Shaking the tree of life

Perspectives in Animal Phylogeny and Evolution

by Alessandro Minelli

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Reading *Perspectives in Animal Phylogeny and Evolution* is like visiting a Michelin-starred restaurant where you are served an appetizer of a plate of chips, followed by a refined main course that, to your surprise, is accompanied by the chef's apologies for its distinctive flavour. You might save your appetite for the main dish by sampling the chips sparingly, or transfer them to a doggy bag for later consumption. I recommend a similar strategy for reading this book.

Alessandro Minelli's starter consists of six introductory chapters that sketch out the field of animal phylogenetics, the study of the evolutionary genealogy of animals. The material provides context for our quest to understand animal evolution, which is explored in the last three chapters. A shorter starter, however, would have left more room for the genuine insights that come later.

Minelli manages reasonably well the difficult task of capturing the ever-shifting structure of the phylogenetic froth that bubbles up continually in the literature. Aware of the short lives of many hypotheses, Minelli to his credit avoids some obvious 'Nonsensozoa' clades and limits his selection to well-supported phylogenetic groupings, such as Ecdysozoa (including arthropods and nematodes) and Lophotrochozoa (including phyla such as molluscs and segmented worms).

Although Minelli claims to discuss alternative and conflicting phylogenetic hypotheses, he lists them with few critical remarks. He includes some that are without merit, such as the Vermizoa hypothesis, in which nemertean and annelid worms were thought to belong to sister taxa because of a misunderstanding of the structure of their blood vessels. Such dead or dying bits of phylogenetic shrubbery might have been pruned. Readers would have benefited from more thorough

discussions in the light of recent molecular and morphological data.

One shouldn't judge a Michelin-star chef too harshly for his chips, however, and the main course is vintage Minelli. The final sections on the evolution of animal body plans contain many arresting insights that arise out of his distinctive evolutionary perspective and encyclopaedic knowledge of the zoological literature. Even though he introduces these chapters apologetically as expressing his "personal and sometimes idiosyncratic views", it is this that makes them so inspiring.

Even the tiniest mite can reveal clues about body patterning and evolution.

Many recent insights into animal evolution are the results of painstaking research on a handful of model organisms. Minelli emphasizes the need to integrate information about the morphology, development and evolution of less studied, non-model organisms. For example, he discusses how the study of miniaturized animals can reveal clues about the body's patterning mechanisms. Comparing the symmetry of skin structures in two miniaturized chelicerates, a mite and a tiny spider, Minelli surmises that the irregular asymmetry of the spider indicates that its evolutionary origin is more recent, and that there has been insufficient time for it

to evolve a regular pattern. The book is full of such brief teasers to provoke further research.

Minelli's observations have great value, irrespective of the lack of a consensus phylogeny of the animal kingdom. He takes a refreshingly

critical look at traditional biological concepts, such as larval stages, sexual reproduction and even development. Although developmental processes can be seen as intermediary steps on the way to an adult organism, this realization does not necessarily help us to understand their evolutionary origin. Instead, he urges us to consider developmental processes and steps as the outcome of a competitive process of developmental modules, such as cells. In this way, he attempts to understand the origin of novelties such as gametes, programmed cell death and larval set-aside cells from which an adult organism develops.

Not all of Minelli's ideas will be embraced. His antipathy to thinking about organisms in terms of hierarchical organization seems, in part, to be the result of his viewing hierarchies as rigid and immutable structures rather than as useful descriptions. Nevertheless, his perspectives are worth pondering.

Minelli also scrutinizes relationships between concepts that are traditionally placed in separate categories, such as sexual reproduction resulting in embryogenesis, asexual development and regeneration. He convincingly argues that it takes more than mapping these features onto a phylogeny to understand their evolution: we should also take into account past selection pressures

and environmental conditions that prevailed during their origin. Moreover, we should consider biological processes that may indicate a closer relationship between features that seem to be phylogenetically distinct, such as sexual and asexual reproduction. This integrative approach aims to produce synthetic evolutionary scenarios.

The book does not merely list facts about animal evolution. It is a celebration of the intellectual puzzles posed by the wonderful diversity of animals, an effective spur for further exploration and debate of the mysterious but unmistakable signs of unity hidden beneath this diversity. No serious student of animal evolution can afford to miss this book. Minelli gives it a distinctive flavour eminently suited to repeated sampling, with or without a glass of wine at hand.

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