BOOKS: EVOLUTION

Do We Need Species Concepts?

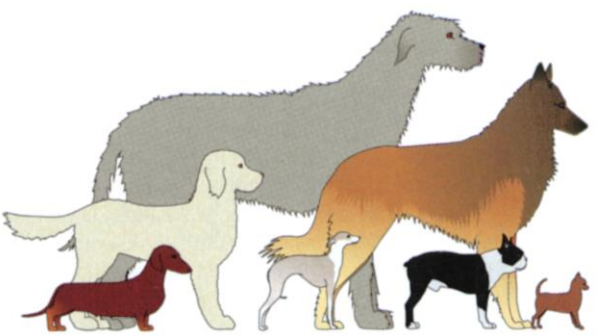
Kerry L. Shaw

Rocky Balboa had it easy. Downing raw eggs at 5 a.m., sprinting through the streets of Philadelphia, pummeling sides of raw beef, and pumping out one-armed push-ups prepared him to go the distance against world heavy-weight champion Apollo Creed. Brute force was what it took.

Genes, Categories, and Species
The Evolutionary and Cognitive Causes of the Species Problem
by Jody Hey
Oxford University Press, New York, 2001. 235 pp. $45, £34.95. ISBN 0-19-514477-5.

For decades, any serious contender on the subject of species concepts has had to go the distance with Ernst Mayr's Biological Species Concept (BSC), the reigning champion since the modern synthesis. Despite the persistence of the BSC and the enormous fan club that supports it, there remains a "species problem" in contemporary evolutionary biology: a set of questions pertaining to the nature of species, species boundaries, and species identification. Although the BSC offers answers to these questions, a substantial degree of dissatisfaction with those answers has accumulated in recent years. In their efforts to replace the BSC, challengers routinely have closely scrutinized the massive contemporary and classical literature on the nature of the evolutionary groups we call species. Jody Hey believes that such brute force efforts aimed at solving the species problem are bound to fail. In *Genes, Categories, and Species*, he offers a new perspective on why the species problem persists.

Hey, a geneticist at Rutgers University, seems fully aware of the murky waters he attempts to chart in his efforts to illuminate the features of the species problem. Although at many points in the book I found his approach more stimulating than illuminating, his casual style and thought-provoking examples are convincing, in a very basic way. Hey argues that the heart of the persistence of the species problem lies in our incorrigible drive to categorize any phenomenon that occurs repeatedly. With respect to species, he claims, we apply the mental tool of categorization as we are exposed to repeated instances of organisms that are similar. To develop his argument, Hey draws on discoveries from diverse fields of study, principally psychology and philosophy. These discoveries provide support for the position that our conception of species as categories is a basic by-product of the way we think, and they suggest that we erect representations of categories in the mental process of devising them. Our use of one of the most fundamental units in biology, the species, mirrors this thought process. To describe the features of a newly hypothesized species, taxonomists traditionally proceed by creating a list of descriptors of the new species to compare with existing taxa for uniqueness. But once a "type" specimen is designated, what emerges is a named species category known by representation. Hey proposes that, despite lessons from Darwin and Mayr that species are evolutionary populations which cannot be understood through representation alone, biologists persistently exercise this representational activity and that this process positively hinders our investigations of biological diversity. The trouble is, Hey claims, that named species often do not, and probably will never, accurately match "real evolutionary groups."



One species or many? Because much of the diversity of dogs is found among fairly distinct breeds, the question is not an easy one to answer.

The author asserts that the real evolutionary groups that we might wish to give species names defy the kind of categorization our penchant demands, and herein we find the second half of the persistence of the species problem. We routinely expect our named categories to match evolutionary entities, but because of the nature of the evolutionary process, Hey claims, they do not. He identifies the key sources of these discrepancies as gene exchange and nonindependent genealogical histories among real evolutionary groups due to genetic invasions from closely or distantly related organisms. The resulting fuzzy boundaries around evolutionary groups thus differ from and are far more complex than those expected when groupings are based on phenotype. Such boundaries eventually lead to that uncomfortable question: is the group a "good" species?

To illustrate the futility of trying to line up our scientific understanding of the products of the evolutionary process with the neat bin-structure needed to name species, Hey develops a simple model for the evolution of a real evolutionary group. It is ironic that he supports his position here with theory, because one of his major recommendations for how to make progress on understanding the nature of real evolutionary groups is that we focus on what data we lack to answer our questions about group structure and boundaries.

The view that data should take primacy in putting the species problem to rest may be a welcome, or even obvious, point. However, if the answer were easily gleaned from nature we probably wouldn't have a species problem. Making matters worse, it certainly appears that the species problem has intensified in recent years as molecular research reveals "species" that experience some level of ongoing gene flow with other "species." How accurate is this impression? Reaching the end of the book, I was disappointed to find that Hey has not provided a summary of empirical data to support his repeated assertion that named species often do not accurately match real evolutionary groups. Undoubtedly, his thesis will not be accepted without a rigorous empirical defense. We would all like to know if the data warrant such a conclusion.

The perspectives Hey offers in *Genes, Categories, and Species* are original in that they have few if any themes in common with existing party lines (such as those put forward by cladists or individualists, for example). The new ideas are valuable, although for contextual comparison Hey provides little more than a caricature of some previous species concepts. Rather than seeking to dethrone the BSC or any other current concept, Hey seems more intent on removing species concepts from the competitive ring entirely. No doubt some (many?) will disagree with the main argument for this upheaval, the claim that data can eventually lay the species problem to rest.

One good reason for adapting a different view than Hey advocates is that species concepts play an important role in furthering our understanding of biodiversity. These concepts can be appreciated as models that inspire

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questions about the nature of both the boundaries and the internal structure of real evolutionary groups. As such, they would play an important role in directing evolutionary biologists toward worthwhile topics for investigation. This approach would require shifting our views on the role of taxonomy, to emphasize the act of hypothesizing species according to a given model. Combining the data collection Hey calls for with a treatment of species concepts as models would advance our understanding of how the world of real evolutionary groups is structured.

BOOKS: COGNITIVE SCIENCE

An Eastern View of Apes and Monkeys

Sarah Boysen

In 1948, Kinji Imanishi and Jun'ichiro Itani opened a new approach to the study of primate behavior when they began continuous, long-term observations of free-ranging macaques at several sites in Japan. Their intellectual descendents have since contributed much to the development of primatology and to the many disciplines concerned with the evolution of mind and behavior. That Japanese biologists, anthropologists, and psychologists continue to do so is amply demonstrated by *Primate Origins of Human Cognition and Behavior*. The volume explores a wide range of issues, with an emphasis on comparative approaches. It will especially benefit American and European scientists and students through its presentation of research and perspectives that have previously been unavailable to them. The volume's emphasis on studies of the common chimpanzee (*Pan troglodytes*) reflects the long-standing interests of its editor, the not-so-common cognitive psychologist Tetsuro Matsuzawa.

Primate Origins of Human Cognition and Behavior
T. Matsuzawa, Ed.
Springer, Tokyo, 2001. 599 pp. $129, €119, ¥9,500. ISBN 4-431-70290-3.

The editor has long worked to bring primatologists from around the world together in innovative ways, by building a model, state-of-the-art facility for studying chimpanzee cognition at Kyoto University's Primate Research Institute. Matsuzawa has provided opportunities for collaborations with other investigators and their graduate students at his home institution. And he has championed efforts, funded by the Japanese government, to bring primate researchers together through a series of focused annual meetings. (These have highlighted such topics as chimpanzee cognition, chimpanzee behavior in the wild, gorilla and orangutan studies, and animal learning and cognition.) Thus, over the years, a large contingent of investigators have been hosted by Primate Research Institute scientists and have had the opportunity to share ideas, cross-fertilize their research efforts, and learn firsthand how primatology is conducted by the Japanese. And, as the volume makes clear, these efforts have helped Japanese researchers stay abreast of studies elsewhere.

KP duty. Japanese monkeys (*Macaca fuscata*) on Koshima Island wash sweet potatoes. Invented by a 1.5-year-old female in 1953, the behavior gradually spread through the population and was transmitted to following generations.

CREDIT: PRIMATE RESEARCH INSTITUTE OF KYOTO UNIVERSITY

Matsuzawa's insightful preface, which itself would be worth much of the price of the book, is followed by 28 chapters. Nearly all authored or co-authored by Japanese investigators, these include a host of contributions from interdisciplinary and international collaborations. Despite the editor's humility in giving historical and current credit to other Japanese primatologists, such a rich mélange would never have been possible were it not for his own scientific vision and generosity. Those of us within the field know Matsuzawa to be an extremely compassionate and ardent champion for the species he loves, as well as a one-man ambassador for the dissemination of the work of his Kyoto University colleagues. Such commitment is also reflected in the programmatic approach to exploring the cognitive capacities of chimpanzees—capacities that are well-documented in the book—that Matsuzawa has encouraged.

Primate Origins showcases an important line of chimpanzee research that has successfully combined observational and experimental approaches carried out in both the laboratory and the wild. In addition, it provides a forum for considerations of numerous areas of study of nonhuman primates. Matsuzawa offers an introduction to comparative cognitive science. Four chapters discuss the phylogeny of perception and cognition. Another set of chapters addresses the origins of human speech through studies of auditory perception and vocalization. Other parts of the book examine learning and memory; the recognition of self, others, and species; and social interactions. The volume's last part discusses culture as it applies to primate traditions such as sweet potato washing in Japanese macaques and tool use in wild chimpanzees.

Without question, this volume belongs on the desk of any student or researcher with a serious interest in primate behavior or comparative cognition. The editor has succeeded admirably in bringing together a coherent collection of important work. Matsuzawa's charming and informative children's book, which describes his own research on language capabilities in apes and similar former projects in the United States, was long required reading for second graders throughout Japan. Likewise, *Primate Origins of Human Cognition and Behavior* should be required reading for investigators around the world who wish to become acquainted with the creative and persistent efforts of Japanese primatologists.

BROWSINGS

The Recombinant DNA Controversy. A Memoir. Science, Politics, and the Public Interest, 1974–1981. *Donald S. Fredrickson.* ASM Press, Washington, DC, 2001. 408 pp. Paper, $39.95. ISBN 1-55581-222-8.

During his tenure as director of the National Institutes of Health, Fredrickson found much of his time consumed by the heated debates over research using recombinant DNA technology. The controversy was ignited by divergent estimates of the risks posed by recombinant experiments. It flared in clashes on whether the work should be governed by regulations or guidelines and how involved the public should be in determining either. Here Fredrickson focuses on the Asilomar Conference of February 1975, which shaped the early rules, and the Recombinant DNA Advisory Committee, which refined and revised them. His narrative account of the complex interactions between science and society highlights the efforts to win public acceptance for biotechnology in its early years.

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