Book review

Genes, Categories and Species: the Evolutionary and Cognitive Causes of the Species Problem

Jody Hey

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Providing a clear definition of species has been a preoccupation of systematists, philosophers and evolutionary biologists for much of the past few millennia. Luckily, for much of this time, the belief in the existence of God provided a good reason why organisms should form clear categories in nature. In the 20th century however, species definitions have somehow become required not only to represent patterns of similarity and difference in the world, but also to provide real insight into the units responsible for the generation of new species.

In this important and refreshing view of the species debate, Jody Hey draws on a range of philosophical and evolutionary arguments to argue convincingly that trying to make species definitions do both these things is unfair. In his view, attempts to define the essentially complex process of evolutionary divergence in genes, genomes and populations with a single definition of species are doomed not only to fail, but may also limit our ability to examine the evolution of biodiversity in a realistic way. It is surprising that of the thousands of categories that we use to interact with the world, it is only species categories that we expect both to describe a pattern in nature, to reflect the units generating the pattern, and to remain relevant as the pattern continues to change. As Hey points out, we do not continually debate and refine our definition, or our belief in the existence of clouds, because it is hard to say when one cloud becomes two. Similarly, we do not expect clouds themselves to reveal the constellation of factors that have caused their appearance in that part of the sky at that particular time. To do this we

employ meteorologists, who necessarily accept that the category cloud is most useful in that it allows us to study the process of condensation.

At the heart of Hey's argument is the idea of recurrence cycles. In this view, adaptation converts the recurrence of particular selective effects into genotypes that themselves generate (by differential reproduction) stronger recurrence than the environment that generated them. This means that, for a monophyletic group, pattern similarity has ultimately resulted from the homologous transfer of DNA through time. However, the crux of the problem (and this is where definitions of species and evolutionary groups depart) is that this recurrence pattern comes to persist even after these adaptations have spread over a greater spatial or temporal scale than that at which the evolutionary groups existed. In this way, Hey argues convincingly against the clear or consistent equivalence between evolutionary groups and species that many concepts of species seem to require.

Luckily, most biologists (particularly those studying plants or bacteria) have understood the unfair weight that has been placed on the species category, and use such terms in a way that does not constrain their thinking about the scenarios in which recurrent patterns can evolve by natural selection. Darwin himself was clearly aware of the arbitrary nature of species definitions, yet continued to use them (and other terms such as populations and individuals) to describe patterns in the world that he sought to explain. Hey suggests that we follow his example. We can (and should) use imprecise definitions of species, individuals and genes to ask important questions about ecology and evolution, provided we remain aware that these categories only represent approximate hypotheses about the real identity of evolutionary groups in nature.

JR Bridle

Institute of Zoology

Regents Park, London NW1 2RY, UK

E-mail: Jon.bridle@ioz.ac.uk