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Editorial

The model zoologist: how should we think about animals, model animals, and non-model model animals?

The first issue of ***Zoology*** in the new decade covers a wide spectrum of interesting topics ranging from the environmental impact (ectoparasites, food, temperature) on fitness and survival in lizards, planarians, and sea turtles to conservation perspectives in the red-legged partridge, a small game bird of the Phasianidae family which is critically endangered. Each of the animals presented in this issue is evolutionarily distinctive with a unique set of features that provides a window into specific aspects of e.g. adaptation, physiology, developmental biology, population viability and dispersal range. As Editor in Chief I find it gratifying to see the great strides the ***Zoology*** has made in the last decade toward the goal of publishing such explicitly organism oriented and integrative work.

Since its foundation in 1886 (as "*Zoologische Jahrbücher*") and the relaunch in 2001 (as ***Zoology***), ***Zoology*** is a journal devoted to experimental and comparative animal science. Since our planet is home to an estimated 30 million species of animals, obviously there is an overwhelming diversity of animals to study. At a recent meeting of zoologists, ecologists and symbioses researchers there was a lively debate on the term "model animal". I suddenly became confused and disoriented: Are we facing definition crisis in the zoological sciences? Are not all animals model animals? What makes a model animal? What are non-model model animals?

Let us start simple: we all work on and study **animals.** Technical powers in modern biology have allowed us to investigate a wide range of animals. Studying more animals can give us a more rigorous and authentic view of biology. But because there are so many animals, it can be a challenge to pick the right one for a particular question and to extract general concepts and rules from comparing different animal species. **Model animals** are widely studied animal species which have been adapted to a vast array of common genetic techniques. Model animals are often easy to keep in the laboratory and easily manipulated genetically. The fruit fly *Drosophila melanogaster*, the nematode *Caenorhabditis elegans*, the zebrafish *Danio rerio* and of course the mouse *Mus musculus* are among the most often used model animals in the life sciences. Over the history of biology, studying such model animals has been a highly successful strategy and helped, for example, to construct a rather complete picture of how a fertilized egg becomes a fully mature animal. However, no single species can ever serve as a universal model. Every single species has unique features that will have assets or drawbacks, depending on the question being asked such as dynamics of fertilization, or the cellular pathways that drive organ morphogenesis and regeneration (Bosch et al., 2019). Until recently, lack of genetic resources has hindered research on the mechanisms governing animal development, physiology and behaviour outside around a handful of such "model" species. This has changed now! – and gave us access to the so called **"non-model model organisms"** (Russell et al., 2017). Recent technological advances have greatly accelerated the ability to generate genetic and genomic tools to develop practically any animal species into an accessible and convenient research object for a particular question in zoology. Novel microscopy and visualization technologies, to point to technological advances outside the molecular sciences, for example, allow the reconstruction of the three-dimensional arrangement of an animal tissue in an unprecedented manner.

"Nature has been generous to Science and has provided us with many model systems", said the late Sydney Brenner in his Nobel Prize Lecture (2002). Technical powers in modern biology allow us to investigate a wide range of animals; and studying more organisms can give us a more rigorous and authentic view of biology. But remember: Every single species has unique features that will have assets or drawbacks, depending on the question being asked. No single species can ever answer all of our questions. Although with regard to the high degree of conservation one occasionally finds statements such as "*The big picture is that worms are little humans"*, worms are not little humans! Worms are worms. "Model" animals may be exemplars, but their evolutionary history needs to be considered before drawing comparisons to humans. We must be cognizant of the phylogenetic history before claiming that any trait is conserved. The challenge is to exploit the unique biological features of a special animal to address questions of general importance.

Zoology responds to the fundamental change of the last decade in how we perceive the biology and underlying complexity of animals by providing a publication and communication forum for all scientists who take an explicitly organism oriented and integrative approach with an evolutionary perspective. The articles in the first issue in 2020 are good examples of how to use **non-model animals** to address questions of general importance.

Still looking for a good New Year's intention? Become a **model zoologist** "*who conducts experiments in the light of evolution, recognizing species differences as well as similarities as information that is critical for drawing informed conclusions"* (cited from Katz, 2016).

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