ANIMAL WELFARE: FROM CONCEPTS TO REALITY

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ABSTRACT

In this review, we provide a brief retrospective history of the science of animal welfare and recognize the sentience of non-human animals; however, we emphasize that crucial problems remain regarding how to define and measure animal welfare. In general, the use of physiological measures to assess welfare is discouraged. Furthermore, there is a theoretical background for measures of stress, but not for welfare states because life may not be at risk. Instead, a preference or choice-based approach, which is based on the animal decision, is recommended. To this end, welfare is discussed and then contrasted with disease, health, stress and distress. In addition, the importance of prospective capacities for the welfare of human and non-human animals is discussed.

Keywords: Welfare, well-being, preference, choice, stress, distress, disease, health.

RESUMO

BEM-ESTAR ANIMAL: DOS CONCEITOS À REALIDADE. Após uma breve retrospectiva histórica da ciência do bem-estar animal, neste artigo reconhecemos a senciência em animais não-humanos; mas enfatizamos que problemas crucias permanecem para definirmos e medirmos o bem-estar animal. Desencorajamos o uso de medidas fisiológicas para avaliar bem-estar. Argumentamos que há substrato teórico suficiente para tais padrões no caso do estresse, mas não no caso do bem-estar, porque neste caso a vida pode não estar em risco. Em contrapartida, defendemos uma abordagem baseada na preferência ou escolha dos animais, a qual baseia-se na decisão do animal. Para tanto, o bem-estar é discutido e, então, contrastado com doença, saúde, estresse e distresse. Além disso, a importância de capacidades prospectivas é discutida em relação ao bem-estar de animais humanos e não-humanos.

Palavras-chave: Bem-estar, preferência, escolha, estresse, distresse, doença, saúde.

RESUMEN

BIENESTAR ANIMAL: DE LOS CONCEPTOS A LA REALIDAD. Después de una breve retrospectiva histórica de la ciencia del bienestar animal, en este artículo reconocemos la capacidad de sentir en animales no-humanos; pero enfatizamos que un problema crucial aun persiste al definir y medir el bienestar animal. Desalentamos el uso de medidas fisiológicas para evaluar el bienestar. Argumentamos que hay bases teóricas suficientes para tales patrones en el caso del estrés, pero no en el caso del bienestar, porque en este caso la vida puede no estar en riesgo. En contrapartida, defendemos un abordaje basado en la preferencia o escogencia de los animales, la cual está basada en la decisión del animal. Por tal razón, el bienestar es discutido y contrastado con enfermedad, salud, estrés y destres. Además de esto, la importancia de capacidades prospectivas es discutida en relación al bienestar de animales humanos y no-humanos.

Palabras clave: Bienestar, preferencia, escogencia, estrés, destres, enfermedad, salud.

INTRODUCTION

Animal welfare is an important current issue in biological sciences. A quick web-based search in ISI (Institute for Scientific Information) shows a clear picture of the growing interest in research that includes either 'animal welfare' or 'animal well-being' in the topic of the publication. This search revealed the following number of all document types for each period: 1940s = 2; 1950s = 4; 1960s = 8; 1970s = 64; 1980s = 296; 1990s = 1,167; and from 2000 to 2008 (October) = 2,715. Thus, this rapidly growing interest is considered in the light of the brief historical background presented below. From this point, the usual topics are considered, but approached differently, in the context of the science of animal welfare, and contrasting welfare and well-being with other well-known states (disease, health, stress and distress). Attempts to characterize states of welfare and well-being in physiological terms are not realistic. Finally, we reinforce the preference or choice definition of welfare and discuss the time perspective (prospective analysis) to the welfare issue.

A BRIEF RETROSPECTIVE HISTORY OF THE ANIMAL WELFARE ISSUE

The welfare issue emerged as a consequence of humans and non-human animal interactions. Non-human animals are here considered as sentient beings, *i.e.*, conscious organisms that feel such perceptions as cold, pain and fear. If animals were not sentient, like a machine, welfare considerations would not make sense. Despite the views that sentience is expected for these animals from everyday contact with them, such an assumption was not accepted until recently because of some conceptual frameworks that evolved over the course of science history. In this review, we provide a brief description of this history, adapted from Wemelsfelder (1997), Jennings (1998), Conte (2004), Dawkins (2006) and Duncan (2006).

During the Renaissance, emotions in non-human animals were accepted by artists such as Leonardo da Vinci, Thomas More, Shakespeare, and Francis Bacon, and also by the general population. Still, in the 17th Century, an idea that complicated considering non-human animals as suffering beings was Descartes' view, in which animals have no emotions or feelings, like automatons. This view derived from Descartes' assumption that the brain and mind were composed of two distinct entities, with the mind attributed only to human beings. The prevalent religious views at the time also contributed to acceptance of this idea, possibly because it reinforced the belief that man was created in the image of God. In the 18th century, the Enlightenment Period, Descartes' assumption was questioned and the possibility of animals experiencing pain and suffering was proposed by academics such as David Hume and Jeremy Bentham. Daily contact of humans with domestic animals (*e.g.*, dogs, cats, and horses) also might have contributed to acceptance of emotions in non-human animals (at least in vertebrates closely related to man).

In 1839, the English veterinarian Youatt considered that non-human animals had emotions, consciousness, memory, associated ideas and reason, and that the difference from human beings was in terms of degree, and not the sort of emotions experienced (Duncan 2006). The gradual acceptance of Darwin's evolutionary theory led to a more rational argument being added to the discussion of emotions in animals. This theory proposed certain evolutionary continuity among organisms, thus conceptualizing man as only another species and not as a special product of God's creation. Accordingly, subjective feelings were expected as adaptations to natural selective pressures.

The consequence of Darwin's evolutionary concepts with regard to the body-mind problem, however, was strong criticism along with the advent of Behaviorism in the 20th century. Watson founded Behaviorism and stated that a behaviorist should abolish all medieval concepts and drop all subjective terms such as sensation, perception, thinking and emotion. This theory, similar to that of Descartes, proposed that animal behavior patterns could be explained entirely in terms of stimulus-response mechanics; it is likely that this view encouraged treatment of animals without regard for their welfare. Resistance to accepting that animals have feelings also was evident in Ethology, which limited such considerations to observed behaviors, although ethologists usually refers to "hunger", "pain", "fear" and "frustration", among other terms.

According to Millman *et al.* (2004), the First World War shifted the attention of the human

community, so that discussions about animal welfare were not resumed again until the 1950s. Moreover, this probably was a result of the increased marketing of domestic livestock and the rise of humanitarian organizations against animal suffering in biomedical research and food industries. These entities, mainly from the USA, also influenced the passing of both the Humane Slaughter Act (1958), aimed at protecting animals during slaughter, and the Animal Welfare Act (1966), protecting animals used in scientific research (Millman *et al.* 2004).

The science of animal welfare has grown gradually since the 1960s (Duncan 2006). In this decade, there was a consensus that animal welfare was linked to stress (the physiological response to stressors) (Bareham 1972, Wood-Gush *et al.* 1975, Freeman 1978; all cited in Duncan 2006). Accordingly, stressed animals were under "poor" welfare conditions while non-stressed animals were under "good" welfare conditions, which assumed that reliable stress indicators were sufficient to allow identification of state of animal welfare.

However, after the publication of 'Animal Machine' by Ruth Harrison in 1964 (Duncan 2006), followed by British government investigations as reported in the 'Brambell Report' (Brambell 1965), studies on animal welfare were redirected. Harrison wrote his famous book to highlight the suffering of animals submitted to poor conditions in intensive culture, biological studies, and product testing (Duncan 2006). Harrison was intrigued by the possibility that such animals could be physiologically stressed and possess a degree of consciousness about the suffered stress. In the same period, the Brambell Committee also defended the idea that 'sentience' (a minimum level of consciousness) was an essential condition for concerns about the welfare of non-human animals.

Since the early 1980s, behavioral scientists have accepted the idea that animal feelings are important to the welfare issue. In the 1990s, because of increasing world animal production, studies on welfare and related subjects (pain, suffering, consciousness) were dramatically increased. The interest in animal welfare has encouraged some companies to establish criteria for handling animals destined for consumption (Fraser 1995), although not necessarily based on scientific principles. Of course, it also may have been a marketing program to reach customers increasingly sensitive to animal welfare. In the scientific environment, ethics committees have been established in most countries to dictate local guidelines for acceptable ways of dealing with animals (for production, experimentation, and recreation purposes). Scientific journals also increasingly have required that authors certify that their studies are in accordance with at least local ethics committees, although some journals still use their own ethical guidelines.

In the present century, the debate intensified and several reviews appeared, including dozens with 'animal welfare' or 'animal well-being' in the title. Some recent conceptual reviews on animal welfare are Dawkins (2006), Duncan (2006), Volpato *et al.* (2007), Bekoff (2008), Broom (2008), Camfield & Skevington (2008), Dawkins (2008), Fraser (2008), Gómez-Laplaza & Gil-Carnicero (2008), Hogan & Phillips (2008), Mendl & Paul (2008), Passantino (2008), Takahashi-Omoe & Omoe (2008), Veissier & Forkman (2008), Yeats & Main (2008).

The possibility of animal feelings, an important focus of the welfare issue, has been a challenge to scientists to prove that non-human animals (mostly vertebrates) are sentient beings and thus deserve welfare considerations. Opposite positions, however, still consider non-human animals as non-sentient beings (see Rose 2002 for fish) and a reverse onus clause has been used (thus shifting the burden of proof to the scientist). We propose that if any doubt still exists in this matter, the burden of the proof should be on those that defend the position that animals are not sentient beings. However, several scientists have accepted this reverse onus clause, probably because of their intrinsic motivation for solving complex questions. Volpato *et al.* (2007) analyzed the logic of such debates and concluded that empirical science can neither prove nor disprove sentience in non-human animals; however, the authors consider that current data (morphological, physiological and behavioral) and theories are suggestive of feeling in such organisms, creating a scenario ethically tempered in favor of assuming non-human animals as sentient beings, thus deserving welfare considerations (and in case of doubt, assuming that they are sentient beings). Therefore, the important question remaining is not about sentience, but how to know when animals are experiencing conditions that affect their welfare.

WELFARE AND WELL-BEING

Although these words have been usually used almost interchangeably, their implications to considerations of animal suffering might be relevant. According to Broom (2008, p. 81), "*In origin, welfare refers to how the individual is faring or going through life whilst well-being is how the individual is ... Welfare is the word used in modern European legislation*." Immediate conditions acting upon an organism are mostly concerned with that state of well-being, while an animal's growing history is related to welfare. For instance, a sick condition on only one day is more relevant to well-being than to welfare, and its permanence is undoubtedly associated with welfare.

Although the welfare issue encompasses organisms in wild and captive conditions, the main focus of the welfare issue is captive animals. Animals used in production systems for food, for instance, are clearly expected to have short lifetime. The welfare consideration in this context is about how they exist during their relatively short life span. To know how these organisms are faring through life (welfare) is obviously important, as also it is to know how they are faring at the moment (well-being). The important question, however, is to know how to assess the well-being of non-human animals.

INTERACTION OF WELL-BEING WITH OTHER BIOLOGICAL STATES

Disease, health, stress and distress should be considered in animal welfare. Understanding the links between these states is essential for a broad conceptualization of well-being and welfare. In Figure 1, these connections are schematized in terms of set theory. Accordingly, well-being does not include disease states and not all health conditions mean well-being; stress and distress may be included in disease, health or well-being states. In the following examples, arguments for these relationships are presented.

DISEASE AND WELL-BEING

Although no one doubts that a sick animal is not in good condition, there are reasonable arguments contradicting that well-being includes disease states. Sickness impairs life, changes normal behavior, causes discomfort or even suffering. Sickness often precedes death and is the consequence of many aggressions upon the organism, *e.g.* viral, bacterial and parasite infections, pollution, and metabolic or immunologic or genetically-mediated diseases. To find conditions where a sick state is favorable to the organism appears to be a hard challenge.

We can imagine, for instance, that some disease conditions in humans could be maintained to provide the sick person psychological attention that could not be attracted otherwise. Such a state could imply a condition of well-being for that individual. That is, the disease state is a social mechanism for attracting attention and care. However, as far as we know, this example has no correlates in the non-human animal world, and thus, we cannot use it to make any general conclusion even restricted to vertebrates. This example seems more an exception for humans than part of a general rule, at least while its occurrence is not demonstrated in non-human animals.

HEALTH AND WELL-BEING

The assumption that all healthy animals are in a condition of well-being ignores some physical or psychological discomforts that might impair life quality. For instance, fear, anxiety, tiredness, thirst, hunger and lack of protection are some conditions that may cause discomfort, and even stress, in healthy animals. As Bekoff (2008) points out, even 'good' welfare is not 'good enough', since the animals' feelings may not be taken into account. Thus, the real question remaining is how exactly we should characterize the welfare or well-being states of healthy non-human animals.

STRESS AND WELL-BEING

The success of the welfare issue in scientific debate in recent years caused many studies to shift the state of "non-stress" to "welfare", including the use of physiological indicators of stress for assessment of welfare. However, our view of current knowledge supports that stress may be part of disease, health and well-being states, and thus is not a reliable indicator of just the disease state (see Figure 1).

Stress originally was defined as the challenge of the relative stability of the internal state by an aversive

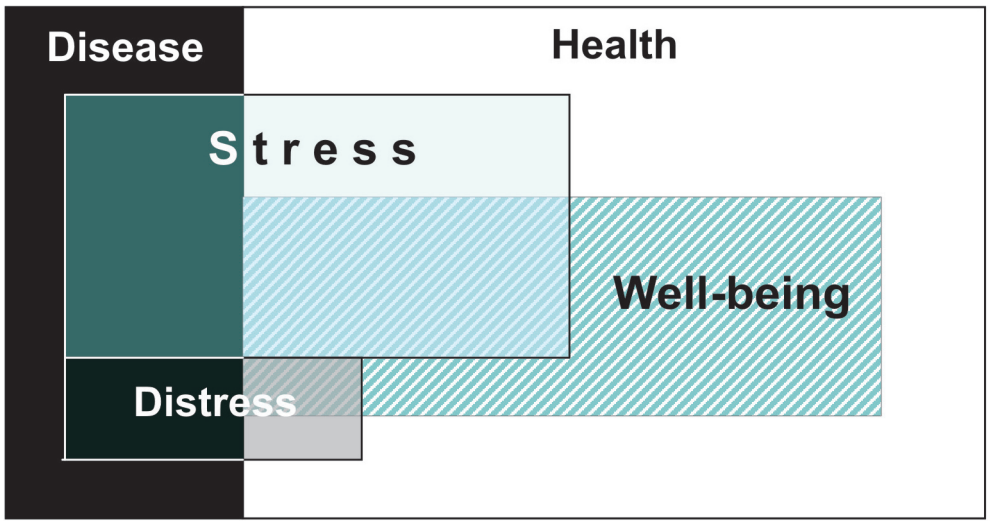

Figure 1. Body states represented by set theory. Consider intersections among subsets instead of areas. Accordingly, health does not include disease; stress does not include distress; disease may include both stress and distress; well-being does not include disease, but instead may include stress and distress; well-being is part, but not the whole, of a health state.

stimulus (Selye 1936). During such a challenge, the sympathetic nervous system and the hypothalamus-pituitary-adrenal (HPA) axis (hypothalamus-pituitary-interrenal in fish) become activated in vertebrates, thus resulting in increased blood levels of cathecolamines and corticosteroids, respectively (Moberg 1999, Mommsen *et al.* 1999, Barton 2002). These physiological changes, and release of other chemical intermediates (*e.g.*, corticotrophin-releasing hormone and adrenocorticotrophic hormone), have been successfully measured as indicators of stress in vertebrates.

Since stress ingenuously was considered to be an impaired condition of the organism, some researchers still view stress as the opposite of well-being. However, this clearly is not the case. In fact, stress is a natural response that enables the animal to cope with aversive or potentially threatening or lethal stimuli, thus overcoming the unfavorable condition and allowing rapid recovery to the pre-stress state. Thus, stress is a biological, adaptive mechanism evolutionarily acquired that has survival value. Release of catecholamines and corticosteroids mobilize or sustain energy release from reserves, which enables the animal to cope with the imposed challenge. Importantly, such a coping mechanism is a necessary part of life and not necessarily hazardous. Increased physiological indicators of stress also have been demonstrated in conditions where a threat to welfare was not expected. For instance, Roney *et al.* (2007) carried out a comprehensive study on endocrine responses of young men to social interaction with young women. Their data indicated that cortisol increases in a positive social opportunity rather than during social threats. The authors assert that cortisol-mediated energy mobilization may be functional for both facilitating courtship and responding to threatening events. In migratory fish, increased cortisol was found to prime the hippocampus or other olfactory areas of the brain to recall memory and, thus, allow the fish to find the natal stream in a reproductive migration, an example where stress-induced cortisol enhances reproductive success (Carruth *et al.* 2002). Greater circulating glucocorticoid levels were correlated with greater survival in the European, common and side-blotched lizards (Comendant *et al.* 2003, Cote *et al.* 2006), and wild rabbits (Cabezas *et al.* 2007). In mice, prenatal stress improves the offspring's performance in motor tasks in a sex- and age-specific way, without increasing anxiety-like behavior (Pallarés *et al.* 2007). Duncko *et al.* (2007) showed that acute stress improves learning in healthy men. Moreover, if these natural conditions that demand energy and impose stress are not part of the welfare state of a species, then how could one justify the role of these conditions to survival and evolution? A parsimonious answer is that stress, in such cases, does not mean impaired condition (see also Breuner *et al.* 2008 and the allostatic theory from McEwen & Wingfield 2003).

DISTRESS AND WELL-BEING

Under more stressful conditions, the organism may reach the distress state. Distress, as clearly defined in Moberg (1999), is the internal state when an over-challenged organism needs extra energy, thus, impairing some other biological function (*e.g.*, reproduction, growth and/or immunological defense). However, we defend that even this strong energy-cost challenge may be part of the welfare condition in some circumstances. Migration is one of the best examples. Migration consumes energy reserve extensively (see Butler *et al.* 1998, Shmueli *et al.* 2000, Tudorache *et al.* 2008) and one expects that a healthy, fit migratory animal would be successfully engaged in this difficult journey. Migration evolved as a strategy to maximize fitness in many organisms and is part of their life history. Even if given the choice, animals will migrate, since they are genetically destined to do so. Fights to defend territories, food, females or offspring also can be interpreted in this same way, causing even distress, although the genetic drivers might be less well expressed in some cases. Why do we suspect that these naturally predictable behaviors or states are not a part of an organism's welfare condition? We state that there is no biological basis for such a suspicion, except for an anthropomorphic view.

DEFINING WELFARE AND WELL-BEING

As we have proposed, the relationships shown in Figure 1 are naturally expected and from this view emerges the need to clearly define the states of well-being. To answer this question, we will summarize the main tenets in the literature and some less explored proposals.

PHYSIOLOGICAL INDICATORS

Most scientists are immersed in studies to find physiological and behavioral patterns that indicate the welfare or well-being states in animals. Part of this aim is derived from the human search for general patterns (also a goal in science), and partly because of successfully finding physiological patterns associated with the stress phenomenon as delineated by Hans Selye (1936). We have supported that such a goal is feasible, but not completely valid for welfare or well-being considerations (Volpato *et al.* 2007). Therefore, we will discuss this position in more detail.

Stress responses provide the organism energy for coping with stressors. During biological evolution, organisms were subjected continually to stressors, and survival was somewhat conditioned by the availability of energy to support the necessary responses. Thus, it is reasonable that evolution shaped physiological mechanisms to a standardized pattern. This is true for vertebrates, the most studied organisms in this field. Similar mechanisms designed to provide energy are, thus, highly expected in other animal organisms.

In this adaptive approach, stress enables life and, paradoxically, extremes of this system can be hazardous (distress as defined by Moberg 1999). Thus, distress mechanisms, instead of a providing negative feedback to stop excessive stress, evolved, which has to be explained in terms of natural selection. One tentative explanation is that distress is also under selection, where an individual that faces distress more frequently will be prevented from reproducing. Excessive exposure to overly stressful conditions that cause distress may be a consequence of non-adaptive environment-animal interactions guided by specific systems (nervous system primarily) for evaluating cues and conditions. Although just a speculative explanation, the physiological mechanisms of distress as well as stress exist, thus indicating that some positive selective pressure acted upon both.

At this point, we support that evolutionary mechanisms have shaped responses to stress and distress, and thus the search for physiological patterns of these processes is highly expected. By analogy, are there physiological mechanisms shaped by evolution for the welfare and well-being states?

The answer to this question is no and the reason is easily explained. A trait should have clear consequences for survival and/or reproduction so that it can be shaped by natural selection over the course of evolution. This is the case with stress, and perhaps distress, but there is no such profile for the welfare and well-being states. As shown in Figure 1, only sick animals surely are not in a condition of well-being, thus they could not be selected evolutionarily. Under good states, neither survival nor reproduction is at risk and thus natural selection is not expected to shape some physiological "pattern". Either high and low demanding conditions (systems) are expected for

well-being or welfare states, which are different from the stress-demanding states. Even animals in poor welfare states might have improved fitness (*e.g.*, see Breuner *et al.* 2008). Considering that a clear point for selection is not found for welfare and well-being states, physiological pathways strictly related to these states are not expected, and thus the consequent physiological indicators are improbable.

NATURAL BEHAVIOR

Several authors have suggested expression of 'natural behavior' to indicate welfare or well-being states (see Huntingford *et al.* 2006). This logic, however, needs caution and is a common approach by veterinarians and people in zoos caring for domestic or wild animals. However, what is considered a 'natural behavior'? Basically, it is the behavior expressed by the animal in nature. This assumes that animals in nature are all in good condition, which is not necessarily true. In the natural behavior's approach, expression of unnatural behaviors is accepted as an indicator of poor state.

When canaries (*Serinus canaria*) deprived of nest material go through the motions of weaving material into a non-existent nest, this is said to be "vacuum behavior" (McFarland 2006). This is clearly a non-natural behavior that indicates the animal is not in a good state (in this case, deprived of nest material while physiologically motivated for nesting). A dog or a cat may lick or scratch its leg to the point that it hurts itself; this is not a naturally expected behavior, since it can impair the animal's health. Clearly, this behavior is indicative that the animal is not in a good state. Although such behaviors may also occur in nature (some psychological disorders are expected even in natural life), they do not indicate state of welfare, but rather absence of good condition. Some prisoners at the Alcatraz prison could even paint pictures, play music and enjoy some other "privileges", and even unnatural (abnormal) behavior could not be detected under these circumstances, but this certainly does not mean the prisoners were in good states (at least psychologically). For some captive animals, the analogy might be valid. In short, natural behaviors do not warrant welfare as well as well-being states, and unnatural behavior might indicate the animal is not in good condition. Thus, the question of how to differentiate a healthy animal from a healthy animal in good state remains unanswered.

STEREOTYPED BEHAVIOR

Stereotypies, also a behavior displayed under extreme conditions, are usually accepted for indicating poor welfare (see in Dawkins 2008), but this seems to be not the case. For instance, in mink, stereotypy occurs in animals with low cortisol levels (Bildsøe *et al.* 1991) but also in those showing better reproductive performance (Jeppesen *et al.* 2004). Hansen *et al.* (2006) could not associate stereotypy with either fearful and anticipation behavior – both indicating welfare. Moreover, De Passillé *et al.* (1993) reported that stereotypies in calves might even be beneficial. Therefore, Dawkins (2008) argues that the welfare implications of stereotypy is not in terms of whether stereotypy is a reliable measure of welfare, but rather whether this behavior is good for health and/or what the animal wants to do. Therefore, stereotypy is not a good welfare indicator.

CHOICE AND PREFERENCE

Some authors have used preference or choice tests to learn more about non-human animals, and use these preferences or choices to offer animals better conditions in an attempt to reach good states (see reviews in Dawkins 2006, Volpato *et al.* 2007 and Dawkins 2008). In this way, Dawkins (2006) has reinforced this approach with regard to the welfare issue. Volpato *et al.* (2007) engaged this approach and proposed a preference-based definition for fish welfare (mainly well-being), which is valid for any other animal. Accordingly, welfare is *"... the internal state of a fish when it remains under conditions that were freely chosen*" (Volpato *et al.* 2007). In this review, these authors also detailed methodological concerns for applying such preference tests.

Here, we still emphasize this preference or choice approach for understanding what the animal wants. More recently, Dawkins (2008) again elegantly reinforced two important questions for approaching animal welfare: 1) Are the animals healthy? 2) Do they have what they want? In short, Dawkins (2008, p. 943) defines good welfare as "*healthy animals*

that have what they want". The inclusion of "health" in the definition presented by Volpato *et al.* (2007) is interesting and also is represented in Figure 1. However, some concerns must be addressed with respect to the recent Dawkins' approach. First is the definition of 'animal needs'. According to McFarland (2006), 'needs' are conditions that are essential for the animal's survival (*e.g.*, foraging for food and feeding for survival), while 'wants' are motivated behaviors not necessary for individual survival, but may be necessary for species survival (*e.g.*, sexual behavior). Therefore, the choice or preference approach is implicated mostly in 'wants' rather than 'needs', since 'wants' refers to a broader spectrum of behaviors and conditions (even including 'needs').

In our research group, we have dedicated a number of experiments to build a comprehensive catalog of 'wants' for one fish species, the Nile tilapia (*Oreochromis niloticus*). Although just an animal model, we have found interesting results, mostly that its 'wants' are not necessarily those that have been used in fisheries. More studies are needed, but this approach will enable us to calculate the welfare/well-being imposed cost for production, a subject that should underlie discussions on animal welfare.

WELL-BEING AND WELFARE, AGAIN!

While welfare is the updated word for guidelines, laws, and regulations, scientists are closer to the notion of well-being states. We can better study what the animals want (see also Dawkins 2008), a state more related to the well-being of an individual. From this perspective, if a captive animal's wants are available, we suppose they are in better well-being condition (even they should choose not to be confined – this is a nonsensical scenario in the welfare issue). Therefore, considering that humans will maintain animal production, well-being can easily be taken into account from preference/choice tests, thus possibly assuring welfare conditions.

TIME PERSPECTIVE FOR WELFARE CONSIDERATIONS

What an animal experiences during everyday life might have immediate consequences and also may affect future outcomes. Such differentiation is important for welfare considerations. An animal engaged in a reproductive migration (an ultimate-based behavior) is subjected to daily high-energy costs and the journey may result in either death or reproduction. Social hierarchy might be disputed daily (*e.g.*, proximate causes), but longer-term consequences are expected (*e.g.*, obtaining females and other resources). Are non-human animals aware or conscious of the long-term consequences in both examples? In other words, are non-human animals prospective beings? Although this might be an anthropomorphic view, daily (and also proximate) experiences can affect life in both short- and long-term perspectives. When judging or choosing daily acts or conditions, an animal might cope well in the short term in an activity that is ultimately not safe for its welfare in the long term. In humans, some play activity for children or certain addictive behaviors might seem beneficial in a short time perspective, but hazardous over a longer period. Thus, prospective analysis might be imperative for survival.

No one doubts that for longer time considerations, mechanisms acquired through evolution warrant success. For instance, we assume that when an animal migrates for reproduction, this is a heritable trait resulting in innate behavior and not a conscious journey for reproduction. The genetically-based 'prospective behaviors' are essential for survival. Ants save food for winter, bears store energy for winter dormancy, and solitary wasps keep anaesthetized prey larvae together with their eggs and run away forever – a behavior that warrants food for the future offspring, for example. Even in everyday situations (in the short term), innate drives are important. The fish, pacu (*Piaractus mesopotamicus*), visually facing a predator fish keeps away from it and releases chemicals that disperse conspecifics, a response where experience is not necessary (a supposedly innate response) (Jordão & Volpato 2000). The carnivorous fish, sorubim pintado (*Pseudoplatystoma curruscan*), stays motionless when smelling a larger-sized conspecific fish, a potential predator; otherwise, it displays feeding search behavior when the smell is from a smaller conspecific (a potential prey) (Giaquinto & Volpato 2005). During copulation, the female sagebrush cricket (*Cyphoderris strepitans*) feeds on a portion of the male wing material and consumes haemolymph flowing from the wounds it

inflicts (Morris 1979, Dodson *et al.* 1983, both cited in Eggert & Sakaluk 1994). A majority of mantid species (*Stagomantis* spp.) might experience sexual cannibalism (the female cannibalizes the male after mating), thus making reproduction a dangerous period, but males engage in reproduction anyway. This 'courageous' initiative is obviously a genetically determined behavior that all mature males will do when facing a mature female.

However, medical care and advice for human health are clearly conscious prospective guidelines. Although non-human vertebrates have learned (or conscious) prospective behavioral drives, as evidenced for example, in time-learning behaviors (Barreto *et al.* 2006, Delicio & Barreto 2008), the duration of these drives is obviously very limited compared with those in humans. However, for welfare concerns, aware or conscious anticipation of the future needs to be considered. Mendl & Paul (2008) carefully reviewed the question "*Do animals live in the present?*" They show behavioral evidence that argues for the capacity to recognize the concept of time in non-human animals, and conclude that this ability may bring both welfare benefits and problems. This emerging area in welfare science still deserves more investigation, even though already was referred to in the Brambell (1965).

The role of nature and/or nurture on the life of an animal may depend on the lifespan: complex processes are more expected for longer life span species. Thus, this problem is complex and caution is needed, while it is a fruitful area for future studies.

CONCLUDING REMARKS

This review highlights topics on the animal welfare issue, trying to clarify the scenario (from concepts to reality). The main ideas discussed and proposed are:

- well-being state is undoubtedly of great importance to the welfare science;
- assessing the individual well-being state is the most feasible way to consider the quality of life of an organism;
- most scientists agrees that a healthy animal is not necessarily in welfare/well-being conditions;
- stress and distress are not reliable indicators of well-being states and might even be part of a welfare condition;
- evolution of clear-cut physiological pathways underlying the well-being/welfare state is highly unlike; thus, general physiological indicators of welfare, even restricted to a taxonomic group, are improbable;
- natural and/or stereotyped behavior are discouraged as indicators of animal welfare;
- the preference-based approach in the welfare issue is useful because the complex system-environment relationship is based on animal decisions;
- the general characterization of an internal state of welfare is biologically unexpected, and scientists should focus more deeply on what the animals want.

The animal welfare issue is complex and deserves much caution. In this review, we criticized some attempts to view the welfare state from either a save-energy approach or from a standardized physiological phenomenon. Instead, we propose a deep look at the animal wants, in line with considerations of the animals' point of view as proposed by Dawkins (2006) and Duncan (2006). In this context, to know how the animal behaves in a specific environment is undoubtedly necessary, and is reached mainly by choice tests. These tests, however, could be tempered by cognition approaches (see Brydges & Braithwaite 2008). Contradictory published data on animal welfare reveals the complexity of this issue, a consequence of different approaches and definitions, thus surely indicating needs for caution.

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