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# Introduction: The Science and Practice of Optimal Animal Welfare

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## Introduction

For decades, animal welfare standards and practices have been advanced by evidence from research conducted in agricultural, biomedical, and zoological settings (Broom, 1988; Broom, 2011). These standards and practices are generally aimed at defining minimum rather than optimal criteria for welfare. One outcome of this is that regulated animals whose care and housing meets the minimum standards may be able to cope but may not thrive. The welfare continuum of suffering, to coping, to thriving has been proposed as a useful lens through which to view animal welfare, and is based on the study of human well-being (Maple and Bocian, 2013). Indeed, coping has been characterized by some investigators as an indicator of animal welfare. The American Veterinary Medical Association (AVMA) website, for example, defines animal welfare as "how an animal is coping with conditions in which it lives." If an animal is judged to be "healthy, comfortable, well nourished, safe, able to express innate behavior, and it if is not suffering from unpleasant states such as pain, fear, and distress" it is said to be living in a "good" state of animal welfare (AVMA). Animal welfare science developed out of concern for animal suffering in captive settings. Suffering has been dramatically reduced due to improvements in physical and social environments (Maple, 2016), but thriving is still a distant goal. Elsewhere, we have argued that we are aiming too low if we accept coping as a good outcome (Maple and Perdue, 2013). In fact, all of the welfare attributes advocated by AVMA and other organizations are characteristics of animals that thrive. Thriving goes beyond what most minimal regulatory standards require. It is the difference between good and optimal welfare.

One construct that encompasses these higher standards and better practices is "wellness". Wellness has been promoted as a goal for human beings that seek optimal physical, mental, social and spiritual health. In fact, one organization promoting wellness for people has extended the construct to include six dimensions; physical, social, intellectual, spiritual,

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emotional, and occupational (National Wellness Institute). In the wellness plan under development at the Jacksonville Zoo & Gardens, we have extended this familiar paradigm to include zoo animals. Because human beings accept no limits to their own wellness and cannot be "too well," it should be possible to provide opportunities for zoo animals to reach a similar standard; to thrive rather than to merely cope. However, we recognize that setting conditions that encourage thriving for animals in human care is a major and costly task.

We are grateful for the invitation from Dr. Olga Lazareva and the editors of *Behavioural Processes* to organize this special issue of the journal to address "optimal animal welfare". The behavioral construct of wellness is new and has not been fully explored in animals managed by human caregivers. Our research collaborators are eager to have this idea tested and evaluated by others. Putting wellness to the empirical test requires an understanding of what constitutes thriving in every unique species we manage on the farm, in the laboratory or at the zoo. A starting point is to require that the life of captive animals be measured in comparison to the way that animals live in nature. The seven papers in this special issue examine various aspects of animals living in captive settings. The authors of the papers herein were not required to adhere to a universal definition of optimal animal welfare, but were left to offer their own approach to understanding the variables that drive animal welfare. It is our hope that the ideas developed in this issue will encourage further research and ultimately result in conditions that significantly improve living conditions for all species managed in agricultural, biomedical, and zoological settings throughout the world. To achieve this outcome, we must design and build superior research and exhibit settings that promote appropriate social groups, engage individuals through provision of environmental and cognitive enrichment, ensure they receive the best nutrition and health care, while providing daily mental and social opportunities and challenges to activate and engage them. Providing a diversity of animals with the kind of space where they can thrive will be challenging and expensive, and it will take time to upgrade the environments of animals in so many different facilities with so many requirements unique to the service they provide. The types of accommodations that need to be made for animals in research settings differ greatly from those needed for animals on exhibit in educational settings. Still, the principal needs of the animals are similar, and designers will surely find templates that work in a variety of settings with canids, felids, primates, and other taxa.

The contributions to this volume will give readers a broad and exciting view of current animal welfare research findings. The papers include in-depth pieces reviewing welfare information for particular species, attempts to address particular behavioral problems, and the importance of individually-tailored approaches to supporting optimal animal welfare. We regard wellness as the functional equivalent of optimal animal welfare. The necessity of cognitive stimulation as an integral part of optimal animal environments is discussed in one paper, and another examines whether play behavior might serve as a useful metric for assessing optimal animal welfare. The final paper outlines a new framework for viewing animal welfare in a comprehensive and lifelong manner.

The welfare of some species has been understudied in comparison to others, despite the demonstrated need for improvement, and two papers in this volume address such situations —one on marine mammals and one on hippopotamus. Brando and colleagues thoroughly

review the current literature on marine mammals, and conclude that fundamental study is needed to identify positive and negative measures of cetacean welfare. The paper highlights future areas of needed research, and like the co-editors of this volume, encourages going beyond minimum standards in caring for marine mammals. They also highlight "best practice case studies," similarly to the Tennant et al. paper on hippopotamus. Tennant and her associates at Jacksonville Zoo & Gardens interpreted survey data for Nile hippos in North American zoos to examine the quality of life for these large mammals. From the responses generated by this survey, it is clear that this species is not thriving nor, with few exceptions, does it come close to a standard of optimal animal welfare. As the Tennant paper demonstrates, however, there are a few institutions that have created highly innovative exhibits, most notably the riverine exhibit at Disney's Animal Kingdom where a sizeable group of hippos are living well. It is important to understand the variables that influence normal socialization. Attempts to increase group size and provide night access to grazing opportunities are two required features of a naturalistic social life.

The paper by Brenda McCowan and colleagues illustrates the value of rigorous experimental techniques to better understand one of the more difficult aspects of managing the welfare of macaques housed in large social groups, which is moderating severe aggression. A network analysis statistical approach was used to identify three major pathways that illuminate our ability to understand, and perhaps eventually predict and prevent, this most deleterious aggression. The complexity and depth of the behavioral data collection and statistical analysis required to come to meaningful conclusions concerning this issue is well illustrated by this paper, and underscores the important role of science in achieving optimal wellness for animals. Clay et al. take a comprehensive approach to assess the effects of sex and early rearing on chimpanzee health, wounding, well-being, and orientation to humans. They conclude that even fairly small differences in early rearing environments, have long-lasting effects on chimpanzee welfare, and that individual chimpanzees with differing histories may require different environments to support their optimal well-being. As we envision 'best practice' plans for chimpanzee care and define programs for optimal welfare, we must carefully attend to these individual differences.

The current state of research on cognitive enrichment is presented by Perdue and her co-authors, as they describe how computerized testing apparatus initially used to test primate cognitive abilities, have also been shown to have a role in providing stimulating and enriching environments for animals. Perdue et al. argue that this type of opportunity for animals to learn, to solve challenging problems with consistent sources of novelty, and to provide for control over their environments have important implications for animal welfare. They advocate for further use of computerized testing in a variety of animal housing settings.

The contribution by Dallaire et al. focusses on one behavioral system, play, and delves into the role play may have in encouraging and identifying optimal well-being across species. They review human literature related to play and the function it has in inducing positive emotions in people and they consider whether play should be interpreted as a measure of optimal well-being in nonhuman animals. This paper illustrates the value of applying findings from the study of humans to nonhumans as we better understand optimal welfare.

In the final paper, Brando and Buchanan-Smith claim that we need to prioritize attending to the welfare of animals over human convenience, and that a holistic system they call the "24/7" approach is needed. This comprehensive method assesses the welfare impact of different features of an animal's life cycle, the roles we assign the animal, variation across day/night, weekdays/weekends, and across seasons. The authors offer a set of assessment criteria including feeding, housing, health and behavior criteria, to facilitate determining whether an animal's welfare needs are being met.

The authors we recruited to write the articles in this special issue are all engaged in studying animal welfare in a variety of species and situations and they agree that we are at the beginning stages of creating better practices and higher standards that will benefit the animals assigned to our care. We understand that significant human and financial resources will be required to advance these standards to wider use among our colleagues. In our view, optimal standards of animal welfare can be achieved and should be the ultimate goal of responsible scientists and practitioners. We begin therefore by examining research and practice in the search for evidence-based models of optimal animal welfare. In the end, optimal animal welfare (wellness) will be achieved by the widespread application of scientific data. Hopefully, institutional leaders will encourage a renaissance of research on this important topic.

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