BOOKS: SYSTEMATICS

Down with the Kingdom (Phylum, Class, and Order Too)

Gerry Moore

The Poverty of the Linnaean Hierarchy
A Philosophical Study of Biological Taxonomy
by Marc Ereshefsky
Cambridge University Press, Cambridge, 2001. 326 pp. $65, £40. ISBN 0-521-78170-1.

Comedian George Carlin once commented, "There should be some things we don't name, just so we can sit around all day and wonder what they are." Clearly, Carlin doesn't keep the company of taxonomists; otherwise he would recognize that giving something a name does not prevent people from wondering (and arguing) about what it is. In *The Poverty of the Linnaean Hierarchy*, Marc Ereshefsky, a philosopher at the University of Calgary, reviews the past and current debates in taxonomy and offers recommendations for how taxonomists should go about their business of classification.

The book begins with an overview on the history of taxonomic thought and recounts how taxonomists have moved toward constructing classifications that are based on history (i.e., phylogeny). Ereshefsky covers a wide range of "-isms" including cladism, essentialism, gradualism, pheneticism, monism, and pluralism. This section serves as a taxonomy of taxonomists and nicely shows how these approaches and different concepts of species can affect the delimiting of taxa. For example, a cladist would never circumscribe a taxon in a paraphyletic manner (leaving out some descendents of the common ancestor), whereas an evolutionary taxonomist might.

In the second section, the author tries to steer a middle course between the taxonomic anarchism of "anything goes" pluralism and taxonomic monism by arguing for a "tempered pluralism." Using normative naturalism (selecting methodological rules for a discipline according to their ability to promote its aims), he develops a list of rules for taxonomists to use in evaluating different approaches to classification. However, I find Ereshefsky's tempered approach to be a mushy middle ground. I suspect that if advocates of the phenetic or pattern cladist species concepts (which fare poorly in the author's analysis) were to work using his guidelines, their conclusions regarding the suitability of their approaches would differ from his (*1*). Also, there should have been more discussion on how Ereshefsky's proposed rules further the aims of biological classification (*2*).

Next, Ereshefsky reviews the Linnaean hierarchy. He concludes, correctly, that ranking of taxa is an arbitrary process. As a result, taxa at a given rank are not comparable. For example, no significant comparison can be made between a family of bacteria and a family of vascular plants. He then makes the radical proposal that taxonomists abandon "ontologically vacuous" ranks (including species) and adopt a rankless system of biological nomenclature in which names are provided with phylogenetic definitions (*3*). No longer would we need to learn the sequence of rank-denoting terms kingdom, phylum, class, and so on. Lazy students, rejoice.

Ereshefsky's proposal is quite similar to the rankless system of nomenclature outlined in the draft PhyloCode (*4*). There are two significant differences: Ereshefsky rejects the species category (whereas the draft PhyloCode does not address species names), and he explicitly allows paraphyletic taxa. Nonetheless, much of the debate surrounding the PhyloCode is applicable [see (*5*, *6*) and references therein].

I would have preferred more discussion of the costs of such a rankless approach, such as the loss of information regarding set inclusivity and exclusivity. For example, under the current rank-based system, the user can recognize the two botanical names Rosaceae and Orchidaceae as names of families whose circumscriptions are mutually exclusive and, thus, realize that information obtained for one taxon is not applicable to the other. Another difference between the proposed and current systems that deserves more consideration is the effect of unexpected changes in phylogenetic hypotheses. Under Ereshefsky's approach, the name remains attached to a taxon regardless of how revised phylogenetic hypotheses may alter that taxon's content. Nor is it clear how the proposed system would work for taxa whose evolutionary history cannot be reflected through a simple phylogenetic tree—taxa, for example, in which lateral gene transfer or hybridization is common.

The system Ereshefsky proposes would abandon functional binomials; although binomial names might be retained, they would no longer indicate a taxon's rank or position. In addition, his discussion of the binomial is flawed. He cites Linnaeus's *Critica Botanica* of 1737 as the source of Linnaeus's motivations for using binomials, but that work only considers polynomial specific names. Linnaeus did not use binomials (which he termed *nomina trivialia*) until 1745, and he never replaced his polynomial-phrase names with them (*7*). His actual motivation for using them was one of convenience (*8*). And I suspect the users of taxonomic names may find it rather inconvenient that under Ereshefsky's system, "*Canis hypotheticus*" would continue to be referred to as "*Canis hypotheticus*" even if new information caused it to be placed in the taxon *Felis*.

I found *Poverty of the Linnaean Hierarchy* to be interesting and thought provoking, and I recommend Ereshefsky's book to anyone curious about the issues that tax-

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BROWSINGS

CREDIT: JACQUES DE TONNANCOUR

Insects Revealed. Monsters or Marvels? *Jacques de Tonnancour.* Cornell University Press, Ithaca, NY, 2002. 284 pp. $35. ISBN 0-8014-4023-8. Translated by Luke Sandford.
For 20 years, de Tonnancour has traveled in search of rare insects, such as the scarab beetle *Dynastes satanas* from Bolivia (left). This book presents his gorgeous color portraits along with brief comments on insects and their ecology. It will delight those who share his fascination, and is likely to increase their number.

onomists are currently debating. His radical proposals, like any revolutionary ideas, will no doubt be met with strong resistance. However, given the urgent need to finish describing Earth's biodiversity, some question whether taxonomists really should be engaged in this debate at all. E. O. Wilson recently compared making radical changes in our current codes of nomenclature with "rewriting the operating manual for the Titanic" (*9*), and Paul Erhlich has regarded it as a silly enterprise (*10*). I too worry that now is not the time to be getting mired in a nomenclatural debate.

References

1. J. Dupré, *Biol. Philos.* **17**, in press.
2. I. Brigandt, *Metascience* **11**, 355 (2002).
3. K. de Queiroz, J. Gauthier. *Trends Ecol. Evol.* **9**, 27 (1994).
4. www.ohiou.edu/phylocode.
5. M. Benton, *Biol. Rev. Camb. Philos. Soc.* **75**, 633 (2000).
6. H. Bryant, P. Cantino, *Biol. Rev. Camb. Philos. Soc.* **77**, 39 (2002).
7. F. A. Stafleu, *Linnaeus and the Linnaeans* (Oosthoek, Utrecht, 1971).
8. P. Stevens, *Taxon* **51**, 11 (2002).
9. R. DeFillips, *Plant Press* **4**, 1 (2001).
10. P. Erhlich, *Bioscience* **52**, 31 (2002).

BOOKS: DEVELOPMENT

Model Representations

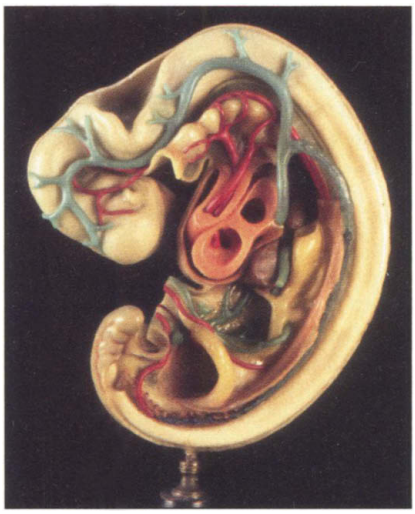
Jenny Uglow

When Franz Keibel, rapidly becoming the world's leading vertebrate embryologist, left Freiburg in 1914 for a chair in Strasbourg, the centerpiece at the departure party was a human embryo modeled in marzipan. This bizarre incident, with male scientists happily nibbling a sweet simulacrum of the unborn, typifies a disturbing undertone that runs through *Embryos in Wax*, Nick Hopwood's scholarly account of the creations and careers of modelers Adolf and Friedrich Ziegler. Techniques of representation are never neutral, however much they claim "objective" status.

Embryos in Wax Models from the Ziegler Studio
by Nick Hopwood

Whipple Museum of the History of Science, University of Cambridge, and the Institute of the History of Medicine, University of Bern, Switzerland, 2002. 216 pp. Paper, $19.50, £13.50. ISBN 0-906271-18-5.

The book is meticulously documented and superbly illustrated. As well as including colored plates of the models, Hopwood takes care to show the workshops where they were made and the classrooms in which they were used. The visual context, which mirrors the author's unearthing of scores of dusty teaching aids from cupboards and storerooms, reinforces his effort to recover the work that went into them: the collecting of specimens, the anatomical and microscopic inquiries, the careful arranging in developmental order. In the process, Hopwood unravels the intricate links between the evolution of wax-modeling and the development of embryology itself in Germany from 1850 to 1920, with all the fierce arguments and jostling for position. Morphology was part of physiology. Without adequate representations, it was impossible to study development: specimens were rare, messy, and bloody; drawings or engravings failed to convey three-dimensional transformations. The models—magnified, solid objects—were essential tools, sold to institutions around the world.



Model dissection. Friedrich Ziegler's models formed an "inseparable" part of Wilhelm His's monumental anatomy of human embryos.

CREDIT: ANATOMISCHES MUSEUM BASEL

The Zieglers neatly represent the seesaw of art, science, and commerce involved. Qualified in pharmacy and medicine, Adolf worked as assistant to Purkyně in Prague and Ecker at Jena before founding his studio. His son Friedrich trained as an artist but studied to boost his medical credentials. They were touchily conscious of their "scientific" status. Their first step was to salvage wax-modeling from the taint of sensationalism attached to both the ravishing, unsettling anatomical models of "La Specula" in Florence and the gory heads of Madame Tussaud's exhibitions. Concentrating on the specimens, they gave no sense of the anatomical context. As Hopwood suggests, something was lost. The embryos stood alone, as if developing without need of the body in which they should nestle. Specimens and models were even named by the initials of the doctors who supplied them rather than of the women they came from.

Adolf Ziegler styled himself as a "plastic publisher," and as such he became indispensable. After 1860 (when he and the anatomist Wilhelm His invented the technique of reconstructing sectioned chick embryos), the standard mode of research was for professors to make waxes from their own specimens, publish descriptive articles, and then send the model to the Zieglers for copying and "publication." In the complete reprint of Friedrich Ziegler's last catalog (from around 1912)—an invaluable feature of the book—each series is tagged with the professor's name.

Like book and journal publishers, the Zieglers were nervous about the validity of the work they distributed, and they sometimes found themselves entangled in theoretical quarrels. Adolf worked for Ernst Haeckel and his Darwinist followers, who were convinced that the development of complex from simple states repeated the evolutionary development of the species. Adolf's models of embryonic diversity included trout, amphioxus, starfish, and Haeckel's own controversial (and alarmingly slow-selling) "gastraea," supposedly a living representative of the hypothetical ancestors of all multicellular animals. Yet he simultaneously undertook work for His, who rejected the evolutionary model in favor of a mechanical approach and openly accused Haeckel of fraud. Both men used Ziegler's models as evidence.

The arguments, like the waxes, are history. We cannot recapture the awe of spectators at the 1893 World's Columbian Exposition in Chicago, where the Zieglers' vast cabinet of wonders won first prize. Yet some models, such as the delicate skull on which Friedrich worked for months with Florence Sabin, retain an aesthetic appeal that outstrips mere curiosity. It is ironic, of course, that a book about the preeminence of three-dimensions has to rely on flat illustrations. This extends to the marble statue of Wilhelm His, a virtual emblem of male appropriation, holding an embryo curled fossil-like between finger and thumb—a tiny organism metamorphosed for us from flesh to wax to stone to film to print. A virtue of Hopwood's study, quite apart from its fine resurrection of the media of 19th-century science, is that it makes one wary of all forms of visualization, whether they take on the somber, static solidity of the Zieglers' wax or the bright, dynamic life of today's 3D computer animations.

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