Much ado about species

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The Units of Selection: Essays on the Nature of Species. Edited by Mark Ereshefsky. *MIT Press: 1992. Pp. 405. $60, £44.95 (hbk); $33, £24.75 (pbk).*

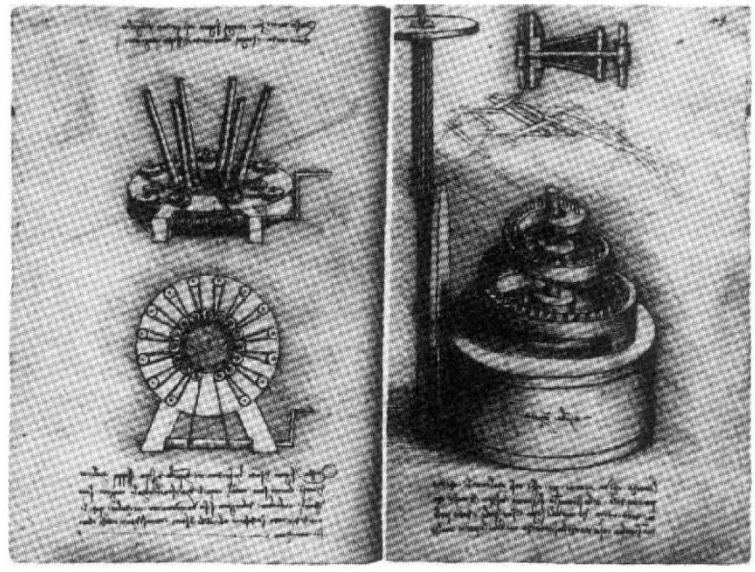
No area of evolutionary biology has been more beset by semantic and philosophical squabbles than the study of speciation. The difficulty of understanding such a slow historical process has repeatedly driven scientists out of their laboratories and into the arms of philosophy. From this union has sprung a bloated, quasi-philosophical literature about whether species exist, what they are and whether they differ from more arbitrary categories such as genera or families. There is some point to this debate; after all, it is hard to study speciation without a reasonable notion of its products. For most evolutionists, however, these matters were settled 50 years ago by Ernst Mayr, who proposed the widely accepted "biological species concept", defining species as objectively real groups of interbreeding populations, separated from other such groups by reproductive isolating barriers such as sterility and mate discrimination. But the debate continues, fuelled by a new generation of philosophers and a curious animosity between evolutionists and systematists. Their recent writings are collected in *The Units of Evolution*, which contains 18 previously published papers aimed at both biologists and philosophers of science.

The first series of papers, by working biologists, deals largely with the reality and definition of species. Most authors (with the exception of Robert Sokal, Theodore Crovello, Brent Mishler and Michael Donoghue) admit that species are real and not arbitrary groups demarcated by humans. There is, however, no agreement about the nature of species, save that it is not adequately described by the biological species concept. Once again we hear the standard catalogue of objections to Mayr's definition: it fails to encompass asexual taxa, geographically separated populations, plants (which are supposed to hybridize pervasively), species that are paraphyletic and different stages of a single evolving lineage. Many of these objections are based on a misunderstanding of the concept's purpose — to describe the discontinuities between groups of sexually reproducing organisms existing in one locality — and have been repeatedly addressed by Mayr and others over the years. Other objections are not scientifically well-founded. Many authors, for example, assert that asexual 'species' are just as distinct as sexual ones, so that reproductive isolation cannot be part of a species concept. Unfortunately, there is little support for this view. First, very few groups are truly asexual. Most, like bacteria, actually have some form of genetic recombination, which can be fairly extensive. Other supposedly asexual groups, such as bdelloid rotifers and Fungi Imperfecta, may actually have sex on the sly, with the reproductive phases not yet identified. But the real problem is the lack of any work demonstrating that asexual and sexual species are equally distinct. Given their different evolutionary dynamics, these two groups may never adhere to a single species concept.

Similarly, the messiness of some plant 'species' may not reflect a failure of the biological species concept, but only the ability of plant populations to undergo substantial morphological evolution without becoming reproductively isolated. Many 'hybridizing' plant species may represent only a single polytypic species differentiated in a few characters by strong habitat selection, a possibility that has been largely ignored.

To replace the biological species concept, the authors proffer nearly a dozen new species concepts, some of them quite ingenious. So, for example, species are defined as phenotypically similar populations (Sokal and Crovello), lineages occupying ecological niches different from those of other lineages (Leigh Van Valen), phenotypically diagnosable groups of organisms having a parental pattern of ancestry and descent (Joel Cracraft), populations sharing a common fertilization system (Hugh Paterson) and populations of demographically equivalent organisms sharing phenotypic cohesion mechanisms (Alan Templeton). Other authors, such as Philip Kitcher, Mishler and Donoghue, offer many-part definitions to cover all existing organisms.

For sexually reproducing organisms living in the same area, nearly all of these concepts identify the same species as does the biological species concept. But these alternative concepts suffer from either the same problems as Mayr's or their own unique problems. Ecological and cohesion concepts are impossible to use in practice, and fail to separate



Industrious inventor — as an engineer, Leonardo Da Vinci designed, among other things, an olive press, counterweights to make a door close automatically, candelabras, a variable-intensity table lamp, some folding furniture, locks and chests, an octagonal mirror that would multiply indefinitely the image of anyone standing inside it (he may have used this for his self-portrait), a therapeutic armchair and a crane for emptying ditches. Pictured here is his drawing of a stretching device and volute gear. The drawing is taken from Serge Bramly's biography entitled *Leonardo: The Artist and the Man*, which was first published in France in 1988 to critical and popular acclaim. The English translation of the book has just been published by Michael Joseph, price £20.