

Making sense of bodies

Simon Conway Morris

Animal Evolution: Interrelationships of the Living Phyla. By Claus Nielsen. Oxford University Press: 1995. Pp. 467. £55, \$95 (hbk); £25, \$49 (pbk).

WHAT is it about metazoan studies that paralyses initiative and reduces the student to stunned inertia? Libbie Hyman's masterly series *The Invertebrates* finally ground to a halt in its sixth volume with her valedictory remark: "What with advanced age (78) and concomitant loss of strength and energy, it has become a physical impossibility for me to continue". Check some of the recent massive textbooks on animal biology; it cannot be long before the US obsession with litigation warns would-be readers against "hernia and sudden rupture". Here in contrast is a book that aims to encompass this vast field in a manageable style. How well has it succeeded?

Its strengths are a clear and engaging style exemplified by a series of superbly concise descriptions of the phyla, 31 of which are recognized. These are complemented by excellent illustrations, albeit the minimum necessary. The volume belongs on every biologist's bookshelf. Its low price means that generous individuals can donate a copy to their colleagues in molecular biology for whom a slightly wider acquaintance with whole-organism zoology might be salutary.

But will this book prove to be the banner in the much needed renaissance of the study of metazoans and their phylogeny? Here reservations begin to emerge. The book is underpinned by two main precepts: the cladistic approach and the fundamental importance of embryology and larval development for our understanding of Metazoa. It remains, nevertheless, a curious fact that it is extraordinarily difficult to decide which characters are phylogenetically informative rather than convergently acquired, presumably because of similar adaptive constraints. Writing of one larval structure found in several phyla, Nielsen opines that: "To me it appears very improbable that the highly characteristic ciliary bands... should have developed convergently". But why not? Further on in the book we read that another character (gap junctions) "must be regarded as a remarkable example of convergent molecular evolution". Such declarations, however intelligent, are really acts of faith (the few theologians who read *Nature* may permit themselves a wry smile). Here a very interesting opportunity seems to have been missed, because this book is a gold mine for examples of evolutionary convergence. A striking example is

the tri-radiate pharynx. In this case functional constraints are probably the overriding factor. The point to make, however, is that there are limits to design, and one way in which metazoan studies may progress is by an explicit exploration of this field.

The most glaring omission is the evidence from molecular biology. Nielsen simply states that he wishes to use morphological data alone. This is his privilege, but he does no service either to the next generation of investigators or to the important contributions that molecular data are now making to metazoan phylogeny. It should be self-evident that science flourishes in a state of tension: the nagging doubt that the bits are still not falling into place. For example, in terms of metazoan relationships, there is a clear dichotomy between placing the lophophorates in the deuterostomes, the orthodox line that Nielsen follows, and the molecular (and palaeontological) data that regard them as mainstream protostomes. Somebody has got to be wrong. Nor need there be endless divergences in opinion. Nielsen's belief "that the tracheates are a specialized group of terrestrial crustaceans" matches very well the latest views from the molecular camp (*Nature* 376, 163-167; 1995). But where things really begin to unravel is when we consider the basic developmental instructions for complex organ systems such as eyes in arthropods or neural tubes and mouths in deuterostomes. Nielsen wrestles with what features in phyla are genuinely homologous, but the story emerging from molecular biology is that what may look very different in anatomical terms can be found on a basically identical genetic architecture.

Eyebrows will be raised elsewhere, but we should not automatically rush to condemn. Thus Nielsen continues to ally the ectoprocts and entoprocts. This idea has won few adherents, but supposing the molecular sequences reveal a close relationship? Could somebody oblige? Courageously, Nielsen locates the ctenophores close to the deuterostomes. Every textbook I can think of places them about as far away as it is possible to go, near the cnidarians. Such molecular data as there are support the latter alternative, but ctenophores remain very puzzling.

These comments should not detract from what is an excellent book. The men in suits will no doubt be offended by Nielsen's forthright style. I am not sure I would care for my life's work to be dismissed as "mere fantasy", as he effectively does of one worker, but it is only by invigoration, argument and enthusiasm that the real problems in understanding the metazoans will be confronted. □

Simon Conway Morris is in the Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK.

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- Books and software dealing with any aspect of science, technology, medicine or natural history are eligible (including encyclopaedias, dictionaries and games), although those specifically tailored to mainstream school curricula are excluded;
- The main language used must be English;
- If possible, cross-platform software (both Macintosh and PC) should be provided.

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