclusion that although humans and animals differ in moral status, the principle of equal consideration is true: When equal weight is given to identical interests, experimentation in a being is generally more detrimental to humans than to animals. In accordance, it would be somewhat more justifiable to thwart the interests of animals compared with those of humans.

3.3.1.2 The relation between ethics – religion and ethics – law

The ethical values of many cultures have historically evolved from religious traditions, which have often been the primary sources of human virtue (Comstock 2000, p. 100). Similarly, views about animals are founded upon religious beliefs. Tannenbaum (1995, p. 21) expounded how the treatment of animals is influenced by religion:

> [R]eligious differences and different interpretations of religious teachings often produce differences in views about how people should treat animals. Someone who believes that God made animals to serve people may have no problem killing a pet no longer of interest to its owner. Someone who does not share this religious belief or who believes that God gave animals a right to live, may reach a very different conclusion. Most vegetarians do not object to the sterilization of animals to prevent breeding, but to Orthodox Jews […] this practice violates religious law. Hindus who believe eating meat to be a heinous sin will find much of food animal veterinary practice morally abhorrent.

From a philosophical point of view what is right or wrong does not necessarily correspond with what a particular religion teaches or the commandments of God (Comstock 2000, p. 100) and many philosophers take the well-founded position that ethical issues can be addressed without referring to religious beliefs. However, sometimes religious elements appear to be very conspicuous in ethical views. For example, the beliefs that "animals were made by God to serve human needs and desires" or that "animals, unlike human beings, do not have immortal souls" are not to assess in a purely philosophical way (Tannenbaum 1995, p. 22).

For rural people in non-industrialized countries, for whom livestock keeping is the main occupation, religion is a major component of social life. Hence, any attempt to discover the moral status of animals in those cultures must necessarily be directed to the predominant religion. Establishing international animal welfare regulations requires standards which people from diverse religious backgrounds can agree upon. In this context, it is important to note that, on the one hand, people's disagreement with moral notions may sometimes be grounded on fundamental differences in religious belief and, on the other hand, people's divergent ethical views may be based on the same moral principles, which derive from different religious sources, as pointed out by Tannenbaum (1995, pp. 22-23).

Not only religious ethics but also laws may be concerned with how animals ought to be treated. Rollin (1981, p. 68) discussed the relation between morality and law posing the questions: Are law and morality

> *logically inseparable*, such that one cannot understand one without necessarily referring to the other? […] Or, on the contrary, are the two in principle separable, so that one can fully explicate, analyze, and define the concept of law without bringing in moral concepts? Is the connection between the two simply one of *causal influence*, with laws affecting morality and morality affecting laws, but with no conceptual connection between the two?

The view that morality and law are logically inseparable is manifest in the *natural law theory*, which derived from the ancient Greeks. According to this theory moral concepts are part and parcel of law. The law embodies certain absolute and fixed principles of right and wrong that do change neither in time nor in location. Traditionally moral notions in the West have been based on Christian doctrine including the commands of God or the Bible. Natural law theory is intimately related to the idea of natural rights, which implies that human beings have by nature or by God certain rights that cannot legitimately disregarded by political law. This position is inherent in the United Nations 1948 Declaration of Human Rights (Rollin 1981, pp. 68-69).

In addition, Rollin (1981, p. 70) pointed out that the view of legal positivism, which was strongly advocated by the British utilitarian Jeremy Bentham, contradicts the notion of natural law. It is implicit to legal positivism that only those laws and rights exist, which have been adopted by judges and are set down in laws and regulations; natural laws or rights are rejected. The positivistic position is founded on empiricism and the exact determination of what positive law is, while moral law is a matter of endless philosophical discussion. As a consequence, moral rules are clearly discernible from legal rules by the way they were adopted.

On the other hand, Dworkin (1977) cited by Rollin (1981, p. 71) denied the possibility of a clear separation between the legal and the moral, because no way of adoption can give a criterion, which distinguishes the positive law from natural moral law. To find a solution in cases for which no explicit rules or statues exist, judges appeal to moral concepts and it is evident from legal cases that laws involve principles or moral notions. These principles constitute a component of the legal system, although they were never explicitly accepted by legislatures. In addition, Dworkin rejected the positivist view that only utilitarian moral reflections about the greatest benefit for the greatest number of beings are relevant to the law. Therefore, legislation is inextricably associated with and influenced by a set of moral principles, which are determining components of legal rights and duties in a similar manner as explicit laws (Rollin 1981, p. 72).

3.3.1.3 The cultural impact on ethics

Concern for animals has been a matter of human interest in many societies and has been employed in religious and philosophical traditions and even in laws. According to Smith (1962, p. 156) cited by Waldau (2002, pp. 11-12), the term *religious tradition* refers to objective historical data, such as „[...] temples, scriptures, theological systems, dance patterns, legal and other social institutions, conventions, moral codes, myths, and so on [...]“. The moral principles might be based on the commandments of God or on scriptures. In contrast, the philosophical tradition of a society is not related to a supernatural power but to this world and therefore in Western moral philosophy ethical decisions are founded on logical reasoning.

King (1999, pp. 198-199) illuminated the *mythos-logos* distinction in modern Western philosophy and he discussed the polarisation of *myth* and *history* as a characteristic element of the Western debate with respect to Indian cosmogony: Modern explanations of history increasingly differentiated between „'facts' (and science) and 'fiction' (and literature)“ since the seventeenth century - a feature that is not present in traditional Indian thought. King (1999, cover) emphasized that there can be no single definition of philosophy and that the history of the subject is tied to “an ethnocentric and colonial perspective so long as they ignore the possibility of philosophical thought 'East of the Suez'”. In this respect, King highlighted the necessity for an approach to philosophy that is post-colonial and global.

Similarly, Gbadegesin (1991, p. 14) raised the issue of the relevance of traditional African thought in the discussion of ethical concerns in a Western sense. There has a contrast been

detected between both *philosophies*. On the other hand, philosophers denied that folk thought is entirely distinct from scientific thought, rather that judgments of logicality are dependent on the prevailing theory, "and that African traditional thought is not as unscientific as is usually assumed". Sandra Harding cited by Gbadegesin argued:

> [T]he definition of logical and rational thinking is a cultural artefact itself that has changed even within the history of Western thought. Judgments of logicality and rationality are „theory-dependent": what counts as a logical statement depends upon other views a society holds about self, community, nature, and their relationships. The beliefs that appear logical to one who conceptualizes species a related to each other through evolutionary patterns will differ from those of one who conceptualizes species as all created by God in the first week of the universe.

If addressing the subject of animal ethics within a nation or culture, a wide variety of attitudes may be relevant. Therefore, in the following sections it will be focused on the *dominant view* within a certain society. Waldau (2002, p. 13) pointed out that „even though there are variations in the ways in which the dominant view dictates the adherents' conceptualization of other animals, the recurrence of the basic view is so pronounced that it qualifies as a fundamental feature of the tradition". Moreover, to approach the moral status of farm animals in different cultures one has to be aware of a culture-specific moment in this debate, because the initial situation of the reflection is the animal welfare debate of Western *couleur*.

When examining the traditions of different cultures attention must also be paid to the fact that the relevant materials were not designed in a systematically organized way to meet the requirements of the animal welfare debate. Nevertheless, in the traditions definite views of animals do exist, which have significant consequences for the interaction between humans and animals (Waldau 2002, pp. 14-15).

3.3.2 Approach to investigate the moral status of animals in different cultures

The investigation of ethical concerns about animals will primarily be based on a dialectical process.

3.3.2.1 Creating new knowledge

This study collects phenomena of the human treatment of animals and discourses about animal ethics with reference to various agro-ecological conditions, value systems and levels of economic/technological development world-wide; though, the availability of materials is often unsatisfactory. Literature about the human-animal relation in different cultures will be analyzed punctual and comparative and the synthesis of this analysis will be the basis of the argumentation. It is important to note that despite great endeavour for objectivity, it probably cannot entirely be avoided that the new insights gained will be influenced by the author's cultural background and perception of the human-animal relationship.

3.3.2.2 Exemplary focus

In this section the analysis of animal welfare concerns in tropical livestock production integrates following ethical and legal issues within the earlier selected examples:

1. Ethical reflection: *cattle values* and *Islamic values* in the Fulbe system

2. The llama and alpaca in the religious ethic in the central and southern Andes
3. Traditional Indian morality concerning the treatment of cattle and animal protection legislation
4. The human-animal relationship in Buddhist ethics in Thailand

3.3.3 Example 1: Ethical reflection: *cattle values* and *Islamic values* in the Fulbe system

The previous analysis of socio-cultural aspects of the Fulbe pastoral system identified the Fulbe as both predominately Muslim and an ethnic group with close relations to animals. Indeed van Raay (1974, pp. 5-6) cited by Mtetwa (1982, p. 19) stated that

> no topic among the Fulani dominates daily conversation as much as matters pertaining to cattle and their rearing. Cattle are loved for their beauty and peculiar traits as much as they are valued for more strictly utilitarian functions which, if they had been critically assessed in terms of the standard of living they permit, would no doubt have struck and frustrated the Fulani pastoralists.

In this context, it would be interesting to know which values or ethical principles underlie the affectionate dealing with pastoral ruminants. The treatment of animals in a culture is attributed to the prevailing value system or ethic, which is generally embedded in religion. In order to explore the animal ethic in the Fulbe pastoral society, a discussion of values derived from their pastoral heritage and values ascribed to religious faith is carried out.

3.3.3.1 Cattle values: the „cattle complex“

Investigations into value systems of pastoral societies often refer to the term *cattle complex*, which was introduced by Herskovits in 1926. In his study of pastoralism in Eastern Africa Herskovits (1926, pp. 652-653) cited by Schareika (1994, p. 10) claimed that cattle and their interests are the central element in these cultures. Mtetwa (1982, p. 18) maintained that for Herskovits' East African pastoralists share certain qualities that together generate a complex. Since cattle and their interests are a dominant feature of the cultural elements that constitute this complex, it was called the *cattle complex*. The *cattle complex* is characterized by an affectionate attachment to cattle, identification with them and in dislike of their slaughtering except in rituals. Raay (1974, p. 4) cited by Duda (1984, p. 118) alleged that the features that form the *cattle complex* are also present in the Fulbe pastoral society. Fulbe pastoralists are closely emotionally tied to cattle, which are a main source of their prestige and status and they have an aversion to killing animals.

In Nigeria, although there still exists a strong attachment of the Fulbe pastoralist to his cattle, this is becoming less pronounced as it used to be several years ago. This is because of some of the demographic and economic dynamics with which the Fulbe family is confronted. The pastoral activities of families are fast turning away from that of meeting cultural or aesthetic values and taking on the economic dimension. In other words, pastoral producers are incorporated into the modern market economy of the larger society. It can, therefore, be argued that the concept of the *cattle complex* is giving way to the demands of the market in addition to meeting subsistence needs of Fulbe families (Gefu 2005, personal communication).

3.3.3.2 Cattle values: „Pulaaku“

Duda (1984, pp. 119-121) assumed that in the pastoral Fulbe the importance of cattle as the basis of subsistence has led to the development of specific cultural traits or values that distinguish pastoral societies from groups engaged in crop production. The prevailing agro-ecological conditions and the mutual relationship between herdsperson and their animals have an impact on the type of human conduct and personal traits that have evolve under pastoral conditions. The animals need human beings for feed, water and care, when they are ill, while pastoralists depend on their animals for food, clothing, their prestige and purpose of existence (Baring 1974, pp. 61-62 cited by Duda 1984, p. 126).

Arnott (1962, pp. 22-23) highlighted that the Fulbe have an affection for their animals that is far beyond an interest in a valuable chattels. On the contrary, each individual animal is known by their markings. In Nigeria pastoralists are known to have names for each animal in the herd. The names are often derived from individual characteristics of the animal such as coat colour, size, behaviour (docility or aggressiveness), shape of horn and other attributes of the animal. This type of personal relationship of the Fulbe pastoralists distinguishes the Fulbe from other livestock keeping groups who do not have this tradition (Gefu 2005, personal communication).

Accordingly, Duda (1984, pp. 128-129, 131, 134-135) argued that the Fulbe not only acquire factual-instrumental competence, including herding, milking and preventing animals from harm but also ethical-aesthetic competence, which is passed on by direct utterances or myths. Such myths are, for example, concerned with the dependence of pastoral people on the thriving of their animals, while at the same time human beings receive a blessing that promises life and safety. In the Fulbe pastoral system values particularly derive from the emotional connectedness between herder and cattle. Existential dependence and affectionate attachment to livestock are manifest in the migration of pastoralists and their animals. The imponderable situation of transhumance including deficiency of food and water, exposure to harsh climate and the jeopardy of wild animals becomes insignificant beside the joy to be a Fulani governed by a certain value system. These values were expressed by a Fulbe as follows: “The love of the cattle, the interdependence between man and animal, the tending of the herd and considerations of its well-being and its increase dominated our existence” (Riesman 1977, p. 158 cited by Duda 1984, p. 136).

A set of right conduct and morality that forms Fulbe identity (Azarya 1978, p. 15 cited by Duda 1984, p. 166), namely *laawol pulaaku*, the ‘Fulani Way’ was regarded as indispensable to establish a successful cattle breeding system (Stenning 1994, pp. 55-56). This way is independent of livelihood, religion or geographical region of the Pullo (Duda 1984, p. 166) and involves several main rules of conduct or morals:

- modesty and reserve (seemteende),
- patience and fortitude (munyal),
- care and forethought (hakkiilo) and
- dignity (neddaaku).

(Stenning 1994, pp. 55-56; Vereecke 1999, pp. 96-97)

For the pastoralist *munyal* or strength is necessary, for example, in the middle of the dry season or in times of epidemic illness of cattle. Most important in terms of the treatment of livestock, however, is the virtue *hakkiilo* (Stenning 1994, pp. 55-56). A man with *hakkiilo* never fails to inspect his cattle in the morning. He goes to market where other cattle-owners are gathered, and finds out as much as he can about current conditions in areas to which he must move. He never fails to obey the water spirit who first gave cattle to the Fulani, by lighting the corral fire before the herd comes back at dusk and putting it out as they leave the corral for morning grazing. He scrupulously observes the lunar cycles by which herds are

moved to new pastures (Stenning 1994, p. 55). Moreover, Vereecke (1999, pp. 96-97) claimed that *pulaaku* includes traits of life, such as "freedom (ndimaaku), owning cattle (marugo na'i), bravery (ngoru), and generosity (caahu), and in some instances herdsmanship [sic!] (ngaynaaka)" that all have developed in the context of pastoral life.

Since the Fulbe are predominately Muslims, Islamic values are the second source of ethics in pastoral life (Duda 1984, p. 143). The concept of *pulaaku* is tied to *diina* (Islamic faith) or is even equalled with Muslim religion and, thus, the Fulbe pastoralists are engaged in praying five times a day and other religious duties. This moral code of Islam related to modesty, reserve and generosity widely corresponds with pulaaku (Vereecke 1999, p. 97). In the subsequent section a more general picture of the human-animal relationship in the Muslim tradition is drawn.

3.3.3.3 Islamic values: The Qur'an and the Sunnah as a source of Muslim ethic

Nanji (1993, p. 107) maintained that like other religious traditions, the Islam is founded on a moral authority. The Qur'an is a main source of ethics and rational reflection on the meaning of revelation produced elaborate rules for ethical conduct including the principles upon which these rules could be based. On the other hand, the sophisticated process of determining human obligations, which relies on human reasoning about the relation between the Qur'an and Prophet Muhammad's life, is the formal basis for ethical thought in the Muslim world. In accordance with Judaism and Christianity, the Islam is rooted in the commandments of God from which derive ethical principles.

The most important sources of Muslim ethic - the Qur'an includes God's message to the Prophet Muhammad and the recordings of the Prophet's norms and actions in the *Sunnah* (Nanji 1993, p. 106; Forward and Alam 1994, p. 80; Özdemir 2003, p. 3).

> For Muslims, the message of the Quran and the example of the Prophet's life thus remain inseparably related through all of history as paradigms for moral and ethical behaviour. They formed the basis for Muslim thinkers subsequently to develop legal tools for embodying moral imperatives. [...] Parallel to the developing legal expressions, there also emerged a set of moral assumptions that articulated ethical values, rooted in a more speculative and philosophical conception of human conduct as a response to the Quran and the Prophet's life.
>
> (Nanji 1993, p. 110)

Since the Qur'an is primarily directed to how human beings can obey God's will, there is only little cosmogony in the Qur'an. The universe came into existence by the command of God (Surah 36: 82) and was created in six days (7: 54) (Forward and Alam 1994, pp. 81-82). Thus, the Qur'an reveals that humans and animals have a common origin: "All living things are made from water (21:30), including human beings (25:54)". In addition, it is said in the sacred scripture that all animate and inanimate things in the world fulfil their obligations towards God: All creatures in the universe fulfil the life God has ordained for them and "[…] everything in the heavens and earth bows to God in worship – sun, moon, stars, hills, trees, animals, and many people […] (22:18)" (Forward and Alam 1994, pp. 83-84).

Özdemir (2003, pp. 22-23) stated that several Qur'anic passages emphasize the importance of animals. It is, for example, noted that animals constitute a community (umma) just like the community of human beings: "There is not an animal on the earth, nor a bird that flies on its wings - but they are communities like you […] and they shall all be gathered to their Lord in the end" (Qur'an 6:38) (Forward and Alam 1994, p. 91; Özdemir 2003, p. 23). The close relationship between God and animals is shown in the following verse: "There is no moving creature on earth but its sustenance depends on God: He knows the time and place of its definite

abode and its temporary deposit: all is in a clear record" (Qur'an 11:6). Other Qur'anic verses (Qur'an 27:16-18) narrate the communication of the prophet Solomon with birds which entitles animals at least in parts as "fellow humans" (Özdemir 2003, pp. 23-24).

According to Gottwald (2003, pp. 4-6) in the Islamic tradition both humans and animals are part of the creation. Similarly, Özdemir (2003, p. 24) alleged that both humans and nonhumans are created by God and denied any definite difference between them. The obligation to protect animals is derived from the Islamic concept of creation that involves the equality of all creatures with respect to the creator. Moral duties to animals based on Prophet Muhammad's teachings require human responsibility for the protection and maintenance of all forms of life (Gottwald 2003, pp. 4-6). In addition, it is prohibited by the Prophet to treat animals cruelly. „They are not to be caged, or beaten unnecessary, or branded on the face, or allowed to fight each other for human entertainment. They must not be mutilated while they are alive [...]" (Forward and Alam 1994, p. 92).

Forward and Alam (1994, p. 92) maintained that since Muslim doctrine suggests that human beings have moral duties towards animals, Muslim believers reject battery cages in poultry production and any other form of animal keeping, which aims at cruelty to domestic animals and their needless killing. However, Gefu (2005, personal communication) drew attention to the point that the Islamic injunction as contained in the Qur'an and emphasized by the Prophet Muhammad regarding the care of animals is fast being eroded even in Islamic areas of livestock production. It is common to see many actions against the animal. Such may include branding for the purposes of identification during marketing of livestock or for treatment for a disease.

On the other hand, there are other scriptural sections that require dominion of human beings over other creatures: "It is He Who has created for you all things that are on earth. (Qur'an 2:29)" (Özdemir 2003, p. 25). Human beings are differentiated from animals in that they are able to make moral judgements. Accordingly, animals are subordinated to humans and can therefore be used in different ways, as said in the Quran 16: 5-8:

> He has created cattle for you. You get from them warmth and many benefits, and food. And you derive pride from driving them home at night, and leading them to pasture in the morning. They carry your burdens to lands you could not reach except with great trouble. Your Lord is full of kindness and mercy. There are horses, mules and donkeys, for you to ride or for show.
>
> (Forward and Alam 1994, pp. 91-92)

Similarly, Gerlitz (1998, p. 166) provided evidence for the pre-eminent position of humans among other living beings in the Qur'an 17:70: "And surely We have honoured the children of Adam, and We carry them in the land and the sea, and We have given them of the good things, and We have made them to excel by an appropriate excellence over most of those whom We have created" (The Holy Qur'an 2005, p. 1). Özdemir (2003, pp. 25-28) concluded that a comprehensive consideration of the Qur'an denies the view that human beings are the owners of nature and can use it just as they like. Despite their dominion "in the hierarchy of creation", human beings are also obliged to serve God. According to Özdemir (p. 28) the following principles of environmental ethics, which are derived from the value system outlined in the Qur'an, are also relevant in terms of animal ethics:

- Nature as a whole, being created and sustained by God, has intrinsic and inherent value, independent of its usefulness for human beings.
- Human beings, though at the top of creation, are only members of the community of nature. They have responsibilities toward the whole environment, just as they have responsibilities toward their families.

- Human beings are the vicegerents of God on earth, and therefore they will be judged in the hereafter for their actions here. They will also be held accountable for their actions related with the environment.

Gottwald (2003, p. 7) maintained that recent Islamic interpretations of the Qur'an demand animal husbandry methods to be species appropriate, reject animal mass production and inhumane transport of slaughter animals. These interpretations are based on the view that animals are creatures, which are, like humans, being willing to maintain their species. Since animals are created by God, they possess rights that must be respected by humans. In this context, the Islam grants animals the right for inter alia fodder, water, rest, milking, keeping dam and young animal together.

3.3.3.4 Islamic values: Animal protection in the Schari'a and slaughter practices

The Islamic value system has become a norm in the Schari'a, which regulates the treatment of animals primarily with regard to slaughter practices and, thus, the protection of animals is an integral part of the Islamic doctrine and practice. The duties towards animals formulated in the Schari'a are binding for all Muslims in all societies. Muslims are obliged to treat animals respectfully, affectionately, considerately, and appropriate to the species. In order to protect animals the Islamic norms forbid:

1. Killing of animals, except for food
2. Using animals as target for shooting practice
3. Organizing and conducting animal fights
4. Treating animals cruelly

(Gottwald 2003, p. 6)

God subjected animals to humans and allowed them their slaughtering for human food consumption. However, certain animals are prohibited for food consumption and the use of animals for food requires their killing in a prescribed form (Forward and Alam 1994, p. 93). In the Muslim tradition slaughtering of an animal is a devotional act. The animal is to be killed by a sharp knife that facilitates to sever the throat cleanly. This method is regarded to cause a quick death and, therefore, to minimize the suffering for the animal. In order not to cause unnecessary distress to the slaughter animal, Muslim law prohibits the ritual slaughter of livestock in the presence of other living creatures. This interdiction requires an adequate design of slaughterhouses. Furthermore, it is necessary to invoke God's name, when the animal's throat is slit. In this context, the pronouncing of God's name is „a reminder of God's permission and ultimate control over all things" (Forward and Alam 1994, p. 94-95; Gottwald 2003, p. 7). Prior to the slaughter process the animal has to be watered, fed, and calmed down (Gottwald 2003, p. 7).

3.3.4 Example 2: The llama and alpaca in the religious ethic in the central and southern Andes

As the previous analysis of Andean pastoralism has shown, the belief in local deities survived under the surface of Catholicism (see Bennett 1946, p. 35; Gareis 1982, p. 35) and religious Catholic holidays typically coincide with ceremonies of non-Christian origin (Valcárcel 1946, pp. 472-475). For example, the ceremony for the reproduction of animals took place at the time of *carnaval* in February, (also in January or March, or from August to Octo-

ber) (e.g. Aranguren Paz 1975, p. 103 cited by Gareis 1982, p. 109). On several occasions ritual ceremonies are carried out that predominately aim at the well-being and successful breeding of llamas and alpacas. In this section it is primarily focused on local moralities for the treatment of South American camelid in the traditional American religion.

3.3.4.1 The Andean cosmogony

Peruvian myths denote the God Viracocha as a creator, transformer and civilizer of the world. Métraux (1949, p. 560) supposed that Viracocha was a Supreme Deity in the ancient Quechua culture.

> According to the myths, he made the earth, the sky, the stars, and mankind; destroyed the first people by a flood and created new men; wandered across Perú establishing the social and moral order and instructing mankind in many arts; and gave men their staple food plants and taught them the secrets of cultivation. In addition, he was a great transformer who changed mountains into plains and valleys into mountains and turned men into stones.

(Métraux 1949, pp. 563-564) further maintained that in ancient Peru natural objects and phenomena, the earth and the sea were worshipped deities. Unlike other Inca gods, the Mother Earth "remained almost intact from Ecuador to the Argentine long after most of the gods of the Inca pantheon had been forgotten". Gareis (1982, p. 34) claimed that at present, in the geographical region where the llama is naturally found, the central Godhead of the traditional religion, the Pachamama or Mother Earth, is worshipped.

Göbel (2001, p. 177) detected two concepts of the Pachamama in the Andean highland. On the one hand, she is regarded as an *abstract entity* capable to create and destroy living beings. In this respect, the Pachamama is considered as the real owner of llamas and alpacas who lends domesticated animals to human beings. Improper treatment leads to withdrawal of the animals by the Pachamama (Flores Ochoa 1975 cited by Gareis 1982, p. 39). In the local tradition the Pachamama is responsible for the fertility in humans, animals, and plants as well as the preservation of the animal herd. This notion is manifest in present-day agricultural rites and ceremonies related to the reproduction of animals, which are carried out for the Godhead (Gareis 1982, pp. 37-39).

On the other hand, the Pachamama is conceived as a *concrete entity* in the sense of the earth people are standing on. However, she is also associated with springs, volcanoes or other holes in the ground. These sites are considered to be dangerous, because the Pachamama can swallow up animals and human beings (Göbel 2001, p. 177). Other numina, such as hills, springs, ponds, and thunder also serve as protectors of llama and alpaca herds and affect their maintenance and thriving (Gareis 1982, pp. 40-50; 60).

Although the world-view of the recent human population in the Andes shows a wide variety in detail, nearly all concepts possess a spatial and a temporal dimension. For example, in Qotobamba nearby Cuzco it is believed that the universe comprises the *hanaqpacha*, the *upper world*, being the residence of God, Jesus Christ and Mary, the saints and the dead who lead a correct life. Close to the *upper world* is the *limpu*, where children live who died unbaptized and the *pueblos de los animales*, where animals went after death. This specific Andean cosmology further includes the *kay pacha*, i.e., *this world*, where humans, animals, plants and several spirits live. Finally, midgets who keep herds of very small animals belong to the *inner world* or *lower world*, the *ukhupacha* (Gareis 1982, pp. 72-73). Webster (1973, p. 121) reported that in the south central Andes the deceased are occasionally buried along with small figurines of llamas, which carry goods for the way to the upper world.

Concerning the temporal dimension, Andean mythology differentiates several epochs of mankind. In Ocongate nearby Cuzco the first epoch embraces the creation, the second the time of the ancestors (*machula*), the third the rule of the Incas and the conquest, the fourth the contemporary time, and the fifth the future (Gareis 1982, p. 75). The temporal aspects of the Andean world-view are closely linked with the origin of the alpaca. Gareis (pp. 67-68) assumed that the beginning of alpacas is related to springs and ponds. In Ocongate mythology tells that during a former epoch of mankind the ancestors (*machula*), who successfully bred alpacas, populated the earth. However, the era of the *machula* ended through a cataclysm and the alpacas hid themselves by climbing into watercourses. When the modern era began, the alpacas stepped out of the waters. In accordance, today the inhabitants of Ocongate make sacrifices to springs and ponds, because they have accommodated the alpacas during cataclysm.

According to Flores Ochoa (1975, p. 16 and 1977, pp. 219-220) cited by Gareis (1982, pp. 77-78) the end of the world is associated with camelids, too. Since the alpacas and llamas are lent by the *Pachamama* or Mother Earth, they can be withdrawn and can gradually disappear in ponds or springs, if they are mistreated. The total disappearance of the camelids coincides with the end of the world. As a result, humans, animals, nature and cosmos are intimately interwoven. The importance of alpacas and llamas in the Andean cosmogony lead Flores Ochoa (1975, p. 19) cited by Gareis (1982, p. 78) to the conclusion that the human-lamoid relationship is not only determined by economic interests but also by two sorts of creatures who are mutually dependent on each other.

3.3.4.2 Moral codes with regard to the treatment of llama and alpaca

Göbel (2001, p. 177) in her investigation into animal husbandry in the Andean highland of northwestern Argentina discussed the aspect of human-animal interaction:

> The pastoral way of life in Huancar is characterized by a close relationship between humans and their livestock. Llamas - in the same way as sheep and goats - are not perceived as being completely outside of the human sphere. On the contrary, they are considered to be family members with an ascribed social status. A herdswoman especially develops strong emotional ties towards her llamas. They result not only from her daily interactions with the animals. Her emotional commitment is also demanded by societal norms. A herdswoman should take care of her flocks in the same way as a mother takes care of her children. Frequently heard comments are: 'You have to look after a herd animal, think of it, like it, not get irritable and loud with it, talk to it calmly, keep it under control but allow it some freedom' [Interview with J.L., 11/96].

For Andean pastoralists' llamas and other farm animals deserve careful attention, because they possess feelings (*sentimiento*), memory (*recuerdo*) and intelligence (*mentalidad*) and have a soul (*alma*). Not even the animal's inability to speak is regarded as an obstacle, since they can react to human speech and can express their needs and sensations in different ways. In the pastoralists view the animal's intention can be understood by empathy, similar to the communication between mother and baby. In addition, farm animals in the Andean system have the status of an individual with a name and an own life history (Göbel 2001, p. 177).

In the world-view of Andean pastoral people economic success in llama breeding is linked to *suerte* (luck) that is obtained by the benevolence of the *Pachamama*. A decisive factor to receive the goodwill of the Mother Earth is right behaviour with regard to the treatment of animals. The malevolence of the *Pachamama*, who is the real owner of the animals, is provoked by wrong conduct (e.g. inadequate care of the flocks, shearing and slaughtering of animals without immediate need) and leads reduced performance of the herd (Göbel 2001, p. 178). Other reasons to loose the benevolence of the Mother Earth are social envy, omen or incorrect behaviour in the human community. For example, the *Pachamama* may send a

puma to a families herd, because a member of this family behaved immorally. Thus, the Mother Earth, on the one hand, has the capacity to prevent harm in individual herd animals and to increase herd growth and fibre production and, on the other hand, to considerably decrease the productivity of alpacas and llamas (Göbel 1999, pp. 220-222).

It is interesting to note that in the Western conception of mind the death of an animal is solely attributed to physical factors, such as illness or violence caused by inadequate nutrition or hygienic conditions, weather extremes or predators. In contrast, Andean pastoralists have a much broader concept of the causal factors of death, which additionally involves *susto* (fright), as a source of disease. Herd animals, for example, frighten, when they pass near by a waterhole or when they meet a fox or a puma (Göbel 1999, pp. 221-222).

To ensure the goodwill of the Mother Earth, Andean pastoral people try to keep the code of right conduct. In this regard, several strategies are pursued: Firstly, the moderate use of natural resources limited to situations of immediate necessity, such as hunger. Secondly, the utilization of certain plant and animal species is entirely prohibited or restricted to particular days. Thirdly, the proper treatment of herd animals is required. For any intervention in the life of domesticated animals, such as shearing, castrating or slaughtering the permission of the *Pachamama* is asked for. At the same time the animal is begged for forgiveness for intervening and the strict necessity for any measure is obligatory (Göbel 1999, pp. 223-224).

3.3.4.3 Ritual ceremonies directed to the Pachamama

Apart from the proper treatment of the wild and domestic nature, the benevolence of the *Pachamama* can be invoked by sacrifices of coca, alcohol and tobacco offered in religious feasts (Göbel 2001, p. 178). Tomoeda (1996, pp. 188-198) reported of a Peruvian ritual ceremony called *ayllusqa* or *agustukuy*, which is performed in August and is dedicated to the fertility of lamoids. On the day before the ritual is carried out by a herding family preparations for the sacrifice (*vispera*) are made. Ritual activities are directed to the preparing of fine maize flour (*llampu*) and the forming of figures of male and female llamas and alpacas from llama fat. On the next day a fire is lighted in the corral of the herding family where coca leaves and fine maize flour is burned. Various libations are made in honour of the *Pachamama* and the *Apu*.

Three male llamas are brought into the corral and are sprayed with *chicha* (maize beer). In the course of the procedure the herdsman perforates the ears of the animals and pulls ribbons through it. Coca leaves are sprinkled over the backs of the llamas, while all attending people surround the animals. The herdswoman covers the llamas' heads with her shawl and her husband shakes figurines over the covered heads of the camelids. Then, the figurines are burned, a libation (*tinka*) is made and grass is tied with the animals' fibre. Drinking rum, playing the drum and singing are also part of the ceremony.

Tomoeda (1996, p. 199) maintained that the songs that accompany the ceremony address not only the human-animal relation but also the human-spirit world:

> The meeting […] of these three beings (man, beast and divinity) is a necessary precondition for animal fertility which the herder so ardently desires, and his desire is satisfied only by the offering of the gifts in the ritual to the gods. Should he neglect them, the gods will become angry and any kind of ill luck might befall him, such as the diminution of his herd through sickness or theft, or even his own death (human death is sometimes interpreted as a result of the mountain having devoured a man's heart). Thus the day of the meeting is crucially important […].

The beings who meet in the ceremony "are all in a state of near exhaustion and tiredness, and it is necessary to replenish the lost forces in order to achieve an increase in fertility". In

this regard, ritual objects, such as maize flour (llampu), incense and coca are regarded as materialized soul or spiritualized force. An increase of the herd is only possible, if the soul "has revitalized itself in the exhausted beings". In the ritual ceremony coca, for example, is a symbol of the *shawl* that envelopes the camelid and induces fibre growth and of the *pasture* that is the feed of the animals. Coca and grass grown in the *puna* symbolize the increase and abundance of fibre (Tomoeda 1996, pp. 199-200). "Once the vitality (*kamaq*) of the camelids has been regenerated through the ritual process, the animals, […] express their happiness and contentment, and demonstrate their latent power […]" (Tomoeda 1996, p. 201).

Another sacrifice that aims at the thriving of livestock involves the ritual slaughter of a llama or alpaca. Gareis (1982, p. 108) reported that the ceremony for the reproduction of animals - a fertility rite - is a regular component of the annual cycle in the Andean life. This religious ceremony contains the sacrificing of a llama or alpaca for the *Pachamama*. Gareis (p. 131) claimed that the blood sacrifice has a long tradition in the Andes. In pre-Columbian time humans as well as llamas were sacrificed. At present, a wide-spread method for the ritual killing of animals is to rip out the heart of the camelid's body - a practice that is also applied, when animals are killed for food.

Lying on the ground, the sacrificial animal is held by some people. A woman puts a coca leaf in its mouth and covers its eyes. Then, a ten centimetre long opening is cut in the right flank of the animal and a person grasps into the animal body. The diaphragm is severed with the thumbnail, the aorta with thumb and forefinger and in the end the heart is ripped of the body. The killing of animals through the tearing of the heart, which is called *ch´illa* in the indigenous population, is practiced in large areas of Peru and Bolivia. If carried out professionally, the *ch´illa* lasts thirty seconds from the point of incision to the extraction of the heart. It is important to note that this method is said to prevent the camelid from suffering and the human being who has killed it from punishment (Gareis 1982, pp. 137-139).

Within the ceremony for the reproduction of animals the marking (*marca*) of one-year-old, not yet marked animals is performed mostly by the owner couple. While the wife feeds the animal *coca* or *chicha* (an alcoholic beverage consisting of maize, barley or quinoa), the husband makes the cuts in the ears. The cut ear pieces are for the moment kept in a woolen blanket and subsequently dug in the corral along with other sacrifices. In addition, often wool threads of varying colours are pulled through the ears of the camelids in order to adorn them (Gareis 1982, pp. 122-127). It is important to note that the administering of *coca* or *chicha*, being narcotics, should have anaesthetic effects on animals and, therefore, at least relieve the pain caused by the destroying of ear tissue. Obviously, the well-being of the animals is taken into consideration.

It is discussed by La Barre (1948, p. 181) cited by Browman (1974, p. 192) that in the *puna* tufts of brightly coloured wool tied to the ears are not merely used to identify individual animals or for aesthetic purposes, but are also intended to promote the increase of the herds. Young alpacas sometimes carry small, herbs containing bags around their necks „to protect them from disease, weather, and other dangers" (Flores Ochoa 1968, p. 113 cited by Browman 1974, p. 192). On the occasion of llama shearing ceremonies take place as well. After shearing the llama body is externally treated with a mixture of plants and minerals in order to stimulate the growth of wool. During the presence of his animals the livestock breeder asks the numina for the increase and protection of the animal herd and the growth of those plants, which are consumed by the animals (Gareis 1982, p. 154). In summation, great efforts are undertaken to ensure the well-being of livestock in the Andean highland.

3.3.4.4 Ritual ceremonies directed to apu and awki

In the Andean high mountain area ritual activities are not only carried out in the name of the *Pachamama* but also in the name of spirits. Webster (1973, pp. 126-129) in his investigation in the *ceja de la montaña* described two types of mountain spirits: Deities that are identified with glaciated peaks - *apu* and spirits that are identified with surrounding hills and promontories - *awki*. Unlike in the puna region, where the rural population mainly depends on pastoralism as a result of very limited access to agricultural land, the agro-ecological conditions in the *ceja* of the eastern cordillera favour both animal husbandry and agriculture, since various altitudinal zones are in relatively close proximity.

Rituals including divinations, libations, burnt offerings, and presentations are carried out in order to propitiate and exhort the spirits. Numina are called upon for health and prosperity of the herd and the family either by ordinary people or the *paqo*, who possesses shamanistic skills. *Paqos* apply ritual practices and remedial treatments, such as poultices with local plants, infusions and fumes in order to cure diseased llama and alpaca herds and herders. Interestingly these curing techniques are reputed not to work in non-indigenous herd animals and people. When an alpaca or llama is slaughtered libation of maize beer are made or fresh blood is sprayed "in the direction of a named *awki* identified with a prominence in the nearby pasture".

In addition, Webster (pp. 127-128) illuminated two seasonal ritual ceremonies related to agricultural and herding cycles, which are carried out in each family in the *ceja* who has the intention of renewal. *P''alcha* (denoting a blossom) a sacrificial activity directed to the fertility of alpacas is exercised after the maize is planted in early February, when "the herd is in the midst of lambing, the rutting season is about to begin, and most of the shearing, dyeing, spinning, and weaving of fresh new garments has been completed". The kind attention of the *apu* and *awki* is requested for the sanctification of the herd, while coca leaves are offered, libations are made and various materials of symbolic value are burned ritually. On the other hand, in August or September the ceremony *Ahata Uxuchichis* adopts the force-feeding of maize beer in male llamas. It focuses on the fertility of the male animals, which, at this time, return from arduous transport of the maize harvest in the valleys and enclosess the symbolism of renewal.

According to Webster (p. 131) elaborate rituals in llamas and alpacas related to fertility, transport of harvests, curing and divination "symbolically integrate herds, herders, alpine pastoral habitat, and a pantheon of supernatural powers identified with high altitudes". The pastoralist's view about herd management is not only determined by economic factors but also by moral values and religion and the awareness of the environment. Their concept of nature sharply differs from the concept of non-indigenous people who aim at the maximization of production. Andean pastoralists reject the pure exploitation of nature and the killing of domestic animals without anything is returned to the Mother Earth, such as offerings to the Godhead or close emotional commitment to livestock. An excessive use of natural resources beyond the immediate human need is regarded to destroy harmony with nature (Göbel 1999, pp. 216, 219-220).

Göbel (pp. 224-225) further claimed that

> […] in the indigenous worldview the human and the natural spheres are closely interwoven. The pastoralists' close relationships with the environment and in particular with their herd animals can be described as very personal or even intimate, although this does not mean that they do not take the concrete utility of an animal as a resource into account.

This Andean perspective shows that cultural influences on the perception of animal welfare are greatly relevant, when international standards for the treatment of farm animals are discussed.

3.3.5 Example 3: Traditional Indian morality concerning the treatment of cattle

Although there is controversy in India about the religious identity in the twenty-first century where, on the one hand, an erosion of traditional ideals takes place through globalization and, on the other hand, traditional knowledge like Ayurveda has a renaissance (Flood 2003, p. 1), religious traditions involve values that inspire human beings in their relationship towards nature (Nelson 1998, p. 2). Philosophical discourse has developed from an early date in the Hindu tradition (Flood 2003, p. 5) and present-day Indian philosophers explore what is right and wrong or good and bad. However, the inquiry is restricted to „describing or codifying the prevailing [...] customs and habitual traditions", that is, in Sanskrit terminology dharma, or roughly the moral and social order. Unlike Western ethics, which is engaged in "ahistorical, abstract and formal theorizing", Indian ethical thought is „the 'soul' of the complex spiritual and moral aspirations of the people" associated with socio-political structures that evolved over the centuries (Bilimoria 1993, p. 43).

However, the contemporary religious culture in South Asia is diverse. Hindus do constitute the large majority of religious communities, but Muslims, Christians, Sikhs, Jains and autonomous ethnic groups belong to the Indian society as well. Hinduism itself consists of a number of distinct facets of beliefs, practices, historical backgrounds and modes of life, which cannot be expressed in a straightforward way (Gosling 2001, p. 7; Singh Raju 2002, p. 17; Flood 2003, p. 2). Owing to the huge variety of religious views within India, the following reflections will focus on Hinduism being the predominant religion in present-day India. Gosling (2001, p. 7) argued that despite the cultural differences in regional communities, a sense of a national culture has arisen. Since Gosling advocated to avoid the term *Hinduism* and to replace it by *Hindu tradition*, this term will be used in the subsequent discussion.

3.3.5.1 Hindu scriptures

In order to approach questions of animal ethics and local patterns of the universe in Indian thought, ancient Sanskrit scriptures play an important role (Sanskrit is an Old Indian written language that scholars use until today). Hindu doctrine is basically founded on the Vedas (veda: literally knowledge), which address religious concepts, the existence of the world and human social conduct (Choudhury 1994, p. 53; Singh Raju 2002, pp. 17-18). The Vedas do not only have great influence on religion but also on philosophy, legislation, customs and literature in India (Gopal 2003, p. V).

There are two main authoritative Hindu scriptures: *sruti* ("'that which has been heard'") and *smrti* ("'that which has been remembered'") (Table 1). *Sruti* mainly includes the Veda. Dated back to 1500-900 BCE the Vedas are divided into four books: *Rgveda*, *Samaveda*, *Yajurweda* and *Atharvaveda* (Klostermaier 2000, p. 11; Gopal 2003, p. V). Most notable in this regard is the *Rgveda* that consists of more than 1.000 hyms (Singh Raju 2002, pp. 18-19). Book ten of the *Rgveda* is concerned with philosophical views about creation and the life beyond death (Gonda 1978, p. 10). According to Herman (1991, pp. 50-52) the *Rgveda* is an essential component of contemporary Hindu religious practice. Gopal (2003, p. V) added that millions of Hindus recite Vedic verses, when they carry out their religious rites.

The Vedas further include the *Brahmanas* that explain rituals and are associated with each of the four vedic books, the *Aranyakas*, literally *forest treatises* and the *Upanisads* (Gonda 1978, pp. 12-14; Klostermaier 2000, pp. 11-12). In the *Upanisads* in which philosophical arguments on Vedic mythology, the relation of God, human being and nature (Singh Raju 2002, p. 18) and ways of liberation from rebirth and suffering are extensively discussed (Klostermaier 2000, p. 12).

Apart from vedic texts, a huge number of materials called *smrti* or tradition are also important for Indian ethics. These include *smrtis*, Codes of Law, most notably *Manusmrti*, *Itihasa*, (history), which embraces the great epics *Ramayana* and *Mahabharata* (including *Bhagavadgita*), and the *Puranas*, old books (Klostermaier 2000, p. 12). Dating from the 1st century BC, the *Manusmrti* is a very influential Sanskrit law. Manu, the first king, composed this practical morality that prescribes sets of duties (*dharma*) to Hindus dependent on their social class/caste and their current stage of life (Encyclopaedia Britannica). The eighteen *Puranas* are a bulk of ancient books, which are not directly founded on the Vedas, but are related to them (Choudhury 1994, p. 77). All these scriptures are important sources in terms of the position of the animal in human thought.

Table 3.16 Overview of the two main categories of Hindu scriptures

1. *Sruti*
a. The Veda in the narrower sense including the four *samhitas* (literally "collections")
Rgveda (Veda of hymns or verses)
Samaveda (Veda of melodies)
Yajurveda (Veda of rituals)
Atharvaveda (Veda of incantations and spells)
b. The *Brahmanas*, texts associated with the four *samhitas* explaining rituals
c. *Aranyakas* (literally "forest treatises")
d. *Upanisads* ("end of the Veda")
2. *Smriti* or tradition including heterogeneous texts
a. *Smrtis*, Codes of Law, most important *Manusmrti* which is attached to Manu, the forefather of human beings
b. *Itihasa* or "history" embracing the Indian epics
Ramayana
Mahabharata (including *Bhagavadgita*)
c. *Puranas* or "old books" deal e.g. with the creation of the world

Modified from Klostermaier (2000, pp. 11-13)

3.3.5.2 The understanding of natural phenomena - cosmology and cosmogony

Indian civilization has its own notions of cosmology and cosmogony. While the eternal existence of the phenomenal world is doubted in many other cultures, Indian thinkers claim that the world has neither a single birth nor an ultimate end. The creation and dissolution of the universe is regarded as a cyclic process (Choudhury 1994, p. 54), that is, a continuing repetition of events or rebirths in contrast to a linear and progressive development. This cycle is recurrent in most Indian systems of thought and in the light of the doctrine of rebirth a long-term conception of human existence is prevalent in India (King 1999, pp. 198-200). This principle subsequently will be referred to as *samsara*.

There are several stories of creation in the Indian tradition with varying information. Firstly, the query of the origin of the world is addressed in Book ten of the *Rgveda*. Some of these early Vedic hymns regard the „creation as a result of the word (*Vãc*) and as the establishment of a rhythmic order (*rta*) to the universe" (King 1999, p. 201). Another story in the *Rgveda* refers to the concept of *hiranya-garbha* that was often quoted in the subsequent literature. According to this concept the primary object from which the current form of the universe evolved gradually was out of primordial fluid with a very bright interior (Choudhury 1994, p. 57). Apparently, in these *Rgvedian* texts no difference is made between various forms of creatures.

The *Purusa Sukta*, a well-known hymn of the *Rgveda*, ascribed the creation of the cosmos to a „sacrificial dismemberment" of the primal person (*purusa*) (Chapple 1998, p. 21; King 1999, p. 202) from which various parts of the body became the earth, sun, moon, animals and humans (Herman 1991, pp. 50-52). This view indicates continuity between humans and the cosmos and implies respect for nature (Chapple 1998, p. 21) and for animals in particular. The equality may also be deduced from the higher principle of reincarnation, which claims that rebirth is independent of the creature.

Secondly, the non-vedic *Puranas* consist of ideas about Hindu cosmology, as well. In this regard, it is worth mentioning how in the fifth century the Hindu scholar *Arya Bhatta* thought about the position of the earth in the universe. „The stars in the firmament and the sun are static, it is the earth that by its own rotation is causing either the rising of the setting of the planets and stars" (Bhattacharjee 1978, p. 6 cited by Choudhury 1994, p. 61). Moreover, in the *Visnu Purana* it is maintained that the development of the world is a purely physical process. "'The matter [the universal stuff] evolves into the material form by virtue of its own potentialities and that requires not other agency to effect the transformation'" (Choudhury 1994, p. 61).

The creation is illustrated more vividly in the story of the ten *avataras* or incarnations of *Visnu*, as narrated by Bhattacharjee (1978, p. 29) cited by Choudhury (1994, pp. 62-63):

> In the watery environment, there appeared the first *avatara*, in form of a fish […]. Next, as the water level receded, the second *avatara* appeared, in the form of a tortoise […]. This marks the amphibian stage. This was followed by the appearance of a boar […], a pure mammal. The next *avatara* appeared in the form of a lion-man […], a form intermediate between animal and human. Then came a dwarf […], a short-statured man. The next *avatara* was Parasurama or Rama with the axe [...] fully human in form but not humane in nature yet [...]. Then came Rama [...] [who] belonged to the *ksatriya* (warrior) caste [...]. Next was Balarama, the bearer of the ploughshare [...], signifying the settled agricultural phase of society. In a variant form, Krsna […] the younger brother of Balarama, is the eighth *avatara*, not Balarama. The ninth *avatara* was the Buddha who preached non-violence. [...] The tenth *avatara* […] is yet to come.

Coward (1998, p. 40) maintained that in the Hindu scriptural tradition the cosmos, which consist of stars, earth and atmosphere as well as plants, animals and humans is regarded as God's body. As a result, the cosmos is divine and human beings are obliged to respect and venerate all other appearances of God's body.

3.3.5.3 The notions of Brahman, samsara, karma and dharma

There is a variety of philosophical ideas inherent to Indian thought that have an impact on the human attitude to animals. One of these ideas is the belief in an eternal, ultimate principle called *Brahman*. As part of all beings, *Brahman* is conceived as the *self* or *atman* and unites the diverse Hindu tradition. It is a religious objective to accomplish the association between the individual self and the cosmos (Encyclopaedia Britannica).

According to Herman (1991, p. 69) the concept of *samsara*, the cycle of existence (Gosling 2001, p. 189) or the cycle of rebirths (King 1999, p. 77) is central to Indian religious tradition. Since rebirth must go on until release is gained, rebirth causes also suffering (Gonda 1978, p. 280; Herman 1991, p. 69). As a consequence, *samsara* means rebirth as well as the suffering that it induces. King (1999, p. 123) emphasized that the doctrine of rebirth is almost universally accepted in India and explained:

> Traditional Indian metaphysics made a distinction between two states of being: *samsara* - the „common flowing" of rebirth which is characterised by suffering (*duhkha*) and ignorance (*avidya*) and *moksa*

or *nirvana* - liberation from rebirth, seen as an end to all suffering and the attainment of complete enlightenment.

When the Vedas are extended beyond hymns and rituals, they constitute a source of ethics and the morally significant principles *dharma* and *karma* emerge (Bilimoria 1993, p. 45). The Rgveda addresses the regulation of the social life by *dharma*, the Sanskrit word for law (Herman 1991, p. 52) or duty (Bilimoria 1993, p. 46). *Dharma* is a complex of traditional religious-ritual-social norm, which includes human moral obligations. Following these duties results in religious merit and maintains the order between human beings and between human beings and the cosmos (Gonda 1978, p. 290). The caste system is intimately related with this order and is integral part of the traditional Indian world view (Gonda 1978, p. 297).

In early Hindu tradition the highest good was the complete harmony of the cosmic or natural order. The convergence of the natural and the moral order is expressed in the category of *dharma* that is comparable to ethics and serves as a rule for human conduct. *Dharma* „gives order and cohesion to any given reality, and ultimately to nature, society and the individual". Thus, a right human action requires conformity with this general principle, while a wrong action is in contravention of it. *Dharma* is justified as the *divined* ordering of things and is acknowledged as an absolute moral norm (Bilimoria 1993, pp. 44-46).

According to the concept of *karma* every conscious deed an individual engages in generates the conditions for the next life and the merits or demerits achieved by a person during lifetime continue to determine the possibilities after rebirth. Something like the *soul* incorporates the latent potential (*karma*) of all what constitutes the person. Selves are being reborn into this sorrowing and sorrowful world time and again, because they underlie the law of karma (action or action-effect) (Bilimoria 1993, p. 46; Gosling 2001, p. 188). The karma theory is the theory of the effects of human activities that go beyond the life of an individual, where selves are constantly receiving the treatment they deserve and are reborn again and again (Gonda 1978, p. 279).

In the Vedas the liberation from the cycle of birth and death (*moksha*) is identified as the ultimate aim of human life. Liberation can be attained by different paths, e.g., the way of *karma* and, therefore, every deed exercised by human beings has an effect on their emancipation from the cycle of rebirth. Right action including non-violence, charity and honesty is a means to obtain release, as expounded in *Mahabharata* and *Rgveda*. In order to achieve *moksha* in the latest stage of life, *dharma* or moral deeds have to be realized (Singh Raju 2002, pp. 47-49).

The concepts of *karma* and *dharma* are interrelated with the notion of transmigration and *dharma*, *karma* and *samsara* form main components of the Indian world-view. Manu's laws claim that every action in opposition to dharma has an effect in the next existence (Gonda 1978, p. 292). According to the theory of transmigration human beings can be reborn in form of animals and vice versa, when the consequences of deeds of a particular being (*karma*) demand it. This implies that the life of animals is as valid as that of humans and reveals the reverence Hindus have for the animal world (Choudhury 1994, p. 74). Since in the Indian tradition human beings and nature are intimately interconnected, harming any part of nature is the same as harming oneself (Coward 1998, p. 39).

3.3.5.4 The principle of „ahimsa" (non-violence)

Similarly, the principle of *ahimsa* - avoiding injury to all creatures - (Bilimoria 1993, p. 45) can be traced back to Sruti literature. Choudhury (1994, p. 76) claimed that although the ideal of *ahimsa* fully developed under the influence of Buddhism and Jainism in the sixth century BCE, it has arisen in the *Upanisads*. According to the upanisadic view all living entities are

part and parcel of *Brahman* (self) and the non-difference of self and others is a prerequisite for the performance of non-violence. The notion of *ahimsa* stresses that all life is sacred and, therefore, denies the killing of animals (Chapple 1993, p. 19; Choudhury 1994, p. 76). Freeing from the self creates "an awareness of and sensitivity toward the wants and needs of other persons, animals, and the world of the elements, all of which exist in reciprocal dependence" (Chapple 1993, p. 19).

Chapple (1993, pp. 3-4, 9) pointed out that the notion of *ahimsa* is closely associated with the conception of karma. The Hindu tradition of *ahimsa* was profoundly influenced by Jainism, where continuity in humans, animals, plants and inanimate things is ascribed to the possession of a soul, which is perceived in different qualities and quantities of karma. Thus, karma theory rejects a dualism between humans and nature and human domination of other forms of nature is disapproved, because they are souls in other states of karma (Coward 1998, pp. 41-42). *Ahimsa* is pursued, since acts of violence will result in hurting oneself in the future, maybe in another embodiment (Chapple 1993, pp. 10-11). The strict vegetarianism practiced by Jainas was partly adopted by Hindu society in India (Chapple 1993, pp. 10-11; Choudhury 1994, p. 76).

The principle of *ahimsa* is a guideline for the treatment and worship of cattle. According to Azzi (1974, p. 317) "*[A]himsa* is the Hindu doctrine of the unity of life, symbolized by the sacredness of cattle". In the *Rgveda* the cow is denoted as a gift of the deities towards humans (Gerlitz 1998, p. 50) and is, therefore, venerated. It is for religious reasons strictly forbidden to kill cattle, while other animals, such as sheep, goats and chicken, can be both worshipped and slaughtered (Gerlitz 1998, p. 55). On the other hand, the *Rgveda* emphasized the human duty to carry out cattle sacrifices in order to assist the striving of humankind for wealth and the forgiveness of sins (Herman 1991, pp. 56-58). Chapple (1993, p. 4) maintained that the doctrine of ahimsa can be said not to be fully adopted in Indian society, when animal sacrifices are practiced.

In addition, the Laws of Manu emphasized the necessity to perform *ahimsa* for all castes (Chapple 1993, p. 16). The code of manusmrti demands not to cause any other creature pain and since animals possess „inner consciousness", they are capable to experience pleasure and pain and are, as all other beings, subject and object of ethical concern (Gottwald 2003, pp. 2-3). However, an exception from the rule of ahimsa is made with regard to animal sacrifices: The manusmrti permits the killing of cattle for ritual ceremonies and the consumption of sacrificed meat. According to this law the killing in a ritual context is not regarded as killing but as non-injury, because the vedic Creator God Himself has created animals for sacrifice and the sacrifice ensures for the prosperity of humankind (Gerlitz 1998, pp. 56-58).

As a result, the animal sacrifice possesses higher priority in Hindu tradition than the ideal of non-violence (*ahimsa*) towards humans, animals, and plants (Gerlitz 1998, pp. 56-58). Although Manu advocated the principle of non-injury for all rites, he did not achieve his goal and the practice of bloody animal sacrifices was continued. Alike, the objections of Buddhists and Jainas who regarded sacrifices as an offence against the ethical principle of ahimsa did not lead to a complete ban of this practice in India (Chapple 1993, p. 43). Hence, an irresolvable conflict between the concept of ahimsa and the religious obligation to sacrifice animals appears to persist, which requires further discussion.

The principle of ahimsa or non-violence towards animals, which is primarily linked with the Brahmanical-Hindu tradition, was also essential in the thinking of Mohandas Karamchand Gandhi (1869-1948). Gandhi suggested the "revitalization of village economies, based on the principles of non-violence (*ahimsa*) and nonpossession (*aparigraha*) [in order to] make villages self-sufficient, able to cooperate through mutual trade without the importation of foreign produced goods" (Chapple 1993, pp. 53-54). The leader of the Indian campaign for national independence extended compassion against bovines to all living beings and did not only

condemn the slaughter of animals for food but also their killing at the end of their productive life (Burgat 2004, pp. 224, 231).

Gandhi clearly disapproved the ill-treatment in Indian cattle stating "[…] [m]y heart bleeds when I see thousands of bullocks with not blood and flesh on them, their bones plainly visible beneath their skin, ill-nourished and made to carry excessive burdens, while the driver twists their tails and goads them on […]" (Burgat 2004, p. 234). McMurtry (1999, p. 246) maintained that in terms of agriculture Gandhi's ethic implies serving of God by serving the life of all creatures made by God. According to Burgat (2004, pp. 238, 241) in Gandhi's ethic the obligation to protect animals is not only an imperative for India but also for the rest of the world. She interpreted this notion as a form of ethical universalism rather than cultural relativism, although she denied that Gandhi referred to normative values.

3.3.5.5 The vedic relation towards nature and animals

According to Choudhury (1994, p. 67) vedic people regarded themselves as part of whole animate community. They recognized and appreciated the beneficial character of nature and domesticated nature, as expressed in Rgveda (I 90: 6-8):

For one who lives by Eternal Law [*rta*]
the winds are full of sweetness,
the rivers pour sweets;
so may plants be full of sweetness for us.
Sweet be the night and sweet the dawns;
and sweet the dust of the earth.
Sweet be our Father heaven to us.
For us may the forest tree be full of sweetness,
full of sweetness the sun,
and full of sweetness the cows for us.

The eternal law (*rta*), mentioned in this hymn, involves the order of the universe including the unvarying course of the sun and moon or seasonal variations in nature, on the one hand, and refers to the moral order, on the other hand. It is expressed in the hymn that those, who abide by the natural law and live in harmony with nature, are blessed and lead a rich life. The human relationship with nature is characterized by harmonious participation not by exploitation.

As humans play an active role in the cultivation of land their relationship with nature turns into a partnership. Human contribution to the production of food is regarded as a co-operative act with the earth or nature. The earth, on the other hand, „is happy to be worked by those who are helping her to produce more and to reach her own plenitude". As a consequence, the relationship between human and nature is neither on of dominion nor of exploitation. In Rgveda IV 57 it is said:

Having the Lord of the Field as our friend and helper, may our cattle and horses have food in plenty. May men and oxen both plough in contentment, in contentment the plough cleave the furrow. Auspicious Furrow, we venerate you. We pray you, bless us and bring us abundant harvests.

(Choudhury 1994, p. 69)

Similarly, the human relation to livestock may be one of partnership. According to Choudhury (1994, p. 74) there are various animals, which serve as vehicles (*vahana*) and companions of particular deities in the Indian religious tradition. Apart from wild animals, (e.g. peacock, lion, elephant and rat) there are also farm animals that are considered sacred and are worshipped. Most notable in this regard is the bull. While the God *Shiva* is riding on the bull

Nandi over the firmament, God *Krsna* protected cow herds, which represented his wealth (Harris 1989, p. 45). It has been handed down that *Krsna's* close association with cattle has established the holiness of the cow. Likewise, the goat and buffalo belong to the sacred animals (Choudhury 1994, pp. 74-75).

Sharma (1998, pp. 51-52) quoted a passage of the early *Upanisads* that illustrates the interconnectedness and mutual dependence of human beings and the world of animals:

> Now this self, verily, is the world of all beings. In so far as he makes offerings and sacrifices, he becomes the world of the gods. In so far as he learns (the Vedas), he becomes the world of the seers. In so far as he offers libations to the fathers and desires offspring, he becomes the world of the fathers. In so far as he gives shelter and food to men, he becomes the world of men. In so far as he gives grass and water to the animals, he becomes the world of animals. In so far as beasts and birds, even to the ants find a living in his houses he becomes their world. Verily, as one wishes non-injury for his own world, so all beings wish non-injury for him who has this knowledge. This, indeed, is known and well investigated.

Choudhury (1994, p. 75) drew attention to a passage in the *Puranas* in which the human indebtedness to animals is recognized and animal intelligence is acknowledged.

> In the puranic literature […] it is recognised that the birds and animals have intelligence of some kind. The difference between the intelligence of animals and the intellect of humans lies in the fact that humans can, if they wish, develop spiritual wisdom beyond the inborn instinctive material sense. To begin with, humans are no wiser than animals. Without the Ultimate Knowledge, humans are equal to animals in intelligence because both are ignorant, knowing merely the sensual world.

Apart from the religious veneration the economic importance of cattle for a society that is widely based on agriculture must not be undervalued. Cattle are an asset to the farmer. While male animals are indispensable for ploughing, cows produce milk and symbolize maternity, endurance and service. Thus, in the rural Hindu society the prohibition of cattle slaughter has not only religious but also economic causes (Choudhury 1994, p. 75). Shiva (1989, p. 176) maintained that currently the cow is regarded sacred, because she contributes to prosperity in agriculture and to protect her integration in the cultivation of food crops. However, Choudhury (1994, p. 70) and Ramaswamy (1998, p. 78) claimed that despite the traditional reverence of cattle, the ideals provided by the ancient scriptures are not always in accordance with animal husbandry in modern India.

3.3.5.6 Animal protection legislation in India

India possesses an elaborated animal protection legislation which is set down in *The Indian constitution* and *The Prevention of Cruelty to Animals Act* from 1960. Article 48 of the Indian constitution requires: "The State shall endeavour to organise agriculture and animal husbandry on modern and scientific lines and shall, in particular, take steps for preserving and improving the breeds, and prohibiting the slaughter, of cows and calves and other milk and draught cattle" (Cox and Varpama 2000, p. 22). According to Harris (1989, p. 44) Article 48 provides some guidelines for the protection of animals in the individual states. Apart from Kerala and West Bengal, each state has enacted a law that forbids the slaughtering of cattle. Cox and Varpama (2000, pp. 22-23) claimed that despite the widespread ban of cattle slaughter, slaughtering is practiced in most states of India. Furthermore, Article 51A of the Indian constitution demanded: „It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and ***to have compassion for living creatures***".

The ***Prevention of Cruelty to Animals Act, 1960*** as amended by Central Act 26 of 1982 considers animal welfare concerns in more detail. Subsequently those paragraphs are

quoted that are pertinent for the protection of cattle and particularly draught oxen. In chapter III, section 11 of the Act, which deals with cruelty to animals, a variety of relevant rules are listed:

(1) If any person

(a) beats, kicks, over-rides, over-drives, over-loads, tortures or otherwise treats any animal so as to subject it to unnecessary pain or suffering or causes, or being the owner permits, any animal to be so treated; or

(b) employs in any work or labour or for any purpose any animal which, by reason of its age or any disease infirmity; wound, sore or other cause, is unfit to be so employed or, being the owner, permits any such unfit animal to be employed; or [...]

(d) conveys or carries, whether in or upon any vehicle or not, any animal in such a manner or position as to subject it to unnecessary pain or suffering; or [...]

(f) keeps for an unreasonable time any animal chained or tethered upon an unreasonably short or unreasonably heavy chain or cord; or [...]

(h) being the owner of (any animal) fails to provide such animal with sufficient food, drink or shelter; or

(i) without reasonable cause, abandons any animal in circumstances which tender it likely that it will suffer pain by reason of starvation thirst; or [...]

(k) offers for sale or without reasonable cause, has in his possession any animal which is suffering pain by reason of mutilation, starvation, thirst, overcrowding or other illtreatment; or [...]

he shall be punishable in the case of a first offence, with fine which shall not be less than ten rupees but which may extend to fifty rupees and in the case of a second or subsequent offence committed within three years of the previous offence, with fine which shall not be less than twenty-five rupees, but which may extend, to one hundred rupees or with imprisonment for a term which may extend, to three months, or with both.

Common treatment of draught animals in India is clearly contradictory to the animal protection law of the country. Both poor animal handling and inadequate provision of feed and water, as illustrated by Ramaswamy (1998, pp. 74-75), are condemned by *The Prevention of Cruelty to Animals Act*. Paragraph 1(a) definitely forbids the practice of beating, overworking and subjecting the animal to unnecessary pain or suffering and paragraph 1(b) demands to abstain from employing draught cattle in any work, when they are sick, injured or wounded. According to paragraph 1(h) livestock keeper are obliged to provide their animals with sufficient food and water to prevent them from suffering from starvation or thirst. However, this cannot always be guaranteed in Indian animal husbandry not only because of the owner's neglect but also because of climatic conditions, as pointed out by Ramaswamy (1998, p. 76) and Pearson (1999, p. 792). Hence, it has to be distinguished between intentional mistreatment or poor livestock management and deficits in animal well-being that must be attributed to the prevailing natural conditions that are unchangeable.

The Prevention of Cruelty to Animals Act explicitly excluded certain practices of livestock management from prohibition:

(3) Nothing in this section shall apply to -

(a) the dehorning of cattle, or the castration or branding or noseroping of any animal in the prescribed manner, or [...]

In chapter VI, miscellaneous of the Animal Protection Act there is a passage concerned with freedom of religious slaughter practices: „Nothing contained in this Act shall render it an offence to kill any animal in a manner required by the religion of any community". Thus, the practice of ritual slaughter prescribed by religion is expressly given priority to any animal welfare consideration.

Special requirements for the protection of draught animals are provided in *The Prevention of Cruelty To Draught and Pack Animals Rules 1965*, as pointed out by Indiatimes (2004). (1) These rules lay down maximum loads and conditions for the work with animals in order to prevent overloading in draught and pack animals. However, no measures of maximum loads have been given for bullocks, probably, because they are neither primarily used for pulling vehicles nor as pack animals. (2) The use of animals for work at temperatures above 37ºC, as common during most summer afternoons, is illegal. Draught animals in hot environments particularly suffer from heat stress, because heat dissipation is aggravated, when internal heat is produced by muscular activity. (3) Animals may not be used for more than a total of 8 hours a day and not for more than 5 hours without rest. (4) Animals have to be unharnessed, fed and watered, when work is completed. (5) "The use of any harness, yoke or bit with spikes, knobs or any sharp projection which is likely to cause bruises, swellings or pain to the animal is forbidden".

Ramaswamy (1998, p. 78) stated that although *The Prevention of Cruelty to Animals Act* forbids the mistreatment of work animals through overloading, whipping etc., the implementation of this law is not effective. According to Cox and Varpama (2000, pp. 25-26) causes for this ineffectiveness are the insensitivity of the Indian Civil Service to traditional ways of animal treatment and the shared responsibility for farm animal welfare by different Ministries with different interests.

3.3.6 Example 4: The human-animal relationship in Buddhist ethics in Thailand

The previous analysis of cultural aspects of livestock production in Thailand showed that more than 90 percent of the population follow the Buddhist tradition, which is prevalent in the daily life in manifold ways. Therefore, ethical concepts of Buddhism concerning the treatment of farm animals will be examined in this section. These concepts will be discussed in relation to the recent massive changes in Thai livestock production and in rural society. Open questions are whether a return to past values can be a meaningful measure in this respect or whether an enhanced responsibility for animals can be inferred from a high level of human intervention in the animal husbandry system.

3.3.6.1 Origin of Buddhism and essential scriptures

Buddhism originated in India as a religious movement founded in the sixth century BC by the Buddha (Bunge 1981, p. 94; Chapple 1993, p. 21) who probably lived between 560 and 480 BCE in North-eastern India (Conze 1990, p. 31). Moral concerns in the Buddhist thought refer to Buddha's writings and reflections on ethical questions formulated in later traditions (De Silva 1993, pp. 58-66) in different Indian languages (Bareau *et al.* 1964, p. 23). Distinct interpretations of the Buddha's teachings have emerged in the subregion. In Thailand interpretations, which were generated in the first century AD in Sri Lanka, are most relevant. They are

written in Pāli, a language linked with Vedic Sanskrit, and are called Tipitaka ("the canon or three baskets") (Bunge 1981, p. 94).

The Pāli canon form the basis of the early tradition of Buddhism called *Theravāda* (Bunge 1981, p. 94) and is the earliest collection of Buddhist scriptures available (Harris 1994, p. 9). The Pāli canon includes three baskets or sections. While the first basket is concerned with governing monastic life, the second basket embraces the discourses of the Buddha and the law (*dharma*) and the third basket presents the comments of Buddhist monks on Buddha's doctrine made in the centuries after his death (Bunge 1981, p. 95). The Pāli canon is a primary source for the study of Buddhism and provides guidelines for human conduct (De Silva 1993, p. 58).

3.3.6.2 Buddhist cosmology and cosmogony related to the notions of reincarnation and karma

The view of the world in a particular culture is closely related to the ethical system that governs human conduct. In the Buddhist world-view in which earlier Indian notions and new ideas are combined, the number of worlds and the space these worlds occupy is infinite (Bareau *et al.* 1964, p. 34). Traditionally, the world is regarded as „a golden disk floating on a mighty cosmic ocean. This ocean is in turn supported by a circle of wind which itself rests on space". Unlike in Christianity, the cosmic order discovered by Galileo and Copernicus had only marginal impact on the long-established Asian systems of thought. However, in Thailand approaches are made to connect Buddhist doctrine with Western scientific knowledge (Harris 1994, pp. 12-13). There is no distinct beginning of the world in Buddhism. Time and life itself neither begin nor end but continue over time (Chapple 1993, p. 19).

According to the early Buddhist tradition set down in the Pāli canon the natural environment and human morality are interrelated. The moral deterioration of human beings has an impact on the alterations bringing about conditions which are detrimental to the welfare of humans. This notion has been systematized in a theoretical framework in which the universe consists of five natural laws including physical laws, biological laws, psychological laws, moral laws and causal laws, respectively. "While the first four laws operate within their respective spheres, the law of causality operates within each of them as well as between them". The physical components of the cosmos (e.g. water, air, soil) have an effect on the biological growth of plants and animals in a particular region. Human beings who interact with nature develop certain which in turn determine moral standards. On the other hand, morals influence human psychology and also the biological and physical environment of a site. Therefore, the five laws express the intimate interrelation between the different elements of the universe, where alterations in one necessarily affect the other elements (De Silva 1992, pp. 20-21).

In addition, the Buddhist cosmos consists of five different kinds of being including humans, animals, ghosts, gods and denizens of hell (Bareau *et al.* 1964, pp. 32-33; Conze 1990, p. 47; Harris 1994, pp. 14-15). Since all these destinies (*gati*) are subject to the eternal circle of birth and deaths (*samsara*), they are destined to spend innumerable lives in each of the destinies (Harris 1994, pp. 14-15); each life continually takes new birth after the death (Chapple 1993, p. 19). This view of reincarnation, which is central in the Buddhist tradition, recognizes the relatedness between humans and these other beings (Waldau 2002, pp. 131, 139). As a consequence, pigs in the sty might have been our deceased parents in their previous existence. On the other hand, the notion of reincarnation does not only support the belief that all life is interconnected but also the discontinuity between humans and animals. Although a few notes suggest that animals can attain enlightenment, the dominant view is that only humans can attain it (Waldau 2002, pp. 139-141). Chapple (1993, p. 19) stated that although the hu-

man condition is the most attractive shape of life, its relation to other forms of life is clearly recognized.

Along with the concept of *samsara* the concept of *karma* is a core element of Buddhist morality. According to this concept people's present thoughts, words and deeds have an influence on their experiences in the future and, therefore, the law of *karma* promotes accountability for what is done under current conditions (Batchelor 1992, pp. 8-9). Since the notion of *karma* is adopted by all living beings and the progress of human and nonhuman beings is subject to certain rules (Waldau 2002, p. 138), the relatedness of beings is also expressed in this concept (see also the concept of *karma* in the Hindu tradition in the previous subsection). De Silva (1992, pp. 23-24) stated that the ideas of karma and rebirth support the Buddhist considerate attitude towards animals, because it is advisable to treat animals carefully, when late family members can be reborn as animals. However, the concept of *karma* also implies that any being on a lower level of the hierarchy has acted not as morally as any being on a higher level of the hierarchy. This might affect the human treatment of animals negatively, since it is suggested that a lower step of existence is the result of the animals' previous way of living and the decisions made (Waldau 2002, pp. 139-141).

In this context, it is worth to be noted that in peasant life a number of spirits, particularly spirits belonging to the category of phi, play an important role with respect to the well-being of humans. Phi is ascribed to trees, hills, water, animals, the earth etc. Violation of moral standards and codes of human behaviour may be punished by these spirits by causing sickness or bad luck in the violating person. Belief in spirits and the performance of ritual ceremonies attributed to phi is in contrast with the doctrine of *karma*, because the responsibility for an individual's destiny is not on its deeds, but on spirits or witches. For example, the propitiation of a human beings *khwan* (body spirit or life soul) is often carried out in rural families in Thailand. Any ritual ceremony directed to the well-being of a human, animal, or plant is addressed as the making of *khwan* (Bunge 1981, pp. 98-101).

Nevertheless, the notion of *karma* has high priority in the Thai world-view. Both the concept of *karma* and the idea of *samsara* or transmigration (recurrent births after death) have derived from Indian thought. The Buddha attached the concept of *karma* more powerfully to ethical consequences, i.e., good deeds result in good consequences and evil deed in evil consequences. The conception of *karma* and *samsara* further implies that all forms of life are interconnected, because the entirety of good and bad acts is transmitted to another entity after death (compare these concepts in the Hindu tradition). An individual can be reborn as an animal, a human being, a ghost, a demon, or a god, however suffering is inevitable. Freedom from suffering can only be attained in the state of *nirvana*, when the individual is free from selfhood and *karma* looses its impact (Bunge 1981, pp. 95-96). The Buddhist idea of suffering and its ceasing will be reflected on in more detail in the following subsection.

3.3.6.3 The notion of dukkha and the Four Noble Truths and the Noble Eightfold Path

The notion that all beings go through various stages of suffering (*dukkha*) is a central insight in the Buddhist tradition (Schweer 2002, p. 274). In the Four Noble Truths, which outline his teachings (Schumann 2004, p. 132), the Buddha described different stages of suffering (Bareau *et al.* 1964, p. 33; Bunge 1981, p. 96; De Silva 1993, p. 60; Schweer 2002, p. 274). The first Noble Truth refers to the existence and to kinds of suffering. *Dukkha* involves physical and psychological states, such as birth, old age, illness, death, sorrow, pain, being tied disliked things or unmet wants. Since conditions as birth, old age, disease and death are part of and inseparable from an individual's life, suffering cannot be avoided in any form of existence (Schumann 2004, p. 133). Therefore, *dukkha* is universal and is shared with other sentient beings. While the second Noble Truth maintains that *dukkha* is caused by craving and

desire, the third Noble Truth acknowledges that *dukkha* can be ceased by the elimination of craving. Finally, the fourth Truth points out the way to end suffering by following the Noble Eightfold Path (Gosling 2001, pp. 69-70).

The Noble Eightfold Path is a means to overcome suffering. Through the Eightfold Path the „ultimate moral ideal of Buddhism“ can be attained. The mutual effects of wisdom, ethics and concentration lead to the enlightenment of the believers. This Path consists of eight components, which should ideally work together (De Silva 1993, p. 60; Gosling 2001, p. 70; Schweer 2002, p. 275). Both the first and the second step of the Noble Eightfold Path demand wisdom with regard to the teaching of Buddha. While the first step requires believers to pay attention to “right view – understanding of the Four Noble Truths”, the second step is directed to “right thought – freedom from lust, ill will, and cruelty”. Being significant ethical norms, the third, fourth and fifth element of the Eightfold Path include “right speech – abstention from lying, gossiping, harsh language, and vain talk”, “right action – forbidding killing, stealing, and sexual misconduct” and “right livelihood – requiring that a living be earned in a way not harmful to living things”. Finally, mental training is achieved by following stage 6, 7 and 8. These involve “right effort – urging the avoidance of overcoming of evil thoughts and the encouragement and maintenance of good thoughts”, “right mindfulness – requiring one to pay close attention to all states of one’s body, feeling, and mind” and “right concentration – calling for concentration on a single object to bring about special states of consciousness in meditation” (Bunge 1981, p. 96; De Silva 1993, p. 60; Schweer 2002, p. 275).

3.3.6.4 The first precept and the principle of non-injury (ahimsa), compassion and loving-kindness

Bunge (1981, pp. 96-100) alleged that compliance with the Noble Eightfold Path is a prerequisite to achieve nirvana. Since ordinary life does not permit to carry out all aspects of the Noble Eightfold Path, the extended ethical obligations laid down in the Path were reduced to Five Precepts (*pañca-sila*). This minimum code of Buddhist ethics is expected to be followed by every lay person (De Silva 1992, pp. 23). The precepts or fivefold principle require abstention from killing and hurting living beings, abstention from stealing, abstention from sexual misdemeanour, abstention from lies and insults and abstention from taking intoxicants (De Silva 1993, p. 66; Gerlitz 1998, p. 35; Gosling 2001, p. 70). In the first precept non-injury to living beings is proclaimed (Chapple 1993, p. 22), which includes compassion and loving-kindness towards all life (De Silva 1992, pp. 23).

The idea of non-injury (*ahimsa*) is not only part and parcel of the first precept but also the essence of right action and, therefore, one element of the Noble Eightfold Path (Harris 1994, pp. 25-26). Although the principle of *ahimsa* is crucial in many historical Indian religions, Vedic texts provide evidence of the practice of ritual animal slaughter. In contrast, the Buddhist tradition refrains from sacrificing animals (Harris 1994, pp. 16-17). The Buddha rejected both the performance of animal sacrifices and the pleasures of hunting and condemned deliberate cruelty to animals, infliction of hurt to animals and their killing (De Silva 1993, p. 66).

Respect for animals in Buddhist thought derived from the view that all beings are intimately related (Harris 1994, p. 26), as addressed in the notions of reincarnation and *karma*. The interrelatedness of various forms of existence is based on the assumption that “each and every human being has experienced a wide variety of animal births in prior incarnations and that if one makes a mistake of significant proportions during human birth that one will again be born as an animal in punishment for wrongdoing” (Chapple 1993, p. 42). Additionally, to do any harm to other beings may contribute to the suffering of one’s parents and has therefore to be disapproved (Harris 1994, p. 17).

On the other hand, a number of Buddhist texts stress the importance of practicing *ahimsa* with regard to a favourable rebirth. Cruelty to animals results in a lower level in the hierarchy of beings in the subsequent existence and a human being may be reborn as an animal or even a denizen of hell. Thus, the principle of non-injury (*ahimsa*) is primarily directed to a person's spiritual development, but not to the well-being of animals. As far as the treatment of animals is concerned, the doctrine of non-injury is essentially instrumental. Nevertheless, a human's compassionate attitude towards animals positively influences the welfare of animals (Harris 1994, pp. 17, 26).

Buddhists are expected to follow the principle of non-injury in dealing with other creatures. The implementation of this principle strongly depends on a person's societal status (Harris 1994, p. 26). For members of the *sangha* killing of animals is strictly forbidden (Gerlitz 1998, p. 37) and the Buddha prohibited monks from digging the ground to save insects living in the earth (De Silva 1993, p. 66). Lay followers were recommended by the Buddha to take serious care of the welfare of domestic animals and not to milk dairy animals dry. Although farmers are obliged to protect livestock, some injury may occur due to the nature of work (Harris 1994, pp. 20, 26).

In addition, the Buddhist tradition attaches great importance to the virtues of compassion and loving-kindness (Gerlitz 1998, p. 13). For Batchelor (1992, p. 4) compassion is "the wish to alleviate suffering and loving-kindness "the wish for others to be happy". Quoting a passage of the *Metta Sutta* (Pali canon), Waldau (2002, p. 133) claimed that „'[j]ust as a mother would protect with her life her own son, her only son, so one should cultivate an unbounded mind towards all beings, and loving kindness towards all the world'". Harris (1994, pp. 19, 21) raised the objection that although the cultivation of loving-kindness (*metta*) is an important element of the Buddhist path, the practice is essentially directed to the spiritual progress of the practitioner not to the recipient of the practice, which may be an animal.

Waldau (2002, p. 147) alleged that the conduct of the Buddha Himself is of particular relevance to Buddhist believers, because it demonstrates the ideal of moral behaviour and ultimately provides guidelines for human morality. Chapple (1993, pp. 22-23) maintained that the manifold references to animals in Buddhists scriptures indicate the Buddhist commitment to the principle of non-injuring. For example, in the Jātakamālā didactic tales the Buddha in retrospect narrates that he "feels compassion when he sees a tired farmer plowing the earth, a bird eating a worm dredged up by the plow, and the welts inflicted on the back of the ox by the farmer; the weariness of both beast and man helped initiate his quest for total awakening".

According to De Silva (1992, p. 23) human loving-kindness towards animals was illustrated in the Nandivisala Jataka. The Buddha tamed a wild elephant by the power of loving-kindness. Humans and animals can live without fear of each other, when sympathy and compassion to all beings is practiced. According to Chapple (1993, pp. 23-24) some passages in Buddhist literature report on animals that are capable to listening and learning the doctrine of the Buddha and portray animals, which sacrifice themselves for the sake of humans. In turn, human beings are described who give their lives in order to safe an animal.

Despite the strong concern for them, in the Buddhist tradition animals are placed on a low stage in the hierarchy of beings and belong to the unfavourable destinies (*gatis*). In comparison with humans, animals are considered as less intelligent but more vicious. The realm of animals is something to be wary of and animals cannot progress effectively on the Buddhist path (Harris 1994, p. 20). Hence, in the Pāli canon merely limited capabilities are attributed to animals. Although farm animals are believed to possess consideration, wisdom is denied in them (Schmithausen cited by Waldau 2002, p. 132). Waldau (2002, p. 10) concluded that in the general Buddhist view animals are regarded both intellectually and ethically inferior to human beings.

3.3.6.5 Past and present-day legislation

Asoka (274-232 BCE), an Indian emperors who converted to Buddhism (Chapple 1993, p. 24), made the attempt to integrate the First Precept into his rule and enacted a number of laws, which punished cruelty to animals (Gerlitz 1998, p. 37; Waldau 2002, p. 143). Asokas laws demanded a decrease in meat consumption, curtailing hunting, establishing animal hospitals in which old and sick animals were cared for and watering points for animals along the roads (Chapple 1993, p. 25; Gerlitz 1998, pp. 37-39). The texts of these edicts on rocks and pillars that were erected all over Asoka's realm express deep respect for animals (Waldau 2002, p. 143). Excerpts of these edicts, which still stand throughout India, were translated by Sen (1956, pp. 154-156) cited by Chapple (1993, pp. 25-26):

Formerly, in the kitchen of the Beloved of the gods, King Priyadarsin (Emperor Asoka), many hundred thousands of animals were killed every day for the sake of curry. But now when this Dharma-rescript is written, only three animals are being killed (every day) for the sake of curry (viz.) two peacocks (and) one deer (and) the deer again, not always. Even these three animals shall not be killed in the future.

And on the road, wells have been caused to be dug and trees have been caused to be planted, for the use of animals and men.

Those she-goats, ewes and sows (which) are either with young or are giving milk (to their young), are inviolable, and (so) also (are) those (of their) young ones which are less than six months old….

One animal is not to be fed with another animal … on every fast-day, fish are inviolable and are not to be sold…[on specific days] he-goats, rams, boars, and other animals that are usually castrated are not to be castrated…[and] the branding of horses and bullocks is not to be done.

At present there is no effective animal welfare legislation in Thailand. However, laws exist with respect to animal health and hygiene in the livestock industry, though its enforcement is poor (Cox and Varpama 2000, p. 8).

3.3.7 Essential features of the moral treatment of animals in tropical livestock production

The exemplary analysis of the animal's moral status in different cultures revealed that in all societies regarded animals have been a matter of interest in the respective local ethic. These moralities are embedded in the particular religious-philosophical world-view. In the following comparative overview an attempt will be made to identify both differences and similarities in the treatment of farm animals in different cultures in terms of

1. the moral relevance of animals
2. ethical obligations towards animals
3. killing of livestock for food
4. reflections on the animal sacrifice

Finally, the view of ethical relativism will be discussed with reference to the implementation of Western moral norms in agrarian societies of the Third World.

3.3.7.1 Ethical concern for animals but distinction between humans and animals

One of the most basic questions with reference to animal ethics is: Are farm animals' objects of moral concern? In the West African Fulbe the close emotional relation to cattle (see Mtetwa 1982, p. 18) implicitly attaches moral concern to the animals. The value system of the Fulbe pastoral people includes a set of right behaviour (*laawol pulaaku*, the *Fulani Way*) which is directed to the care of cattle and mirrors the strong interest the pastoralist have in the welfare of their animals (see Stenning 1994, pp. 55-56). This behavioural guide, the *Fulani Way*, implies that animals, particularly cattle, are objects of moral concern. Moreover, the Fulbe ethic is constituted by Muslim belief. According to the Quran all creatures have a common origin (are made from water) and both human beings and animals live the life God has predetermined for them (see Forward and Alam 1994, pp. 83-84). In this respect the Islamic notion of creation confirms equality of all creatures. However, the Quran also alleges that human beings have dominion over animals, because they are capable to make moral judgements (Forward and Alam 1994, pp. 91-92). Modern interpretations that weigh up the arguments (e.g. Özdemir 2003, pp. 25-28) advocate concern for animals and attach importance to the human responsibility for animals.

Concern for llamas and alpacas in the Andean pastoralist's conception of the world is expressed by moral values that integrate humans, animals, nature and cosmos (see Webster 1973, p. 131). The human-camelid relationship was found to be characterized by mutual dependence on each other. Additionally, in the Andean world view feelings (*sentimiento*), memory (*recuerdo*) and intelligence (*mentalidad*) and also a soul (*alma*) are attributed to animals. Due to these characteristics animals obtain human attention, care and protection (see Göbel 2001, p. 177). On the other hand, recent concepts of the cosmos of Andean inhabitants differentiate various worlds. There is a division of worlds where human beings go (*han pacha*) and where animals go (*pueblos de los animals),* if they have died (see Gareis 1982, pp. 72-73). This emphasizes the distinction being made between humans and animals in the Andean pastoral system.

The Indian world-view is closely interwoven with the theory of transmigration. Equal validity of animal and human life is implied by the possibility that a human being can be reborn as an animal in a future life and thus expresses reverence towards animals (see Choudhury 1994, p. 74). What makes animals objects of ethical concern is their capability to experience pleasure and pain (see Gottwald 2003, p. 2). Additionally, in the *puranas* intelligence is attributed to mammals and birds. Though, human beings are distinguished from animals in that they possess the capacity to achieve spiritual wisdom or *Ultimate Knowledge* (see Choudhury 1994, p. 75). At the same time *karma* theory disapproves human domination of domesticated animals, since they are regarded as souls in other states of *karma* (see Coward 1998, pp. 41-42). The relationship between human and nature was described as lacking dominion and exploitation (see Choudhury 1994, p. 69).

Similarly, in the Buddhist tradition the view of reincarnation is central and recognizes the close relation between humans and other beings (see Waldau 2002, pp. 131, 139). Since, according to the concept of transmigration, late family members and friends can be reborn as animals, the kind treatment of animals is an obligation (see De Silva 1992, pp. 23-24). Despite strong concern for them, in the Buddhist world-view animals are positioned on a lower stage in the hierarchy of creatures than humans and are regarded as unfavourable destinies (*gatis*). In comparison with humans, animals are considered as less intelligent and not capable to advance on the Buddhist path successfully (see Harris 1994, p. 20). Therefore, human beings are regarded both intellectually and morally superior to animals (see Waldau 2002, p. 10). However, although the human condition is the most attractive shape of life, it remains related to and dependent upon all other beings (see Chapple 1993, p. 19).

The previous analysis showed that all cultures included in the study have developed a human-animal relationship which is interwoven with their particular world-view. There is evidence that concern for animals in tropical livestock production is part of the religious ethic and determines codes of human conduct. Animals are viewed as objects of moral importance in all societies considered. Moral relevance of animals can primarily be inferred from the fact that rules for the treatment of livestock are incorporated in local moralities. Concern for animals is founded on the argumentation that equality of all beings is constituted with respect to common origin or destiny and mental capabilities are attributed to animals. Though, the descriptions of the later vary in extent and variability from case to case. However, it is important to note that traditional concepts have been eroded in the course of time (e.g. Gefu 2005, personal communication).

Furthermore, the analysis revealed that in all the cultures studied animals are ascribed to a category that is distinct from humans. In the Muslim, Hindu and Buddhist tradition elaborate intellectual capacities of human beings are the crucial criteria for their superiority in the hierarchy of beings. For the Andean tradition this could not explicitly be confirmed. In the Andean ethic merely a distinction of humans and animals was ascertained based on the different "worlds" to which late human beings and animals go to. However, it is assumed that also local Andean morality makes a distinction between human and animal mind. As Christian doctrine, also the Islam proclaims human dominion over animals, while Hindu and Buddhist ethics deny it.

3.3.7.2 Moral duties towards animals

According to Muslim doctrine humankind have moral duties towards animals, which are set down in the Schari'a. The Prophet Muhammad forbids cruel treatment of animals: „They are not to be caged, or beaten unnecessary, or branded on the face, or allowed to fight each other for human entertainment. They must not be mutilated while they are alive [...]" (see Forward and Alam 1994, p. 92). Additionally, pastoral Fulbe morality emphasizes *hakkiilo* (care and forethought) that demands all conceivable endeavours to meet the livestock's needs for adequate pasture and water (see Stenning 1994, p. 55).

Likewise, in the Andean ethic humans have moral obligations towards domestic animals. Right behaviour with regard to herd animals is indispensable to attain the benevolence of Mother Earth, since llamas and alpacas can be withdrawn by the Pachamama and gradually disappear in ponds or springs, if they are mistreated (see Flores Ochoa 1975, p. 16 and 1977, pp. 219-220 cited by Gareis 1982, pp. 77-78). Wrong human conduct, such as inappropriate animal care or disregard of the camelids' needs, may cause the Pachamama to decrease herd productivity (see Göbel 2001, p. 178). In addition, any intervention (e.g. shearing, castrating and slaughtering) that gives rise to unnecessary pain must be bound to strict necessity and both the permission of the Pachamama and forgiveness of the animal are asked for (Göbel 1999, pp. 223-224). In order to prevent harm in individual herd animals, sacrifices are offered to invoke the benevolence of the Pachamama (Göbel 2001, p. 178).

The treatment of farm animals in the Indian tradition is founded on the principle of *ahimsa* (non-injury), which claims to avoid injury to all creatures. This concept contains the prohibition of cruelty to animals, not to cause them pain and requires placing farm animals in an environment that is favourable for their well-being. Non-difference of all living entities is a precondition for the performance of non-violence and creates both awareness of and sensitivity towards the needs and wants of other creatures (see Chapple 1993, p. 19; Choudhury 1994, p. 76). The idea of *ahimsa* also includes the rejection of killing of animals and has in parts led to vegetarianism in Indian society (see Chapple 1993, pp. 10-11; Choudhury 1994, p. 76).

Alike, Buddhist ethics integrates the principle of *ahimsa* as well as compassion and loving-kindness towards all living creatures (see De Silva 1992, pp. 23). The Buddha did not only condemn deliberate cruelty to animals, infliction of hurt and killing of animals but also rejected animal sacrifices and hunting (see De Silva 1993, p. 66). Buddhist farmers have a duty to treat livestock carefully, though some hurt is unavoidable in animal keeping (Harris 1994, pp. 20, 26). Asoka, the Buddhist emperor, took the moral rule of non-injury very seriously and enacted various laws, which prohibited cruelty towards animals (see Gerlitz 1998, p. 37; Waldau 2002, p. 143). Although the principle of non-injury primarily aims at the favourable rebirth of humans and not explicitly at the well-being of animals, a compassionate attitude toward animals will affect them positively, independent of a person's intention (see Harris 1994, pp. 17, 26).

It can be concluded that in terms of moral obligations towards animals all moralities considered possess far-reaching concepts for the treatment of animals, which are partly set down in laws and regulations. Although these ethical norms derive from various cultural and religious backgrounds, interestingly, the core components of all morals are widely identical. They disapprove intentional cruelty towards animals, causing them unnecessary pain or injury and demand the fulfilment of animal needs. Implicit in these norms is the duty to treat livestock respectfully, considerately and in harmony with their nature. In the face of the variety of ethical guidelines available, any mistreatment of farm animals must be ascribed to the ignorance of the local ethic and the missing implementation of ethical and legal norms in rural communities.

3.3.7.3 The issue of killing of animals for food

Unlike animal keeper in modern livestock production systems in the West or fast-developing countries, such as Thailand, those in traditional agrarian systems in the tropics widely abstain from killing of farm animals for food, except in a situation of need. In these systems the use of milk, fibre, or draught power predominates. Pastoralists in the Sahel or the high Andes and Indian smallholder, who depend on the draught power of their oxen to a large extent, usually slaughter an animal only at the end of its productive life, if it is ill, or if it is expected not to survive the strains of the dry season movements.

In view of the important role animals play for human thriving by the provision of animal products and work, a close bond between humankind and animals has developed. Marschall (1985, pp. 68-69) pointed out that despite the affectionate interrelation, under certain conditions animals must be killed for food. In order to overcome this conflict, rituals are performed, which are intended to repress the fact of killing an emotionally tied animal. In the history of humankind this problem was resolved by various strategies: The killing of animals on the hunt is closely connected with repression by shifting the blame onto somebody else and begging the animal's forgiveness. For example, the Mbuti hunter and gatherer in the Kongo rainforest sing after hunt:

Our spears have got astray, o father elephant
We didn't mean to kill you, […]
Not our warrior ended your life,
The destiny decided that your hour has come,
Hence, do not return to devastate our huts,
O father elephant […]

(Hamm 1984, p. 509 cited by Marschall 1985, pp. 66-67; own translation)

Likewise, animal slaughter in sedentary or semi-sedentary communities is associated with negative emotions and thus in many traditions animal slaughter is tied to certain rules. Fulbe

pastoralists, for example, are known to dislike the killing of cattle (see Raay 1974, p. 4 cited by Duda 1984, p. 118). Marschall (1985, pp. 69-70) argued that for husbandmen an apology or justification that claims that an animal's death was caused by strangers is inappropriate, because domesticated animals are kept close to human settlement or even under the same roof. Hence, in animal keeping cultures the apology is replaced by the performance of the sacrifice in order to repress the inevitable killing of intimately related farm animals. The sacrificing of one or a few herd animals for the Godhead or the ancestors permits to rule over the remaining animals. Moreover, the ritual sacrifice ensures the benevolence of the Godhead as well as the well-being and successful reproduction of the herd.

The association of animal sacrifices and rites of fertility with the well-being of animals is particularly discernible in the formerly considered llama and alpaca breeding system. Central in the Andean system is the pastoralist's interest to maintain fertility, prosperity and well-being of their herd animals on which they economically depend. Sacrifices for the numina involve the extracting of the heart of the body of individual animals - a practice that is applied in both circumstances, if animals are killed for sacrifice and for food. It is interesting to note that the practice of animal slaughter is said to prevent llamas and alpacas from suffering and the slaughterer from punishment (see Gareis 1982, pp. 138-139). According to the Muslim tradition God subjected animals to humans and permitted their killing for food. However, the consumption of meat requires the killing of animals in a prescribed manner and the slaughtering of pigs is entirely prohibited (see Forward and Alam 1994, p. 93). In the Islamic value system animal slaughter is regarded as a devotional act that is regulated in the Schari'a. Severing the animal's throat with a rapid and clean cut aims at protecting the animal from unnecessary pain and suffering (see Forward and Alam 1994, pp. 94-95; Gottwald 2003, p. 7). While the Islam prohibits the consumption of pork, the Hindu ethic strictly forbids the killing of cattle and the consumption of beef (Harris 1989, p. 44). The slaughtering of cows is permitted only within ritual ceremonies; other species may be slaughtered without any restriction (see Gerlitz 1998, p. 55). In Buddhist communities there is no prohibition of meat consumption, though Buddhists are expected to follow the concept of non-injury in treating farm animals. In contrast to the Indian tradition, the religious practice in Buddhism refrains from sacrificing animals (see Gerlitz 1998, p. 37 and Harris 1994, pp. 16-17).

The prohibition of pork or beef was found to be a result of the ecological conditions in areas, which do not favour the raising of pigs and cattle, respectively for meat and is therefore not primarily directed to the well-being of these species. While on the Indian subcontinent centuries ago human population growth had induced a competition between cattle and human beings for food that had forbidden the food wasting fattening of cattle, in countries where the Islam is prevalent climatic conditions are unfavourable for the raising of pigs (Harris 1989, pp. 44-88). However, the ban of slaughter on a single species may also express the unwillingness of killing animals and the close attachment towards the animal world, which then converges in a particular species.

Marschall (1985, pp. 71-72) criticized that in comparison with pastoral and farming communities in industrialized societies the relation between humans and animals is characterized by repression and splitting of consciousness. While an anti-cruelty ethic is vividly practiced in relation to individual animals or pets, hundreds of thousands of animals living under inhumane conditions are anonymously killed and treated cruelly for the food and cosmetic industry. In this regard, Marshall advocated to grant both animals and the nature their own right and not to take the risk of a lifeless nature with humankind being part of it.

Mass production in commercial livestock units and slaughtering on the production line has lead to a loss of respect for life, which is prevalent in more traditional animal husbandry systems. In addition, Rudolph (1972) cited by Gerlitz (1998, p. 154) detected that in various cultures there is a high sensitivity for the feeling of blame regarding secular killing of animals or killing of animals for food. The loss of such sensitivity is characteristic for the human treatment of livestock in industrialized animal agriculture, although human guilt persists, when

animals are killed for food. Rudolph further pointed out that guilt and necessity are intimately connected, because slaughtering of livestock is vital for human life. Nevertheless, dealing with livestock is never without guilt and has to be recognized.

3.3.7.4 Reflections on the animal sacrifice

At first glance sacrificing animals appears to be ambivalent. While, on the one hand, strong regard is attached to livestock, on the other hand, some animals are killed in a gruesome manner during sacrificial ceremonies. However, if the spiritual background of the sacrifice is explored, the seemingly contradiction begins to dissolve. According to Baudrillard (1994, p. 134) cited by Bleakley (2000, p. 12) all myths tell that sacrificial animals possess divinity and nobility and are therefore not taken as real animals. Giegerich (1993, p. 7, 14) cited by Bleakley (2000, p. 13) further explained that the act of ritual slaughtering created a moment of distancing and reflection

> in which the human gained distance from the purely biological life and opened up a 'clearing' that first determined cultural life. The point of the slaughter is that such a moment of distancing and reflection is inherent to the *act*, and not an after-thought. Psychology and religion begin in the act of sacrifice, prior to the *idea*. The opening of the wound is also the opening of the soul, or the establishment of psychological life as opposed to a merely biological existence. Through animal sacrifice, as a religious act, 'enfleshed' biology was replaced by 'irreal logos or soul'.

Thus, ritual slaughter is regarded as non-violent because of religious thought-patterns and explanations that approve such actions. Analyzing the animal sacrifice Giegerich (1993, p. 7) cited by Bleakley (2000, p. 13) claimed that in the European past and elsewhere until recently the animal sacrifice is accompanied by "a range of public activities such as the signing of treaties, building works, and religious festivals". Giegerich further pointed out that in the past ritual slaughter was a public event, while today slaughtering has become an entirely secular experience within the slaughterhouse.

When analyzing the relation between the animal sacrifice and the human-animal relationship in the Jewish tradition Hanna Rheinz focused on the basic principles (that are partly shared with other traditions). Hence, first of all, her statement is provided in place of those traditions discussed earlier in this thesis: According to Rheinz (2004, p. 17) Judaism considers the ritual slaughtering of animals as a considerate killing method and Jewish religious laws as a relic of the biblical commandment for animal protection. The Torah indicates the early dialogue between human and animal through

1. the ritual slaughter (schechita) of the animal by severing the aorta with a single cut,
2. the food laws (kaschrut) that limit the consumption of meat and the killing of animals, and most important
3. animal slaughter and meat consumption in relation to rituals, which expresses guilt and responsibility. When the taboo to kill is broken, both guiltiness and responsibility are reactivated through gratefulness and reconciliation with the animal world.

For Rheinz (2004, p. 17) the taboo for killing was central in the biblical dialogue between human and animal: "[…] because the life of every living creature is its blood, and I have forbidden the Israelites to consume the blood of any creature, because the life of every creature is its blood: whoever eats it is to be cut off" (Leviticus 17:14). From these words the Torah deduced the prohibition of every destructing deed against life including cruelty to animals, mutilation (also castration) and the senseless devastation of plants. In accordance, ritual slaughter that aims at the soul, the animal's capability to feel and to suffer becomes a spiritual act, which requires the slaughterer (schochet) to be law-abiding and of strong character.

Similarly, the Muslim slaughterer is obliged not to cause the animal unnecessary suffering because of God's mercifulness. This religious principle forms the spiritual basis for the slaughter process, which is carried out in the name of God. The prophet Mohammed said: "[...] if you slaughter, than slaughter in the best way and sharpen the knife and spare the slaughter animal unnecessary suffering" (own translation). Aorta as well as gullet and trachea should be severed simultaneously by a single clear cut with a sharp knife. Moreover, Muslim scholars recommend the slaughterer to take rest from professional exercises after some time in order to cultivate the feeling of mercifulness and respect for life (Ilkilic 2004, p. 17).

Ritual slaughter was also practiced in early Christian communities, but over the centuries the slaughtering of animals has become a completely secular concern. Though, in the modern age a more responsible attitude towards animals and nature has evolved, Christian morality lacks ethical reflection on animal slaughter and meat consumption in comparison with Jewish and Muslim ethics (Baranzke 2004, p. 17). In the Western world moral reflection on the killing of animals is replaced by stunning and decapitation to ensure the painless slaughtering of livestock. According to Baranzke the issue of killing is evaded and the insistence on stunning only fills a gap in the Christian-secular culture.

Alike, in the Hindu tradition a painless slaughtering of animals within a ritual context is required. It is maintained in the Rgveda 1,162,20 sqq that a horse, when sacrificed neither dies nor is its body damaged by the slaughterer. The sacrificed horse enters the next world and receives salvation, just as the human beings whose guilt it atoned for. As a consequence, the sacrifice is approved, because its motive is founded in a Meta ethic or a divine origin (Gerlitz 1998, pp. 57, 58).

On the other hand, Simoons and Simoons (1968, pp. 170-171) reported on the pain imposed on the mithan, which has a primary role as sacrificial animal in some ethnic groups in the mountainous areas of easternmost India. According to Simoons and Simoons (p. 183)

"[t]he traditional Hindu, recognizing the mithan as a relative of common cattle, is shocked at the sacrifice of mithan and offended at the brutality so often involved. The result is pressure against mithan sacrifice and, where possible, modification of the traditional ceremonies requiring it".

Simoons and Simoons (pp. 179-180) described various practices of sacrificing mithans. Strangulation presumably aims at keeping the animals breath which is thought to be the location of the soul and the life. With the aid of a wooden or bamboo rack and a rope tied around the animal's neck the mithan is pulled across the rack and is raised until it suffocates. Another method to sacrifice the Asian bovine is the hitting in the neck of the tied animal with an axe. "Before the animal is dead a bamboo device is forced into the throat to collect blood. Then the creature is struck again until it dies."

Simoons and Simoons (1968, pp. 170-171) maintained that rituals are being accomplished to ensure human prosperity, fertility, and well-being and it is related to religious belief (p. 182). Smith (1925, p. 103) cited by Simoons and Simoons (1968, p. 182) interpreted the deliberately cruel ways of sacrificing the mithan in a certain ethnic group as "intended to intimidate the beast's spirit and to prevent if from wreaking such vengeance". It is, however, important to note that the person who carries out the sacrifice appeals to the mithan for forgiveness or attempts to pass the blame on to another person (Mills 1926, p. 390 cited by Simoons and Simoons 1968, p. 182). In some cases the sacrificer engages in purification or punishment after performing the deed (Simoons and Simoons 1968, p. 182).

From an animal welfare point of view, it is necessary to clarify whether physiological or psychological suffering is invoked in the animal sacrifice. It can hardly be denied that the mithan suffers, when sacrificed in the described way. However, as mentioned earlier, in many religions ritual slaughter is demanded to be painless, that is, the most rapid death is caused to

the animal, when conducted in the prescribed manner. Though, the prescribed rules may not always be strictly followed. In terms of animal welfare a critical reflection on the painlessness of the animal sacrifice is necessary and those forms of killing that are painless for the animal are to be preferred. Such a debate and decisions about alterations in societal practices is primarily the task of those communities in which the practice has evolved.

When throwing a glance at market-oriented, large-scale livestock production, the necessity to reconstitute the human-animal relationship becomes obvious. In this context, the famous European intellectual George Steiner quoted by Bleakley (2000, pp. 11-12) complained that modern livestock production has shifted from an affective relation with domestic animals to an economic or utilitarian relation that involved a change of values. Steiner demanded "a shared responsibility for the mismanagement of our relations to the cattle that we breed to feed us, and with the animal world in general". Interestingly, Steiner reminded that in Europe centuries ago cattle were not merely regarded as a functional unit but were honoured far beyond their utility. The cattle sacrifice was a major element in Indo-European cults.

In many European and non-European countries the animal sacrifice has gradually altered into animal slaughter and livestock agriculture and processing industries are guided by economic goals to a very large extent (Bleakley 2000, p. 17). In this context, considerations about the restoration of an affective human-animal interaction and of animal rites were made. Hillman (1994, p. 13) cited by Bleakley (pp. 15-16) suggested that the reconstituting of animal rites could be related to a human-animal relation, which is based on an *animalizing imagination*. The "[c]onscious animal sacrifice of a sacred nature, rather than animal slaughter - does [...] realize [...] the animal soul, now released as spirit animal and familiar." In order to approach this concept of *animalizing imagination* Bleakley proposed:

> If the 'real' can be psychological, conceptual, imaginal, linguistic, as well as literal; then the 'animal' can be sign, symbol, Metaphor, image, thought, felt presence, memory, notion, intuition, allegory. [...] Also, if we give equal ontological status to image and object (the fact that we separate these categories in the first place points to an ontological fallacy introduced by Cartesian opposition between objects of the world and the sceptical mind that supposedly apprehends those objects, or casts their independent existence into doubt) then the animal in the dream is as 'real' as the cat on the sofa, or the eel in the river.

Hillman (1994, p. 18) cited by Bleakley (2000, p. 17) rejected the view that the honour of God is exclusively bound to the act of ritual slaughter. "The animal god is not raised to awareness just by the act of the spilling of its blood, but [...] may be 'present anywhere to the heart of sensuous imagining and the mind's eye that sees imagistically, imaginatively.'" According to Hillmann animal rites can also be constituted by such psychological understanding. It is, however, worth to be noted that even if animal rites are widely implemented, as, for example, in the Jewish tradition, the surrounding of present-day gigantic processing industries may be inadequate to carry out ritual ceremonies. Rheinz (2004, p. 17) maintained that ritual slaughter under conditions of industrialized slaughter houses is incompatible with the notion of painless and compassionate killing of animals. As a consequence, Jewish animal conservationists often become vegetarian.

Industrialized livestock production units have increasingly been established in developing countries as well (see, for example, the commercial pig and poultry production in Thailand in this study). Accordingly, reflections on how to overcome the detected lack of affective human-animal relationship are vital for livestock agriculture in these regions and new challenges and questions have to be addressed: Is the traditional animal ethic appropriate to meet the needs of modern livestock production systems? Can the traditional animal ethic be adapted to the altered conditions or is there a necessity for an entirely new conceptual approach? Can animal welfare laws and/or international trade agreements serve as regulating instruments?

3.3.8 The implementation of norms as a question of the paradigm and the view of ethical relativism

The initial question in this multicultural perspective on the moral status of farm animals referred to the adoption of Western norms in societies having distinct cultural backgrounds, as a possible consequence of international trade agreements. Although in all livestock production systems investigated moral concern is attributed to animals from which duties for human beings can be deduced and rules for the killing of animals and meat consumption are established, in detail these corresponding features widely differ. The variety of moralities for the treatment of farm animals underlies different world-views, which have shaped over a long time. Based on the traditional world-view, in these cultures particular attitudes towards and symbolic meanings of animals have evolved (e.g. carrying out ritual ceremonies for the prosperity of the llama herd, abstaining from killing cows in India, which symbolizes maternity).

On the contrary, the contemporary debate on animal welfare is mainly founded on philosophical discourses and scientific investigations conducted during the last fifty years in the Western hemisphere. The roots of this discussion can be dated back to the sixteenth century when, induced by the findings of Galilae and Copernicus, a new view of the world or *paradigm* came into being, which is still prevalent. In the philosophy of science the term *paradigm* refers to “a pattern of thinking, a set of background assumptions taken for granted” (Mautner’s dictionary of philosophy). However, there was concern for animals in the Western Christian tradition even before the modern age has arisen, as verified in the writings of St. Augustine and Aquinas. The ideas of these early philosophers necessarily must have been based on another paradigm.

If the focus is extended not only on a temporal but also on a spatial scale and the human-animal relationship in other regions of the world is considered, it becomes obvious that other paradigms yet exist. These views, for example, include the Andean concept of Mother Earth and mountain spirits or the notion of transmigration in the Hindu and Buddhist philosophy. Taking into account different cultural traditions, Waldau (2002, p. 13) argued that “each of these traditions [in this case the Buddhist and the Christian tradition] has its own particularly interesting and paradigmatic complex of ideas about other animals. These often are unstated, operating as ‘background’ or ‘foundation’ in ongoing debates”. As a result, the reflection on moral concerns in the assessment of animal welfare in tropical livestock production is a matter of the paradigm or the principle view of the world, which determines the basic categorization of the problem.

To recapitulate, the various ethical standards concerning the treatment of animals are regarded to be specific to any culture and are manifested in religious traditions, laws, and policies (Orlans *et al*. 1998, p. 4; Pieper 2000, p. 55). Pieper (pp. 55-56) claimed that moralities and moral norms are part and parcel of a community’s cultural identity. In the Western tradition, the justification of these norms is based on general principles or theories (The New Encyclopaedia Britannica 1997, p. 578), which claim universal validity (Williams 1972, p. 37; Rollin 1995, pp. 3-4). This general validity of moral concepts is controversial and therefore has to be discussed in terms of the introduction and implementation of Western animal welfare standards in non-Western cultures.

For example, the African philosopher Godfrey Tangwa rejects the Western view of the universal validity of ethical principles and the thinking that things, which are right in the West are right at other places in the world, too. What is considered as universally justifiable categories in the West, Tangwa describes as the Western view of things (Schweizer 2002, p. 28). According to Comstock (2000, p. 102) it is a difficult task to formulate a generalized set of rules that is applicable to people in identical circumstances at any time and in any location. This task further implies the risk of cultural imperialism. In addition, experiences of failed imple-

mentation of Western technology and know-how in foreign aid have shown that the social system and norms of local societies must not be disregarded.

A theory that takes into account the juxtaposition of different moralities or paradigms is the view of ethical relativism. While Western moral philosophy traditionally claims the binding nature of a single true morality for everyone, everywhere (Harman and Thomson 1996, p. 5; Cook 1999, p. 7), the view of ethical relativism holds that moral standards depend upon, or are relative to, an individual's historical, economical, geographic and cultural-religious background. The relativist position denies that one moral framework is objectively privileged as the true moral principle (Fleischacker 1992, p. 1; Harman and Thomson 1996, p. 3; Des Jardin 1997, p. 19; Cook 1999, p. 8). Hence, the view of ethical relativism aims at an equal position of all parties and requires mutual acknowledgement and tolerance towards other ethical traditions. According to this view there is no universally right morality.

However, increasing global interaction requires at least a minimal common ethical foundation. In this study a number of identical principles in different moralities have been identified. For example, in all cultures investigated there was concern for animals and the intention to do the best for them. Sacrificing animals in general aims at the continuing and improving of the well-being of humans and animals who are regarded as "the elder brothers and sisters of human beings" (own translation) (Marschall 1985, p. 72). In this context, Patzig (1971) cited by Pieper (2000, p. 51) argued that the variety of moral norms can mostly be attributed to different circumstances, while moral principles on which these norms are based are equal.

It is concluded that ethical standards in every society are open to reflection and change. As the Oxford dictionary of philosophy tells: "A paradigm does not impose a rigid or mechanical approach, but can be taken more or less creatively and flexibly". Thus, there is a chance to renew the prevailing ethical views (e.g. the method of sacrificing animals) as a result of new insights. Earlier practices will be replaced, people will refrain from certain deeds and a new attitude towards animals will supersede the foregoing. In this process it is substantial that a self-induced shift of values takes place in which the cultural identity of a society is taken into account. Information is an important prerequisite for a self-induced change. In the end, there is a responsibility to actively contribute to the ethical discussion by philosophy and the respective societal group and to reflect on the ethic-value-complex by science.

3.4 Scope for changes in the treatment of animals in tropical livestock production

3.4.1 Implementation of changes in the human-animal relationship

The ethical and scientific issues, which were exemplary analyzed in the previous sections, revealed that although all cultures possess an ethic that disapproves the ill-treatment of animals, the conditions in tropical livestock production systems are not always appropriate to ensure the well-being of farm animals. Despite all appreciable measures to promote animal welfare, threats against the well-being of farm animals are diverse: These may include the disregarding of the local animal ethic by animal owners, harsh environments that impose stress on livestock and poor housing and management systems in resource-poor smallholdings. In intensified, large-scale animal units in fast-developing nations the animal's performance of natural behaviour may be seriously impaired.

The implementation of animal welfare norms is associated with a societal process in which the human attitude towards animals alters. Based on socio-cultural traditions, the interaction between human beings and domesticated animals is shaped by mutual effects on each other. Societal change in the treatment of farm animals involves the participation of individu-

als in social discourses, empirical knowledge and technological innovations. Decision making in any culture depends on the perception of problems and the modes of resolving problems in the particular social group (Teherani-Krönner 1992a, pp. 23-25). This is also applicable to the introduction of norms that derived from other cultures. In order to pay attention to the interests of animals, it is worth illuminating the scope for changes in the treatment of farm animals in tropical environments.

3.4.2 Methodological frame for considering the scope for changes in the treatment of farm animals

Scope for alterations in relation to animal welfare is analyzed by using the interdisciplinary concepts of human ecology and culture ecology that refer to integrated global problems (Teherani-Krönner 1992a, pp. 16-39). In these concepts, the relation between human and environment are conceptualized in the human ecological pyramid by Park which at the same time forms the framework for the scope for change in dealing with the environment (Figure 3.14). The scope decreases in the following order: ecological order, economic order, political order and moral order (Park 1936/1952, p. 157 cited by Teherani-Krönner 1992a, p. 27).

In Park's model society is constituted by four elements including:

1. Population
2. Material culture (technology)
3. Immaterial culture (customs and traditions)
4. Nature (natural resources in the habitat).

(Teherani-Krönner 1992a, p. 28)

Cultural ecological approaches emphasize the role of the culture in the human-environment interaction (Teherani-Krönner 1992a, pp. 32-33). According to Sahlins, (1964/1977, p. 216) cited by Teherani-Krönner (1992a, p. 36) the cultural change constitutes itself as a dialectic process in which culture and nature mutually affect each other. These theoretical concepts were applied to explain the relation between humans and domesticated nature by Teherani-Krönner (1992b, pp. 363-365) and are therefore employed to analyze the dynamic of possible changes in the human treatment of farm animals within the examples considered in this study.

Park's conception provides a framework for the process of actively shaping the human-animal relationship. The farm animal's quality of life is influenced by factors, such as agro-ecological resources, value systems, economic/technological development and by human intervention. Hence, in terms of the interaction between humans and domesticated animals the society constituting factors by Park have to be modified and supplemented. While natural resources, customs and traditions, and technology in Park's model correspond with the new conceptual framework, the aspect *population* has little relevance for the human use of farm animals. Instead the component of human intervention is added.

3.4.3 Example 1: Scope for changes in the Fulbe pastoral system in northern Nigeria

Natural conditions are the most decisive factor in the Fulbe pastoral system, because direct and indirect effects of harsh climate are almost unchangeable. Detrimental climatic effects and temporary shortage of feed could only be compensated by massive human intervention

and investments. Owing to little monetary reserves, the Fulbe subsistence economy largely fails to make extensive investments and the extent of human intervention can merely be low. Although, relative to other systems, considerable amounts of money are spent for veterinary drugs and supplementary feed (see Gefu 1992, p. 57), livestock owner can provide only minimal protection from aversive environmental effects. Thus, in the Fulbe pastoral system the impact of agro-ecological conditions can be termed as the most decisive factor for the welfare of ruminants.

However, rigorous climate and scarcity of natural resources affect humans and animals equally. Aridity thwarts intensification of pastoral systems and livestock and livestock keeper must adapt their life to the rhythm of nature. The well-being of pastoral animals is intricately linked with the well-being of human beings. For example, in dairy cows a poor feeding and watering status results in declining milk yields, which have negative effects on the food supply of the pastoral family. In addition, reduced milk output affects bartering activities with agriculturalists and a decreased exchange of milk and milk products for vegetarian food further lowers the quality of the human diet. On the other hand, financial and technological assistance by development aid not only improves human livelihood but also benefits animals, because higher disposable income supports animal care and management (see McCrindle 1998, pp. 227-229).

Freedom from hunger and thirst is one of most fundamental criteria in relation to animal welfare. In the Fulbe pastoral system the prominent agro-ecological conditions may give rise to hunger and thirst in livestock and alleviating measures would require enormous investments; but monetary resources in the system are poor. As a consequence, in times of scarce fodder growth the pastoral family has only very little scope to alternate the precarious, welfare-relevant feeding and watering situation of their animals. In some instances suffering of livestock from hunger and thirst may be inevitable and may often be shared by livestock keepers. Nevertheless, Fulbe pastoralists are known for their close attachment towards animals, which is embedded in the local ethic. Under the prevailing circumstances they provide the best possible care for their animals.

3.4.4 Example 2: The possibility to change the treatment of farm animals in the llama and alpaca breeding system in the Andean highland

Similarly to the Fulbe pastoral system, the Andean llama and alpaca production system is characterized by a subsistence economy. The unfavourable environment and the rugged, inaccessible Andean relief are major constraints for intensifying the system. Lacking financial means thwart, for example, the provision of sanitary and veterinary measures or shelter, which could protect livestock from night frost. Since ecological and economic conditions essentially influence the well-being of farm animals in this system, the scope for changes in the human treatment of animals is very limited.

Llama and alpaca breeders on high altitude in the Andes maintain a value system that is characterized by a close interaction between human, animal and nature (see Webster 1993, p. 131). In the local ethic llamas and alpacas are objects of elaborate religious rituals, which are chiefly concerned with llama welfare and fertility (see Gareis 1982, pp. 137-139). Therefore, in the Andean highland the human treatment of animals is clearly attributed to the value system of a culture. Concern for animals is part of religious-philosophical traditions and is based on the paradigm or principle view of the world predominant in a particular culture. Sacrificing llamas is in agreement with the world-view of the Andean inhabitants, but, for example, contradicts the European view of things.

In view of initiatives to possibly establish international norms for animal welfare, difficulties may arise, because Western moral philosophy in general claims the universal validity of ethical principles. This implies that the Western way of treating animals is right for everyone, everywhere. However, some philosophers (e.g. Cook 1999; Des Jardin 1997) rejected the general validity of Western ethics and considered it as a cultural artefact itself. They argued in favour of the view of ethical relativism, which holds that ethical standards depend upon, or are relative to, an individual's cultural-religious background.

According to the view of ethical relativism, local moralities deserve adequate attention and are to be respected. Ethical views are deeply rooted in a culture and form part of a society's identity. The scope for alterations is closely associated with a complex discussion in which new ideas are introduced and modified to local circumstances.

3.4.5 Scope for adjustments: Considering the ox in the Indian smallholder crop-livestock system

Indian smallholders very much rely on the draught power of their bullocks for land preparation and pulling carts. However, the well-being of draught animals is often seriously threatened (see Ramaswamy 1998, p. 75). They are subjected to human intervention more than any other farm animal in the crop-livestock production system, because they spend long time under direct human guidance. During work draught animals have to obey to the command of the farmer and necessarily have to be punished, if they do not. In order to minimize painful disciplinary measures, careful and calm handling of animals is vital. Quit and considerate management of farm animals is appropriate to improve both their productivity and well-being (Grandin 2004, p. 119).

Apart from poor human treatment of draught animals, there are some other factors that may affect animal welfare. Although in crop-livestock systems environmental conditions are in general less severe than in pastoral systems, they have an impact on the well-being of oxen. However, seasonal feed availability can be compensated more easily with crop residues and by-products from the food processing industry. Compared with pastoral and commercial systems in the crop-livestock production system the socio-economic status of the farming family is intermediate.

The degree of human intervention is a relevant factor for the well-being of draught animals and the specific requirements of tropical livestock production for particular aspects of animal use, such as draught power, have to be taken into account in the study and assessment of animal welfare. Ramaswamy (1998, p. 75) estimated that the replacement of draught animals by tractors may require an investment of 15 billion dollar. Since huge investments for technological innovations are clearly beyond the capacity of the majority of smallholders in India, the use of draught animal power will certainly continue over the next few decades.

However, there is scope to adopt principles of human handling, which avoid injuries and mistreatment of animals. Prompt treatment of wounds and withdrawal of ill and injured animals from work are part and parcel of good husbandry practice and promote animal welfare. Although cruel mistreatment is to be disapproved, some driving/punishment may be inevitable in the use of draught animals. Thus, a guiding principle may be not to cause unnecessary pain. The higher the level of human intervention in the animal's life, the higher is the farmers' responsibility for adequate handling and housing of their animals.

3.4.6 Prospects to change the treatment of farm animals in large-scale commercial poultry and swine production in Thailand

The country's economic growth resulted in huge investments in the Thai poultry and pig production systems and the establishment of vast animal units, where balanced, calculated rations, modern management practices and veterinary inspection are provided to gain high economic returns. Effects of nature are minimized and the provision of high-quality feed is almost independent of climate and environmental disasters, such as droughts or floods. Therefore, the high level of technological development in these large-scale systems satisfies the animal's needs for proper nutrition, shelter from the rigours of climate and veterinary care and is conducive to high productivity.

However, in modern livestock production new sources of animal suffering have arisen including

- physical and psychological deprivation in confinement that hinder the exercise of inherent behaviour,
- in the large animal herds/flocks the time the farmer attends to the individual animal declines in the light of mass production and micro-economic pressure,
- system related illnesses, such as metabolic disorders.

(Rollin 1995, pp. 10-11)

Thus, the economic/technological progress has an impact on the quality of life of farm animals. Since large-scale confinement systems are largely independent of local natural resources, there is much scope for change from an agro-ecological point of view. On the other hand, the recent change in Thai animal husbandry challenges reflection on the adequacy of the traditional ethic, because it may have become inapplicable in view of the tremendous technological transformations. In general, a higher level of commercialization implies a higher accountability of the farmer to invest in animal-friendly technology. When the high level of economic development can be maintained, there is clear scope for the application of housing technology that is appropriate to animal well-being. In case of an economic recession a return to traditional values and more traditional forms of animal husbandry could be discussed.

3.4.7 Conclusion

It is concluded that the scope for changes with regard to animal welfare in tropical livestock production is dependent on environmental effects, management practices, local moralities and economic circumstances in the specific situation. World-wide technical standards for animal-friendly husbandry appear to be inappropriate. They have to be adapted to the local level of economic/technological development, financial power and ethics. Similarly, global ethical standards based on Western morality are critical, because they ignore local moralities in other parts of the world, which constitute the individual and social identity of people. In this respect, a dialogue between the cultures is desirable to initiate local debates and to develop the issue of animal welfare.

4 Perspectives for the assessment of animal welfare

The previous analysis of scientific and ethical aspects of animal welfare revealed that the well-being of animals is an elaborate issue that confronts research with problems and requires new ideas of scientific inquiry. Great efforts have been made to discover the peculiarities and particularities of the concept of animal welfare and impressive results have been gained, which have briefly been summarized in this work.

The term *welfare* cannot be defined like a technical term (e.g. weight), because the conception of animal welfare involves both *objective* information and values. Therefore, in the assessment of animal welfare methods for scientific inquiry as well as for the underlying ethical concepts are required. Ideally an epistemological approach should be created in which both aspects – the scientific and the ethical – can be adequately taken into consideration. However, it is questionable whether traditional scientific methodology is appropriate to evaluate a concept like welfare, which also involves value judgements. Limitations may be inherent to the methodology of science. Thus, the question arises: Is traditional scientific methodology adequate to assess a concept like animal welfare?

There are two widely accepted approaches available for the assessment of animal welfare. While the assessment orientated to the biological function combines a variety of measures including health, physiological, behavioural and production parameters, the assessment with respect to the animal's subjective state chiefly relies on the indirect measure of animal behaviour, because an adequate methodology to determine emotional states is absent. Although functioning-based approaches result in exact measurements, their conceptual background is weak. The most striking constraint seems to be that quantitative measurements, which are carried out in diverse experiments, are not compatible with the qualitative phenomenon of feelings in animals. At this point the question arises: Are these events really incompatible or are they incompatible due to our view of things? Would another principle research approach achieve more meaningful results?

4.1 Critical reflection on methodological traditions in science

The applied methodology of modern science is widely based on the philosophy of the 17th century French philosopher René Descartes. At the turn from medieval times to the modern age, he developed a general methodological framework in order to explain natural phenomena. This frame claims that

- science is solely related to material things,
- study objects are reduced to simple models,
- quantitative relations in nature are analyzed in mathematical terms,
- evidence of the objective validity of quantitative relations.

(Roed 1995, pp. 119-122; Gerten 2001, pp. 75-76; Henry 2002, pp. 26-27)

Perceived qualities in nature are to be reduced to its simplest elements to make them amenable to mathematical proof (Cassirer 1995, pp. 50-51; Roed 1995, p. 121; Gerten 2001, p. 270) and to achieve objective and accurate results. Scientific analysis traditionally minimizes hypothesis, attempts to eliminate bias, verifies experimental results and makes inferences closely related to empirical evidence (Des Jardin 1997, pp. 6-7).

However, some scientists believe that this model of inquiry is inappropriate for the understanding of biological systems, since the *reductionist* approach ignores the complex relations within such a system. Even carefully established scientific data may be inadequate to fully explain a natural phenomenon (Des Jardin 1997, pp. 6-7). Alike, Altner (1993, pp. 101-104) argued against the *mathematization* of the reality stating that the nature does not only consist of quantitative but also of qualitative features. Altner further criticized reductionism, which implies a subject-object-dualism rather than an integrative relation between human and nature. Mench (1993, p. 68) stressed the importance of integrative research approaches for the assessment of animal welfare affecting emotional and cognitive states in animals.

In addition, the view that science is value-free and cannot make ethical judgements is a commonly maintained opinion by scientists (Rollin 1996, p. 5). According to Broom (1993, p. 24) moral judgements about what is tolerable can be made separately from scientific measurements on animal welfare. Rollin (1995, p. 32) explained that

> [t]he roots of scientific common sense were grounded in the desire to draw a clear distinction between genuine science and softer fields such as theology and philosophy, which in the nineteenth century had become mixed with science [...]. This effort took the form of attempting to excise from science any notions which could not be „cashed out experientially," and was articulated as the principle of verification by the influential school of philosopher-scientists called the logical positivists. According to this principle, no concepts could be admitted into science unless they could be tied directly to empirical observations. […] Since value judgments of any sort cannot be verified and falsified, the argument went, they had no relevance to science.

On the contrary, Hurnik (1993, p. 34), Lehmann (1993, p. 62) and Rollin (1996, pp. 5-6) claimed that science is not free of value judgements. Rollin (1996, p. 7) pointed out that

> the scientific revolution of Newton, Galileo, Descartes, and others was based on a value judgement; namely, that it was better or more desirable to explain the world in terms of mathematical laws than to persist in an Aristotelian medieval science that recognised that the world contains many different kinds of things, and insisted that each thing be explained according to its own kind.

Comstock (2000, p. 101) alleged that although there are scientific questions that can be answered without any involvement of ethics, moral issues that arise from the scientific study of animals cannot be resolved by further research, but require to engage in normative ethics. On the other hand, abstract ethical theory that ignores scientific information cannot provide meaningful statements about problems in the field of biology (Des Jardin 1997, p. 9) and thus, defensible ethical judgements must be founded on facts confirmed by science (Comstock 2000, p. 101).

Moreover, Rollin (1996, pp. 6-9) maintained that scientists not only deny that science cannot make value judgements but also that mental states and subjective experiences in animals can be assessed in scientific terms. Since science deals only with what can directly be experienced, and since subjective states of animals cannot be experienced by humans, it cannot be studied scientifically. Although there is a broad consensus about that animals possess the capacity to experience pain and suffering (e.g. Lorz 1987, p. 84; Tannenbaum 1995, p. 123; Orlans *et al*. 1998, p. 8) the measurement of subjective states in animals is vague.

A comparison of main characteristics of the concept of animal welfare with main characteristics of scientific methodology (Table 4.1) indicates that the prevailing methodological tradition in science offers only limited access to the given concept of animal welfare. While the physical well-being of animals is fully amenable to scientific methodology, subjective states in animals and the consideration of values cannot be assessed by traditional science. Hence, additional reflection is required especially in the context of the animal's subjective experience and the ethic-value-complex.

Table 4.1 Comparison of characteristics of the concept of animal welfare and modern science

	The concept of animal welfare		
Main characteristics of modern science	Physical well-being	Subjective states	Values
Quantification and objectivity	+	-	-
Reduction to simple terms	+	-	-
Claim that science is value-free	+	-	-
Denial of mental experiences in animals	+	-	-

+ compatible - incompatible

4.2 New approaches for the assessment of animal welfare

4.2.1 Functional magnetic resonance imaging (fMRI)

Agricultural research is traditionally based on scientific methodology. However, it is controversial whether science can provide an adequate methodological frame for the assessment of animal welfare. With functional magnetic resonance imaging (fMRI) (for a detailed explanation see chapter 3) a new technique has evolved, which could be an interesting approach to quantify emotional experiences in individuals in a scientific way. Developed in the late 1990s, functional MRI has been shown to measure the subjective feeling of pain in human beings by visualization of brain activity. Even psychological processes can be visualized by the fMRI technique. However, according to experts, numerous patient observations are necessary to make meaningful statements.

In this context, the question arises whether functional magnetic resonance imaging (fMRI) could be used to assess farm animal welfare. Conceivable would be an apparatus surrounding the animal head and collecting data, while the animal is under normal housing conditions. The application of this technology would primarily require to

- locate respective zones for well-being in the animal brain,
- to further explore the complexity of well-being, and
- to resolve a lot of technical problems

Though far from being applied to farm animals, with fMRI a principle way is detected to possibly overcome a major problem of animal welfare science, namely, the measurement of mental experiences or *subjectivity* in animals. However, it must clearly be stated that ethical and cultural aspects of animal welfare cannot be assessed with the traditional scientific methodology. Therefore, other epistemological approaches have to be investigated yet.

4.2.2 Models to assess subjective states

According to the positivists view only those processes in animals can be studied scientifically that are directly observable. The scrutiny of unobservable, subjective experiences in animals

requires a different logical framework, which is open to dispute (Duncan and Fraser, 1997, p. 23). Wemelsfelder (1997, p. 77) developed a subjective concept in which the behaviour of an animal is conceived as an expression. She emphasizes the intersubjective character of this perspective; in the communication between individuals behaviour is perceived as an expression of personal experience. According to Hacker (1993, pp. 134-135) cited by Wemelsfelder (1997, p. 78) behaviour reflects the subjective state of the animal directly, although it is not the same.

Wemelsfelder (1999, pp. 42-44) in her approach connects the behavioural expression of animals with conscious awareness. In contrast to a dualistic model of the behaviour-consciousness relationship Wemelsfelder suggested a conception in which the causation of behaviour is not merely reactive, but involves active, subject-related and self-generated participation, based on common-sense.

Conscious awareness does not drive the behavioural machine from „within", but comes to expression in action, as an emergent property of the behaving animal as a whole. This suggests that the way in which an animal pays attention to, and interacts with, a given environment directly expresses its subjective experience and awareness of that environment.

Accordingly, physical and mental aspects form an integrative view of animal behaviour.

Since there are no models of animal suffering available, dualistic concepts of the behaviour-consciousness relationship have to be applied for practical measurement. Standard methods refer to static categories of behaviour or discrete conditions of physical movement (e.g. walk, play). However, these categories ignore the dynamic transition between these conditions or "the way in which an animal performs these physical movements". Such transitional qualitative categories are not amenable to quantitative procedures and demand a more active role of the investigator compared with quantitative studies (Wemelsfelder 1999, pp. 49-51).

4.2.3 Epistemologies in different cultures

Alike, progressing globalization requires science to engage in new categories of thinking. Livestock agriculture in different parts of the world appears in many different forms, which are determined by natural conditions, human influence and the animal itself. At present humankind and nature are commonly considered individually manifest in the separated disciplines science and philosophy. The reflection on the human treatment of animals and welfare concerns of individual animals, on a global platform embodies the oscillation between different scientific disciplines and possibly logics as well as between the cultures, as demanded by the natural scientist Alexander von Humboldt. In this context, there is a necessity to open up to the thinking and needs of other societies. The project therefore aims not only to the collection of empirical data but to a thinking conversion of these data (Reflections are based on the radio programme "Alexander v. Humboldt" by Info Radio, Sept 19 2004)

Forward and Alam (1994, pp. 89-90) pointed out that, for example, in Muslim thought all knowledge has a religious dimension and God has created the wonders, which are studied by science. They do not find a role for God in the areas of life which science cannot explain. Scientific explanations of natural phenomena unveil the majesty of God who created the universe.

This point of view contrasts strongly with the philosophy of science widespread in Europe and America since the eighteenth century. Most Muslims regard western science as not so much Christian as secular and profane, unconcerned with God and his will. Such a view of the autonomy of science has, in their judgement, led to a widespread abuse of the natural world among many western scientists, who regard it as a laboratory for their often irresponsible experiments. Muslims believe that science and its practitioners have a more limited scope: they reveal the unity of God as they explore the unity of the

created order; and they reverence what they explore as God's handiwork, given purpose and order by him.

The issue of the foundation of knowledge was discussed throughout history in different cultures. In Indian tradition epistemological questions about nature, means and sources of knowledge are directed to the Sanskrit category of *pramana*. The sources of valid knowledge vary dependent on the philosophical school. The Nyaya School, for example, acknowledges perception, deduction, authoritative evidence and analogy as foundations of knowledge. Especially, the acceptance of analogy, which is based on knowledge that is obtained from a combination of information that is already known (King 1999, p. 128), is an interesting aspect, because parallels can be drawn to the concept of analogy in the interpretation of animal behaviour and the assessment of animal welfare.

Similarly, any philosophical discourse is related to a particular history and culture and is therefore concerned with a presupposed notion of the nature of philosophy (King 1999, p. 24). Ethical norms, which refer to what *is* done, are specific to any culture and are manifested in religious traditions, codes of professions, laws, and policies (Des Jardins 1997, p. 16; Pieper 2000, p. 32). Morals and their legitimate norms constitute the cultural identity of a community and are as diverse as the historical, geographical, economic and philosophical-religious conditions under which they emerged (Pieper 2000, pp. 55-56). Comstock (2000, p. 102) maintained that although the formulation of an universal set of rules is a difficult task and may involve the danger of cultural imperialism, "[e]thics will not […] tell George that it is acceptable to kill a cow in circumstances q, r and s, while telling Jorge that it is unacceptable to kill a cow in exactly the same set of circumstances".

The discussion of animal ethics in different cultures has revealed that there is a plurality of truths and competing claims with regard to these truths. At the same time a global world is faced with the challenge to deal with the huge variety of ethical views. In the light of these facts tolerance is a significant property to develop. In the sense of mutual acknowledgement the striving for truth is tied to debates, which are characterized by respect for the views of others and their claims for truth. On the other hand, attitudes towards animals in other cultures can provide valuable ideas for the own discussion.

5 Summary

Interest in the welfare of farm animals has arisen in Europe, when intensification in livestock agriculture was increasingly carried out some decades ago. Modern animal production systems were detected to cause serious health problems, abnormal behaviour and decreasing life spans in high producing farm animals – apparently a consequence of their reduced well-being. Widespread public concern has challenged the scientific study of animal welfare. However, the assessment of welfare still poses problems, because subjective experiences in animals are not amenable to the traditional methodology of science. In the light of globalization and the extension of international trade the subject of animal welfare may become relevant also for agrarian countries in the southern hemisphere. Though, it is questionable whether an unmodified transfer of European animal welfare norms is meaningful and workable. Therefore, there is a necessity to consider the issue of animal welfare from different cultural and regional perspectives.

First of all, the study addresses the moral status of animals and their mental capacities. The possession of mind and reason were found to be essential criteria to make animals fall within the scope of moral concern. While the French mathematician and philosopher René Descartes denied any mental capacity to animals, Immanuel Kant maintained that animals lack reason and therefore deserve no moral consideration. Though, in Kant's view not any treatment of animals is justified, because it predisposes human beings to be cruel to each other. The utilitarian Jeremy Bentham based his ethic on the animal's ability to feel. Accordingly, humans have moral duties to animals not to impose pain and suffering on them. Contemporary ethical concepts primarily attribute the moral importance of animals to their possession of interests and consciousness. These reflections on the moral relevance of animal minds, sensations and awareness reveal the close interrelation between ethics and science, which is a main feature of the work.

The present-day debate about animal welfare, as expounded in the second chapter, involves both the scientific assessment of the well-being of animals and the philosophical reflection on the moral status of animals. A main problem the scientific study of animal welfare is being faced with is the large variety of *definitions* and concepts of animal welfare available. Literally *welfare* means being or doing well, good fortune, well-being. The *definitions* of animal welfare adopted by scientists have an influence on how they attempt to assess the welfare of animals. They refer to such different aspects as the physical and mental well-being, physical and psychological harmony, negative feelings, disturbance of physiological systems and human responsibility for animals. The scientific investigation of animal welfare is closely related to the *five freedoms*, which provide minimum standards for the well-being of farm animals and serve as a guideline for the scientific discussion:

(1) Freedom from thirst, hunger and malnutrition
(2) Freedom from discomfort
(3) Freedom from pain, injury and disease
(4) Freedom to express normal behaviour
(5) Freedom from fear and distress

Suffering plays an important role in the animal welfare debate. It is termed as an acute or prolonged unpleasant subjective sensation and is clearly associated with animal welfare in that welfare is poor, when suffering occurs. The study of animal suffering has attained new insights in the emotional lives of animals and has emphasized the importance of subjective experiences in animals for the assessment of their well-being. Health is considered as a crucial criterion to ensure good welfare in farm animals, as well; the prepathological state can indicate when individual fitness and well-being is reduced. However, it is important to note

that absence of disease is not a proof of welfare, since also healthy animals may suffer. Stress was originally interpreted as the animal's response to threats (or stressors) to its homeostasis, but also refers to the animal's state, if it is challenged beyond its adaptive capacity. Stressful events are to be avoided to maintain good welfare. While some scientists suggest that an animal's welfare is poor, when fitness is reduced or the animal enters a prepathological state, others maintain that an animal's welfare is impaired long before pathological or physiological responses occur. Owing to the complex physiological reaction of the animal body to stressors, the sole measurement of plasma cortisol concentrations is inadequate to assess animal welfare accurately. Welfare is also conceptualized as the satisfaction of needs that maintain the biological functioning of an organism. When an animal's needs are not being met, its welfare is compromised. The degree of poorness of well-being varies and this variation can be scientifically assessed. Although the satisfaction of desires may be important for an animal's welfare, it may not always beneficial to the animal (overconsumption of highly palatable feed). Most influential in the assessment of animal welfare are the concepts of coping and animal feelings. All animals adopt coping strategies (e.g. modification of behaviour, release of opioid peptides, activation of the adrenal cortex) to encounter environmental challenges. Accordingly, the welfare of an individual is related to its attempts to cope with its environment. This conceptualization aims at the measurement of good and poor welfare. Welfare is good, when an individual copes successfully, but is poor, when it has difficulty in coping or fails to cope with its environment. In his concept the relation between coping and the indicators actually measured is weak – a problem, which is primarily embedded in scientific methodology. The concept of feelings aims at the animal's mental state including feelings and emphasizes the animal's point of view. According to this approach negative subjective experiences (e.g. thirst, fear and frustration) will lead to reduced welfare, while positive experiences (e.g. pleasure, comfort) will improve the well-being of animals. However, it is worth to be noted that welfare may be poor without suffering occurring. Another critical point is that an animal's short-term preferences may deviate from its long-term health and welfare. A major limitation of the concept of animal feelings is that subjective states cannot be expressed in quantitative mathematical terms.

Different measures are used in relation to these theoretical frames or concepts in order to assess animal welfare. Veterinary pathology can diagnose diseases and injuries that are caused by the environments in which farm animals are kept. In addition, changes in the immune system can indirectly be measured by the occurrence of disease. Welfare is poor, when the number of disease incidences is high. However, the interpretation of pathological indicators is uncertain, because changes in body physiology and behaviour can also be detected in healthy animals. Although serious pathology indicates very poor welfare, behavioural and physiological alterations prior to the development of pathological states can be a sign of poor welfare. There is further a consensus that parameters of production and reproduction are appropriate to compare the well-being of farm animals under different housing standards. While a decline of performance strongly supposes that the welfare of an animal is reduced, the state of welfare of a high producing animal is not necessarily good. In addition, threats to homeostasis can induce behavioural regulatory mechanisms in animals, such as depression of feed intake, signalling, alteration of posture etc. The frequency and intensity of escape, avoidance or immobility provides information about the distress experienced and the poorness of welfare. It is widely accepted that the more the animal displays abnormal behaviour the worse is its well-being. Neuroendocrine responses to environmental challenges affect, for example, heart rate, ventilation rate and blood hormone levels, which in turn influence metabolic processes in the body cells. Main indicators of neuroendocrine activity are glucocorticosteroid levels, on the one hand, and adrenaline and noradrenaline levels, on the other hand. However, the elevation of blood hormone levels cannot be a clear indicator of poor welfare because of various influencing factors. Finally, animal preferences and aversion are relevant indicators to attain information about the animal's point of view. Though, the limitations in adopting these measures in the assessment of animal welfare are manifold, since the relation between animal preferences/aversion and welfare is not unambiguous. The assessment of vocal signals is also very promising in terms of subjective emotional experi-

ences in animals, but is in an early stage of development. Due to certain shortcomings of individual indicators, commonly a combination of measures is recommended to compare different affective states in animals. In the future the study of physiological correlates in the brain by neuroscience may improve the understanding of animal emotions.

On the other hand, the ethical study of animal welfare in Western moral philosophy is mainly concerned with how animals should be treated. Early Judaeo-Christian views demanded human dominion over animals. In the 17th century the French philosopher and mathematician René Descartes emphasized the mechanical principle of the animal (and human) organism. For Descartes the possession of mind was tied to the possession of language. He denied that animals deserve moral consideration, because animals have neither speech nor reason. Though, Descartes' view was criticized by his contemporaries, for example, the Scottish philosopher David Hume clearly ascribed mental capacities and sensations to animals. According to Kantian theory rationality is closely connected with the capacity to formulate universal laws and only rational beings fall within the scope of moral concern. Since animals lack reason, they are no *ends in themselves* but are merely a means to achieve a human goal. Cruelty to animals is only prohibited, because it would incline humans to be cruel to each other. However, little children lack rationality as well, but are clearly objects of moral attention. Thus, being rational cannot be the only criterion for the moral status of a being. For the utilitarian Jeremy Bentham the ability to experience pleasure and pain is the decisive factor to deserve moral consideration. Therefore, he did not exclude children from the scope of moral concern and attributed unqualified moral relevance to animals. The 19th century philosopher Arthur Schopenhauer based his motivation for moral action on the sensation of compassion. Although according to this notion animals are clearly objects of moral concern, the ethic of compassion permits suffering in order to prevent more severe suffering, because it is not founded on an absolute value.

Influential contemporary theories concerning the treatment of animals have been formulated by Peter Singer and Tom Regan. Both theories advocate the abolition of the use of animals for food. Adopting a utilitarian position, Singer aims at the equal consideration of human and animal interests. Sentience and having interests confer moral status on animals from which human duties derive. A weakness of this concept is that utilitarian views are directed to the overall welfare and, therefore, may neglect the interests of individuals. According to Regan's animal rights view animals deserve moral attention, because they possess inherent value. His ethic is related to the principle of justice, which postulates that all beings are equal, because they possess equal inherent value. Animal rights protect legitimate claims of individuals. In the light of the increasing use of new reproductive technologies in farm animals, the concept of integrity and dignity of animals or *Würde der Kreatur* has been developed, which ascribes intrinsic worth to animals. Since genetic engineering does not necessarily impose pain and suffering on animals, such activities cannot be morally assessed by the traditional concept of *pathozentrischer Tierschutz* and, therefore, call for a new approach.

Finally, the analysis highlights the dualistic character of the concept of animal welfare that involves both ethical and scientific considerations.

In the third chapter animal welfare concerns in tropical livestock production related to scientific and ethical considerations are discussed in an exemplary way including

5. The Fulani pastoral system in northern Nigeria
6. The llama and alpaca breeding system in the Andean highland
7. Draught oxen in the smallholder crop-livestock system in India
8. Large-scale commercial swine and poultry production in Thailand

Natural conditions are the most decisive factor in the Fulbe pastoral system, because direct and indirect effects of harsh climate are almost unchangeable. Detrimental climatic effects and temporary shortage of feed could only be compensated by massive human intervention

and investments. Owing to little monetary reserves, livestock owner can provide their animals merely insufficiently from aversive environmental effects. Therefore, the problem from hunger and thirst is relevant to be analyzed scientifically in this system, while an ethical reflection aims at cattle values and Islamic values in the Fulbe system. Similarly, the Andean llama and alpaca production system is characterized by a subsistence economy. The unfavourable environment and the rugged, inaccessible Andean relief are major constraints for intensifying the system. Lacking financial means thwart, for example, the provision of sanitary and veterinary measures or shelter, which could protect livestock from night frost. Aspects to be reflected on include thermal stress and incidence of disease and local moralities about the treatment of South American camelids. Indian smallholders very much rely on the draught power of their bullocks for land preparation and pulling carts. Draught oxen are highly esteemed for securing livelihood of the farming family and this appreciation is expressed in the religious veneration of cows which prohibits the slaughtering of cattle. However, despite the traditional reverence of cattle, the ideals are not always followed in modern India. Welfare-relevant aspects identified are the impact of pain in farm animals and the treatment of animals in the Hindu tradition. Owing to the enormous growth of the economy from the 1960s until the mid 1990s, large-scale poultry and pig production systems in Thailand expanded rapidly. Commercial development of these production branches was promoted by a few feed mill companies which provided imported breeds, animal feeds, drugs, and know-how about modern farm management and housing to contracted producers. At present Thailand is one of the largest chicken-producing countries in the world, which exports poultry products into the European Union. Therefore, the investigation of behaviour and fear in intensive animal production systems and Buddhist concepts for the treatment of animals were identifies as pertinent issues to be investigated.

Stress factors affecting animal welfare, which are particularly relevant to tropical environments, have been analyzed from a scientific perspective. Hunger in relation to welfare has primarily been assessed in terms of undernutrition and malnutrition. Intensively kept farm animals have been found to develop abnormal behaviour, when their nutrient requirements are not met. The performance of stereotyped behaviour is related to a disturbance of the animal's motivational system and is therefore assumed to result in an impairment of welfare. In addition, elevated blood cortisol levels may indicate acute nutritional stress and reduced well-being. Chronic stress induced by feed restriction is supposed to depress the immune system of animals. Behavioural, physiological and pathological changes are also appropriate to assess welfare problems arising from the restriction of water. Experiments using novel techniques for the visualization of brain activity (PET, fMRI) provide evidence that animals experience thirst consciously and thus suffer from dehydration not only physiologically but also psychologically. An animal experiences cold stress, when it activates one or several thermoregulatory control mechanisms (e.g. vasoconstriction) to sustain body core temperature. Since stress impairs an animal's well-being, thermoregulatory response indicates reduced welfare of an animal. Welfare will be further lowered, when active heat conservation (shivering and non-shivering thermogenesis) is invoked. Scarcity of food aggravates the situation of the animal. It is axiomatic that ill-health depresses animal welfare. Disease is traditionally assessed by careful visual inspection of signs of illness and the interpretation of behavioural and physiological parameters. Such an empathetic approach may also be useful in the interpretation of the animal's state of well-being. Pain is a major source of suffering in farm animals. Due to structural similarities between pain and welfare, methods for the assessment of pain including behavioural changes, neuroendocrine responses and cerebrocortical activity are likely to provide meaningful results, when employed in the assessment of welfare. Information about subjective states in animals may particularly be acquired by the adoption of functional MRI technique. Behavioural patterns in farm animals may be perceived as signs of their welfare. Displaying a rich behavioural repertoire is generally regarded to indicate good welfare. On the contrary, abnormal behaviour is believed to be connected with poor welfare, though, the number of interacting factors that cause abnormal behaviour is large and emphasize the complexity of animal welfare. Fear can significantly depress the well-being and performance of farm animals. Frightened chicken have difficulty in coping with

their environment, show low growth rates and food conversion efficiency and are difficult to handle. Unpredictable and unavoidable fear has massive effects on the psychological and physiological welfare of animals.

All welfare constituting factors considered possess physical and mental features, though the later are difficult to measure. It is postulated that states as thirst, pain or fear are present and thus welfare is impaired, when corresponding signals are transmitted to the brain. Stressors have long-term and short-term implications on animal welfare. Every poor physiological or psychological state must be expected to result in a depression of welfare. Many questions are still open in this regard.

Alike, ethical concerns about animals are considered in relation to the described examples. Morality in the Fulbe pastoral system is directed to *cattle values* and the protection of animals derived from the Qu'ran and the Schari'a. The Fulbe moral codex, called *pulaaku*, requires the pastoralist to engage in serious care in his animals. Muslim doctrine maintains that humans have moral obligations towards animals not to treat animals cruelly and to slaughter them in a prescribed form that minimizes suffering. The religious ethic in the Andean highland refers to extensive ritual ceremonies with regard to the well-being of lamoids. For Andean pastoral people llamas and alpacas deserve careful treatment, since they possess sensations, memory and intelligence, and have a soul. In traditional Indian morality the principles of *karma*, *dharma* and *ahimsa* are guiding with respect to the treatment of animals. These principles are closely related with the concept of transmigration, which claims that human beings can be reborn in form of animals and vice versa dependent on their actions in the previous life. This implies an equal status of human and animal life expressed in the Hindu respect for animals. The Buddhist ethics in Thailand also addresses the notion of reincarnation that emphasizes the relatedness of beings. In addition, the idea of non-injury (ahimsa) is central with regard to human conduct. Deliberate cruelty and infliction of injury to animals was condemned by the Buddha. Therefore, all cultures considered have developed human concern for animals, which is embedded in the particular world-view. Moral duties towards animals require not to treat them cruelly, not to inflict unnecessary pain on them and to meet their needs. Killing of animals for food in traditional societies is primarily characterized by respect for life and the feeling of blame, which has disappeared in modern societies. Ritual slaughtering is generally regarded as non-violent, considerate method, but there is a necessity to investigate whether suffering is invoked in the animal sacrifice under different circumstances. In this respect, the implementation of a new animal ethic oscillates between the view of ethical relativism and moral absolutism. In general moral standards are open to reflection and change; though it is essential that the dynamic processes involved in a shift of values is self-induced by the respective society.

The scope for changes in terms of animal welfare is closely interrelated with the predominant climate, management practices, moralities and economic development in the particular situation. World-wide ethical and technical standards appear to be inappropriate, because they ignore the specific local circumstances.

Chapter four provides a brief prospect for the assessment of animal welfare. It has been shown that the traditional methodology of science, which is embedded in Positivism, is very limited for the assessment of subjective mental states in animals. Therefore, there is a demand for a new epistemological approach. In this regard, some ideas have been outlined including the visualization of brain activities by functional magnetic resonance imaging (fMRI), conceptual models to assess subjective states in animals and the importance of paradigms and epistemologies in different cultures for future developments in relation to the assessment of animal welfare.

6 Zusammenfassung

Das Interesse am Wohlergehen landwirtschaftlicher Nutztiere in Europa kam im Zuge der zunehmenden Intensivierung der Tierhaltung vor ein paar Jahrzehnten auf. Es wurde festgestellt, dass moderne Tierhaltungssysteme erhebliche Gesundheitsprobleme, anormales Verhalten und verringertes Lebensalter bei Hochleistungstieren verursachen – scheinbar als Folge verminderten Wohlbefindens. Weitreichende öffentliche Bedenken haben die wissenschaftliche Untersuchung des Wohlbefindens von Tieren initiiert. Dennoch ist die Bewertung des Wohlbefindens immer noch problematisch, da subjektiven Erfahrungen bei Tieren mit traditionellen wissenschaftlichen Methoden nicht erfasst werden können. Angesichts der Globalisierung und der Zunahme des internationalen Handels kann das Thema des Tierschutzes auch für Agrarländer in der südlichen Hemisphäre relevant werden. Es ist jedoch fragwürdig, ob eine unveränderte Übernahme europäischer Tierschutznormen sinnvoll und durchführbar ist. Deshalb ist es notwendig, das Problem des Wohlbefindens von Tiere aus verschiedenen kulturellen und regionalen Perspektiven zu betrachten.

Die Studie betrachtet zunächst den moralischen Status der Tiere und ihre geistigen Fähigkeiten. Der Besitz von Geist und Verstand wurden als wesentliche Kriterien erachtet, Tiere in die moralische Verantwortung mit ein zu beziehen. Während der französische Mathematiker und Philosoph René Descartes den Tieren jegliche geistige Fähigkeit absprach, behauptet Immanuel Kant, dass Tiere keine Vernunft besitzen und deshalb keine moralische Beachtung verdienen. Allerdings ist nach Kant's Meinung nicht jegliche Behandlung der Tiere gerechtfertigt ist, weil es die Menschen zur gegenseitigen Grausamkeit prädisponiert. Der Utilitarist Jeremy Benthanm gründete seine Ethik auf der Fähigkeit der Tiere zu empfinden. Dementsprechend hat der Mensch eine moralische Verpflichtung gegenüber den Tieren, diesen keinen Schmerz und Leiden zuzufügen. Zeitgenössische ethische Konzepte führen die moralische Bedeutung von Tieren auf deren Besitz von Interessen und Bewusstsein zurück. Diese Reflexionen über die moralische Relevanz von Verstand, Empfinden und Bewusstsein zeigen die enge Beziehung zwischen Ethik und Wissenschaft auf, die in dieser Arbeit eine zentrale Stellung einnimmt.

Die heutige Debatte über den Tierschutz, wie im zweiten Kapitel dargestellt, beinhaltet sowohl die wissenschaftliche Bewertung des Wohlbefindens von Tieren als auch die philosophische Reflexion über den moralischen Status von Tieren. Ein Hauptproblem in der Arbeit über das Wohlbefinden von Tieren ist die große Vielfalt von Definitionen und Konzepten. Im wörtlichen Sinne bedeutet *welfare* gut sein oder gut tun, Glück, Wohlergehen. Die von den Wissenschaftlern verwendeten Definitionen über animal welfare haben einen Einfluss darauf, wie sie versuchen das Wohlbefinden von Tieren zu bewerten. Sie beziehen sich dabei auf verschiedene Aspekte wie das physische und mentale Wohlbefinden, physische und psychologische Harmonie, negative Empfindungen, Störungen physiologischer Systeme und die Verantwortung des Menschen für die Tiere. Die wissenschaftliche Untersuchung von animal welfare steht in engem Zusammenhang mit den *fünf Freiheiten,* die einen Mindeststandard für das Wohlergehen von landwirtschaftlichen Nutztieren darstellen und als Richtlinie für die wissenschaftliche Diskussion dienen:

1. Freiheit von Durst, Hunger und Mangelernährung
2. Freiheit von Beschwerden
3. Freiheit von Schmerz, Verletzung und Krankheit
4. Freiheit zur Ausübung des normalen Verhaltens
5. Freiheit von Angst und Verzweiflung

Leiden spielt eine wichtige Rolle in der Debatte über animal welfare. Es wird als eine akute oder langandauernde unangenehme subjektive Empfindung bezeichnet und steht in klarer

Beziehung zu animal welfare, und zwar dadurch dass das Wohlbefinden schlecht ist, wenn Leiden auftritt. Die Untersuchung über das Leiden von Tieren hat neue Einblicke in das emotionale Leben von Tieren gewonnen und die Bedeutung subjektiver Erfahrungen von Tieren für die Bewertung von animal welfare hervorgehoben. Auch die Gesundheit wird als entscheidendes Kriterium für das Wohlbefinden von landwirtschaftlichen Nutztieren betrachtet; der präpathologische Status kann aufzeigen, wenn individuelle Fitness und Wohlbefinden gemindert sind. Es ist jedoch wichtig anzumerken, dass die Abwesenheit von Krankheit kein Beweis für Wohlergehen ist, da auch gesunde Tiere leiden können. Stress wurde ursprünglich als die Reaktion eines Tieres auf Bedrohungen (oder Stressoren) der Homöostasie interpretiert, bezieht sich aber auch auf den Status des Tieres, wenn dieses über seine Adaptationsfähigkeit hinaus gefordert wurde. Ereignisse, die Stress hervorrufen, müssen vermieden werden, um ein gutes Wohlbefinden aufrecht zu erhalten. Während einige Wissenschaftler davon ausgehen, dass das Wohlergehen eines Tieres bei verringerter Fitness oder bei Eintritt in einen präpathologischen Zustand schlecht ist, behaupten andere, dass das Wohlergehen eines Tieres bereits lange vor dem Auftreten dieser pathologischen oder physiologischen Reaktionen beeinträchtigt ist. Aufgrund der komplexen physiologischen Reaktionen des Tierkörpers auf Stressoren ist die ausschließliche Messung der Plasmacortisolkonzentration für eine genaue Beurteilung von animal welfare nicht geeignet. Wohlbefinden wird auch als die Befriedigung von Bedürfnissen, welche die biologische Funktion eines Organismus aufrecht erhalten, definiert. Wenn die Bedürfnisse eines Tieres nicht befriedigt werden, ist dessen Wohlbefinden gefährdet. Der Grad an schlechtem Wohlbefinden variiert und diese Variation kann wissenschaftlich erfasst werden. Obwohl die Befriedigung von Wünschen wichtig für das Wohlbefinden eines Tieres sein mag, muss es jedoch nicht immer gut für das Tier sein (Überaufnahme von höchst schmackhaftem Futter). Den größten Einfluss in der Bewertung von animal welfare haben die Konzepte der Bewältigung (coping) und der Tiergefühle. Alle Tiere wenden Bewältigungsstrategien an (z.B. Verhaltensänderungen, Freisetzung von Opioidpeptiden, Aktivierung der Adrenalcortex), um den Anforderungen in der Umgebung zu begegnen. Dementsprechend ist das Wohlbefinden eines Tieres bezogen auf seine Versuche mit seiner Umwelt zurechtzukommen. Diese Konzeptualisierung hat die Messung von gutem und schlechten Wohlbefinden zum Ziel. Das Wohlbefinden ist gut, wenn ein Individuum gut zurecht kommt und ist schlecht, wenn das Tier Schwierigkeiten hat oder überhaupt nicht in seine Umwelt zurecht kommt. Die Beziehung zwischen dem Bewältigen und den tatsächlich gemessenen Indikatoren in diesem Konzept ist schwach – ein Problem, welches vor allem der wissenschaftlichen Methode begründet liegt. Das Konzept der Gefühle bezieht sich auf den geistigen Zustand des Tieres einschließlich seiner Gefühle und stellt den Gesichtspunkt des Tieres in den Vordergrund. Diesem Ansatz entsprechend führen negative subjektive Erfahrungen (z.B. Durst, Angst und Frustration) zu einem geminderten Wohlbefinden, während positive Erfahrungen (z.B. Freude, Annehmlichkeit) das Wohlbefinden verbessern. Es ist jedoch erwähnenswert, dass das Wohlbefinden auch ohne Leiden schlecht sein kann. Ein weiterer kritischer Punkt besteht darin, dass die kurzfristigen Präferenzen eines Tieres von seiner langfristigen Gesundheit und seinem Wohlbefinden abweichen können. Eine starke Beschränkung des Konzepts der Tiergefühle besteht darin, dass sich der subjektive Status nicht quantitativ mathematisch ausdrücken lässt.

Verschiedene Maße werden in Verbindung mit diese theoretischen Konzepten angewendet, um animal welfare zu bewerten. Die Veterinärpathologie kann Krankheiten und Verletzungen diagnostizieren, die von der Umgebung, in welcher die Tiere gehalten werden, verursacht werden. Außerdem können Veränderungen im Immunsystem indirekt durch das Auftreten von Krankheiten gemessen werden. Das Wohlergehen ist schlecht bei einer hohen Vorkommen von Krankheiten. Die Interpretation der pathologischen Indikatoren ist jedoch unsicher, da Veränderungen in der Körperphysiologie und im Verhalten auch bei gesunden Tieren festgestellt werden können. Obwohl ein ernster pathologischer Zustand ein sehr schlechtes Wohlbefinden anzeigt, können Veränderungen im Verhalten und in der Physiologie vor Eintritt des pathologischen Zustandes ein Zeichen für schlechtes Wohlbefinden sein. Es besteht weiterhin ein Konsens darüber, dass Produktions- und Reproduktionsparameter geeignet sind, das Wohlbefinden von landwirtschaftlichen Nutztieren in verschiedenen Stallungen zu

vergleichen. Während eine Leistungsabnahme deutlich darauf hinweist, dass das Wohlbefinden eines Tieres gemindert ist, ist das Wohlergehen eines Tieres mit hoher Leistung nicht unbedingt gut. Außerdem können Bedrohungen der Homöostasie verhaltensregulatorische Mechanismen, wie die Reduktion der Futteraufnahme, Signalisieren, Veränderung in der Körperhaltung, etc bei Tieren auslösen. Die Häufigkeit und Intensität von Flucht, Vermeidung oder Immobilität gibt Auskunft über die wahrgenommene Bedrängnis und den schlechten Zustand des Wohlbefindens. Es wird weithin akzeptiert, dass das Wohlbefinden eines Tieres umso schlechter ist, je mehr es ein abnormales Verhalten aufweist. Neuroendokrine Reaktionen auf umweltbedingte Herausforderungen wirken sich zum Beispiel auf die Herzfrequenz, Ventilationsrate und den Bluthormonspiegel aus, die ihrerseits einen Einfluss auf metabolische Prozesse in den Körperzellen haben. Die Hauptindikatoren der neuroendokrinen Aktivität sind das Glucokorticosteroid Niveau einerseits und das Adrenalin- und Noradrenalin Niveau andererseits. Die Erhöhung des Bluthormonspiegels kann jedoch aufgrund der vielfältigen Einflussfaktoren kein eindeutiger Indikator für mangelndes Wohlbefinden sein. Schließlich sind die Präferenzen und Aversionen von Tieren relevante Indikatoren für Informationen zur Sichtweise des Tieres. Dennoch sind der Anwendung dieser Messungen in der Bewertung von animal welfare vielerlei Schranken gesetzt, da die Beziehung zwischen den Präferenzen/Aversionen von Tieren nicht eindeutig ist. Die Bewertung von Lautsignalen, welche sich noch in einem frühen Entwicklungsstadium befindet, ist ebenso vielversprechend was die subjektiven, emotionalen Erfahrungen des Tieres betrifft. Aufgrund der Unzulänglichkeit einzelner Indikatoren wird in der Regel eine Kombination von Messungen empfohlen, um verschiedene affektive Stadien der Tiere zu vergleichen. Es ist zu erwarten, dass in Zukunft durch die Untersuchung der physiologischen Zusammenhänge im Gehirn durch die Neurowissenschaften das Verständnis von Tieremotionen verbessert wird.

Andererseits befasst sich die ethische Untersuchung von animal welfare in der westlichen Moralphilosophie hauptsächlich damit, wie Tiere behandelt werden sollten. Frühe jüdisch-christliche Ansichten beanspruchten die Herrschaft des Menschen über die Tiere. Im 17. Jahrhundert betonte der französische Philosoph und Mathematiker René Descartes das mechanische Prinzip des tierischen (und menschlichen) Organismus. Für Descartes war das Innehaben von Geist mit dem Besitz der Sprache verbunden. Er sprach den Tieren moralische Bedeutung ab, da Tiere weder Sprache noch Vernunft besitzen. Descartes' Ansicht wurde jedoch auch von seinen Zeitgenossen, zum Beispiel dem schottischen Philosophen David Hume kritisiert, der den Tieren mentale Fähigkeiten und Empfindungen zuschrieb. Gemäß der Kant'schen Theorie ist die Vernunft eng mit der Fähigkeit universale Gesetze zu formulieren verbunden, und nur rationale Wesen fallen in den Bereich moralischen Interesses. Da Tiere keine Vernunft haben, haben sie keinen Selbstzweck, sondern sind lediglich Mittel zum Erreichen eines menschlichen Ziels. Grausamkeit Tieren gegenüber ist nur verboten, weil es die Menschen dazu bringen könnte, gegeneinander grausam zu sein. Kleine Kinder, welchen es auch an Vernunft fehlt, sind jedoch eindeutig Objekte moralischer Beachtung. Daher kann die Vernunft nicht das einzige Kriterium für den moralischen Status eines Wesens sein. Für den Utlitaristen Jeremy Bentham ist die Fähigkeit, Freude und Schmerz auszudrücken der entscheidende Faktor, moralischer Betrachtung Wert zu sein. Er schloss Kinder nicht von der moralischen Betrachtung aus und maß den Tieren uneingeschränkte moralische Bedeutung bei. Der Philosoph Arthur Schopenhauer gründete seine Motivation für moralisches Handeln auf das Empfinden von Mitleid. Obwohl dieser Auffassung gemäß Tiere eindeutig Objekte moralischer Beachtung sind, erlaubt die Ethik des Mitleids Leiden, um schlimmeres Leiden zu vermeiden, weil es nicht auf einem absoluten Wert gegründet ist.

Einflussreiche zeitgenössische Theorien, welche sich mit der Behandlung von Tieren beschäftigen, wurden von Peter Singer und Tom Regan formuliert. Beide Theorien verfechten die Abschaffung der Nutzung von Schlachttieren. Aus der utilitaristischen Position heraus, verfolgt Singer die gleiche Berücksichtigung menschlicher und tierischer Interessen. Empfinden können und Interessen haben verleihen den Tieren einen moralischen Status, von welchem Verpflichtungen des Menschen abzuleiten sind. Ein Schwachpunkt dieses Konzeptes besteht darin, dass die Sichtweise der Utilitaristen auf das Wohlergehen allgemein ausge-

richtet ist und deshalb die Interessen von Einzelnen unbeachtet lassen kann. Aus der Sicht der Tierrechte von Regan sind Tiere moralische Beachtung Wert, da sie einen inhärenten Wert besitzen. Seine Ethik bezieht sich auf das Gerechtigkeitsprinzip, welches postuliert, dass alle Wesen gleich sind, weil sie einen gleichen inhärenten Wert besitzen. Tierrechte wahren legitime Forderungen von Einzelnen. Angesichts der steigenden Nutzung neuer Reproduktionstechnologien bei landwirtschaftlichen Nutztieren ist das Konzept der Integrität und Würde der Tiere oder *Würde der Kreatur* entwickelt worden, welches den Tieren einen immanenten Wert zuschreibt. Da Gentechnik den Tieren nicht unbedingt Schmerz und Leiden zufügt, können solche Aktivitäten moralisch nicht mit dem traditionellen Konzept des *pathozentrischen Tierschutzes* beurteilt werden, und verlangen einen neuen Ansatz.

Schließlich wird in der Analyse der dualistische Charakter des Konzeptes von animal welfare hervorgehoben, welcher sowohl ethische als auch wissenschaftliche Betrachtungen beinhaltet.

Im dritten Kapitel werden Tierschutzbelange in tropischen Nutztierhaltungen bezogen auf wissenschaftliche und ethische Aspekte exemplarisch diskutiert:

1. Das Weidenutzungssystem der Fulani in Norden Nigerias
2. Das Zuchtsystem von Lamas und Alpacas im Andenhochland
3. Zugochsen im kleinbäuerlichen Ackerbau- Tierhaltungssystem in Indien
4. Kommerzielle Schweine- und Hühnerproduktion in Thailand

Die natürlichen Gegebenheiten sind im Weidenutzungssystem der Fulbe der entscheidende Faktor, weil die direkten und indirekten Effekte des rauen Klimas nahezu unabänderlich sind. Die Einwirkung klimatischer Effekte und temporäre Knappheit an Futter könnten nur durch massive Intervention des Menschen und Investitionen kompensiert werden. Die Tierbesitzer können aufgrund ihrer finanziellen Knappheit ihre Tiere nur unzulänglich vor den widrigen Umwelteffekten schützen. Deshalb eignet sich dieses System besonders für die wissenschaftliche Analyse von Hunger und Durst, welche durch eine ethische Reflexion über die Werte von Rindvieh und islamischen Werten im System der Fulbe ergänzt wird. Auch das Produktionssystem der andinen Lamas und Alpacas ist durch eine Subsistenzwirtschaft charakterisiert. Die ungünstige Umgebung und das schroffe, unzugängliche Relief der Anden sind die größten Beschränkungen hinsichtlich einer Intensivierung des Systems. Aufgrund der knappen finanziellen Lage können sich die Tierhalten zum Beispiel keine sanitären und veterinären Maßnahmen oder Unterstände leisten, welche die Tiere vor dem Nachtfrost schützen könnten. Aspekte, wie zum Beispiel thermischer Stress, Vorkommen von Krankheiten und lokalre Moralitäten über die Behandlung der südamerikanischen Kameliden werden reflektiert. Indische Kleinbauern sich stark auf die Zugkraft ihrer Ochsen zur Landbestellung und zum Ziehen der Karren angewiesen. Zugochsen werden hoch geschätzt, da sie den Lebensunterhalt der Bauernfamilie sichern. Diese Wertschätzung drückt sich in der religiösen Verehrung der Kühe aus, welche das Schlachten von Rindern untersagt. Jedoch werden diese Ideale, trotz der traditionellen Verehrung der Rinder, im modernen Indien nicht immer befolgt. Als für das Wohlbefinden relevante Aspekte wurden die Auswirkung von Schmerz und die Behandlung der Tiere in der Tradition der Hindu identifiziert. Aufgrund des enormen Wirtschaftswachstums von den 1960er bis Mitte der 1990er Jahre haben sich die Großhaltungssysteme von Hühnern und Schweinen in Thailand schnell ausgebreitet. Die kommerzielle Entwicklung dieser Produktionszweige wurde durch einige wenige Futtermittelherstellungsbetriebe gefördert, welche den Vertragsproduzenten importierte Rassen, Futtermittel, Arzneimittel, und know-how zu moderner Betriebsführung und modernen Stallungen bereitstellen. Thailand ist zurzeit eines der größten Hühner produzierenden Ländern der Welt, welches Hühnerprodukte in die Europäische Union exportiert. Daher werden Verhalten und Angst in intensiven Tierhaltungssystemen sowie buddhistische Konzepte hinsichtlich der Haltung von Tieren als für die Untersuchung relevante Problemstellungen angesehen.

Stressfaktoren, die sich auf die animal welfare auswirken, und unter tropischen Bedingungen besonders relevant sind, wurden aus einer wissenschaftlichen Perspektive analysiert. Hunger in Bezug auf Wohlergehen wurde in erster Linie unter den Aspekten Unterernährung und Mangelernährung bewertet. Es ist herausgefunden worden, dass Tiere in der Intensivhaltung Verhaltensanomalien entwickeln, wenn ihr Bedürfnis nach adäquater Ernährung nicht erfüllt wird. Das Auftreten von stereotypem Verhalten ist verbunden mit einer Störung des Motivationssystems des Tieres, weshalb davon ausgegangen wird, dass es eine Beeinträchtigung des Wohlbefindens darstellt. Außerdem können erhöhte Blutcortisolwerte einen akuten Ernährungsstress und vermindertes Wohlbefinden indizieren. Es wird davon ausgegangen, dass chronischer Stress, induziert durch Futterresriktionen, das Immunsystem von Tieren schwächt. Änderungen im Verhalten, in der Physiologie und Pathologie sind ebenfalls geeignet, Probleme im Wohlbefinden, welche auf Wasserrestriktion zurückzuführen sind, zu bewerten.
Versuche unter der Anwendung neuer Techniken für die Visualisierung der Gehirnaktivität (PET, fMRI) zeigen, dass Tiere bewusst Durst haben und daher nicht nur physiologisch, sondern auch psychologisch unter Dehydrierung leiden. Ein Tier fühlt den Kältestress, wenn ein oder mehrere thermoregulatorische Kontrollmechanismen (z.B. Vasokonstriktion) aktiviert werden, um die Körperkerntemperatur aufrecht zu erhalten. Da Stress das Wohlbefinden eines Tieres beeinträchtigt, deutet eine thermoregulatorische Reaktion auf ein gemindertes Wohlbefinden hin. Das Wohlbefinden wird noch mehr reduziert, wenn die aktive Wärmeerhaltung (zitternde und nicht-zitternde Thermogenese) eingeschaltet wird. Futtermangel verschlimmert die Situation des Tieres. Grundsätzlich verringert schlechte Gesundheit animal welfare. Krankheiten werden traditionell durch sorgfältige visuelle Inspektion auf Anzeichen auf Erkrankung und die Interpretation von Verhaltens- und physiologischen Parametern erfasst. Solch ein auf Empathie beruhender Ansatz kann auch für die Interpretation des Zustands des Wohlbefindens nützlich sein. Schmerz ist ein Hauptleiden bei landwirtschaftlichen Nutztieren. Aufgrund struktureller Ähnlichkeiten zwischen Schmerz und Wohlbefinden, scheinen die Methoden zur Erfassung von Schmerz und Verhaltensänderungen, neuroendokrine Reaktionen und cerebro-corticale Aktivität in der Bewertung von animal welfare aussagekräftige Ergebnisse zu liefern. Informationen über den subjektiven Status von Tieren kann insbesondere die Anwendung der funktionalen MRI Technik liefern. Verhaltensmuster in landwirtschaftlichen Nutztieren können als Anzeichen ihres Wohlbefindens verstanden werden. Ein reiches Verhaltensrepertoire wird allgemein als ein Anzeigen guten Wohlbefindens betrachtet. Im Gegensatz dazu glaubt man, dass anormales Verhalten mit schlechtem Wohlbefinden verknüpft ist, trotz der großen Anzahl interagierender Faktoren, welche anormales Verhalten verursachen, und so die Komplexität von animal welfare unterstreichen. Angst kann das Wohlbefinden und die Leistung von landwirtschaftlichen Nutztieren deutlich vermindern. Verängstigte Hühner haben Schwierigkeiten, mit ihrer Umwelt zurechtzukommen, weisen langsame Wachstumsraten, eine schlechte Futterverwertung und sind schwierig im Umgang. Unvorhergesehen und unvermeidbare Angst wirkt sich massiv auf das psychologische und physiologische Wohlergehen von Tieren aus.

Sämtliche in Betracht genommene Faktoren, welche das Wohlergehen ausmachen, haben sowohl physische als auch geistige Eigenschaften, wobei letztere schwer zu messen sind. Es wird postuliert, dass Stati wie Durst, Schmerz oder Angst auftreten und damit gemindertes Wohlergehen, wenn entsprechende Signale dem Gehirn übermittelt werden. Stressoren haben langfristige und kurzfristige Auswirkungen auf das Wohlbefinden. Jeder schlechte physiologische oder psychologische Status muss erwartungsgemäß zu einem verringerten Wohlbefinden führen. In dieser Hinsicht sind noch viele Fragen offen.

Ebenso werden ethische Belange der Tiere in Verbindung mit den beschriebenen Beispielen betrachtet. Die Moralität im Weidenutzungssystem der Fulbe richtet sich nach den *cattle values* und dem Schutz der Tiere, welche vom Koran und der Scharia abgeleitet werden. Der Moralkodex der Fulbe, genannt *pulaaku*, fordert vom Hirten eine ernsthafte Fürsorge für seine Tiere. Die Doktrin der Muslime besagt, dass die Mensche moralische Verpflichtungen gegenüber den Tieren haben, und zwar diese nicht grausam zu behandeln und auf die vor-

geschriebene Weise zu schlachten, um das Leiden möglichst gering zu halten. Die religiöse Ethik im andinen Hochland bezieht sich auf extensive rituell Zeremonien in Bezug auf das Wohlbefinden von Lamoiden. Die andinen Hirten stehen den Lamas und Alpakas eine sorgsame Behandlung zu, da diese Gefühle, Erinnerung und Intelligenz besitzen, und eine Seele haben. In der traditionellen indischen Moralität sind die Prinzipien von of *karma*, *dharma* and *ahimsa* bestimmend, was die Behandlung von Tieren betrifft. Diese Prinzipien stehen in engem Zusammenhang mit dem Konzept der Transmigration, nach welchem die Menschen in Form von Tieren wiedergeboren werden und umgekehrt, je nach ihren Handlungen im vorherigen Leben. Dies impliziert, dass das Leben von Mensch und Tier denselben Status haben, was in der Achtung der Hindus vor den Tieren zum Ausdruck kommt. Die Ethik der Buddhisten in Thailand beinhaltet ebenso den Begriff der Reinkarnation, welcher die Verbundenheit der Wesen unterstreicht. Außerdem ist der Gedanke der Nicht-Verletzung (ahisma) von zentraler Bedeutung für das menschliche Verhalten. Absichtliche Grausamkeit gegenüber Tiere und das Zufügen von Verletzungen wurden von Buddha verurteilt.

Deshalb haben alle Kulturen menschliche Belange für Tiere entwickelt, welche in der jeweiligen Weltanschauungsweise verwurzelt sind. Moralische Verpflichtungen gegenüber Tieren verlangen, dass diese nicht grausam behandelt werden, ihnen nicht unnötigen Schmerz zugefügt wird und ihre Bedürfnisse befriedigt werden. Das Töten von Tieren zur Ernährung ist in traditionellen Gesellschaften hauptsächlich durch die Achtung vor dem Leben und ein Schuldgefühl charakterisiert, welches in modernen Gesellschaften verloren gegangen ist. Rituelles Schlachten wird im Allgemeinen als eine nicht-gewaltsame, bedachte Methode betrachtet. Es gilt jedoch zu untersuchen, ob mit dem Tieropfer unter verschiedenen Bedingungen Leiden verbunden ist. In dieser Hinsicht bewegt sich die Implementierung einer neuen Tierethik zwischen der Auffassung des ethischen Relativismus und dem moralischen Absolutismus. Generell sind moralische Standards offen gegenüber Reflexion und Änderung; hierbei ist es wichtig, dass der damit verbundene dynamische Prozess eines Wertewandels von der jeweiligen Gesellschaft selbst herbeigeführt wird.

Der Spielraum für Veränderungen in Bezug auf animal welfare ist eng verbunden mit dem vorherrschenden Klima, Haltungspraktiken, Moralitäten und wirtschaftlicher Entwicklung unter den jeweiligen Gegebenheiten. Weltweite ethische und technische Standards scheinen unangemessen, weil sie die spezifischen lokalen Bedingungen nicht berücksichtigen.

Kapitel vier beinhaltet einen kurzen Ausblick auf die Bewertung von animal welfare. Es ist gezeigt worden, dass traditionelle Methodik der Naturwissenschaft, die im Positivismus eingebettet sind, nur sehr beschränkt in der Beurteilung von animal welfare eingesetzt werden kann. Deshalb besteht ein Bedarf für einen neuen epistemologischen Ansatz. In dieser Hinsicht wurden einige Ideen skizziert wie die Visualisierung von Hirnaktivitäten mit der funktionalen Magnetresonanztomografie (fMRI), konzeptuelle Methoden zur Erfassung subjektiver Zustände bei Tieren und die Bedeutung von Paradigmen und Epistemologien in verschiedenen Kulturen für zukünftige Entwicklungen in der Beurteilung von animal welfare.

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