

BOOK REVIEW

***Homo sapiens*, an unlikely but effective model in Evo-Devo—a review of *Quirks of Human Anatomy: an Evo-Devo Look at the Human Body*, by Lewis I. Held, Jr.**

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Quirks of Human Anatomy: An Evo-Devo Look at the Human Body, Lewis I. Held, Jr., Cambridge University Press, Cambridge, XII+260 pp. Hbk £ 65.00. ISBN 978-0-521-51848-2. Pbk £ 21.99. ISBN 978-0-521-73233-8.

What can we expect from an Evo-Devo look at the human body? The subject species—man rather than the worm or the fruitfly—is one toward which a lot of potential readers will be attracted. But is an Evo-Devo approach to our species really promising? How good can *Homo sapiens* be as a model species for Evo-Devo? The simple fact of restricting focus to only one species is likely to reduce to a very minimum any hope for a compelling evolutionary argument. In addition, the previous publication record of the author deals solely with pattern formation in *Drosophila melanogaster*: a model species quite distant from humans. A potential reader might envision a possibly popular but eventually less than academic exercise. All these quibbles, however, are destined to rapidly fade as soon as we start reading from this fascinating book.

Held's prose is brilliant, very often informal but always accurate, and the message it conveys is always clear and well documented, sometimes incredibly so. This is not the first time this author provides a list of references filling roughly one half of the whole book (cf. Held 1992, 2002). In *Quirks of Human Anatomy*, 152 pages of text and illustrations are followed by 86 pages of references, with 2924 entries, followed in turn by a 22-pages index. Moving into new territory, Held has obviously taken care to gather a very broad and sound background of published information.

What, then, of the suitability of *Homo sapiens* as model species in Evo-Devo? If one is effective, as Held is, in mining

the literature for potentially relevant data, there is indeed a lot of evidence to be found there, particularly from the perspective of comparative developmental genetics. To be sure, this comparative evidence differs qualitatively from the body of knowledge we are gathering with flies or worms, that is animals amenable to experimental manipulation. In the case of humans, the comparative dimension is obtained by studying intraspecific variation already present in human populations, in all kinds of pathological (if not monstrous) deviation from the “normal” phenotype.

Held's Evo-Devo approach to the anatomy of the human body, and its many oddities, is nonetheless rooted in a search for genes and gene expression cascades such as those involved, for example, in establishing the characteristic asymmetry of our viscera, the odd crossing of the body midline by optic nerves, or the more or less obvious morphological differences between males and females. A search for genes, of course, because body parts can diverge developmentally—that is, “dissociate”—to any great extent only if they have acquired distinct genetic identities. Held admirably also maintains an open eye toward those features, like our fingerprints, which are beyond the control of our genome. This adventurous path amidst the oddities of the human body includes a couple of pages on the presence of nipples in men, or men's privilege, so to speak, to have a chance of getting bald. Held's well-justified interest in monsters, for example humans affected by cyclopia, or with completely furry skin, inclusive of hands and feet, opens the door to a related, very intriguing question. How do we determine whether a given kind of monstrosity never observed in humans, but which is nonetheless imaginable, can ever evolve in our species? More precisely, why are some morphologies forbidden in humans, whereas

comparable morphologies can be obtained in distant phyla and may even prove to be perfectly viable and successful?

If the focus is always on man, Held is, however, ready to collect comparative evidence from a diversity of suitable models. This is obviously where the author can put to the best use his long familiarity with the developmental genetics of *Drosophila*. Examples are chosen either because of our excellent understanding of the genetic control of their anatomical features, or because of their unique morphology, as in the case of the skeleton of the pterosaur wing, or the asymmetrical body of flatfishes. However, when moving into the territory of comparative morphology and in the occasional explicit applications of the comparative method, Held's argument becomes a bit less stringent and the examples less precise. For instance, one may question whether we can legitimately say, in phylogenetic terms, that the platypus is "at the base of the mammal clade." But this is hardly a major fault. The same can be said for the author's obvious zoocentric perspective, which demonstrates how far we remain from considering plants, in addition to animals, as legitimate objects of Evo-Devo studies, as witnessed by the following lines (p. 37): "tubes tend to be built by the invagination (e.g., rolling) of cell sheet, rather than by the (safer?) cavitation of solid cylinders." Plants vessels would suggest a less "quirky" evolutionary story.

Beginning with geometry and modularity, such as mirror symmetry and the deviation from it, and a pithy selection of serial anatomical features, with particular regard to the fingers, the reader tours increasingly complex features of body organization. Twenty-four groups of impressively drawn and intelligently annotated figures summarize different sets of

"quirks" of human anatomy. This scenic anatomical tour however ultimately provides the reader with a nontrivial familiarity with heterochrony, evolvability, modularity, developmental constraints, gene co-option, dissociation, homeosis, phylotypic stages, and a few other core concepts of evolutionary developmental biology. Not a minor result indeed.

The potential readership of this precious little book is wide and diverse. Among those in the trade of Evo-Devo, I doubt there are more than a handful who have ever looked at their own body with professional eyes, as Lewis Held has done so successfully in these pages. Thus, I expect many colleagues will enjoy this book as I did. But for those who need an introduction to the field, this is one of the first titles I would recommend, not simply because it offers a readable and provocative introduction to most of the core concepts and issues in Evo-Devo, but also because it balances so effectively two seemingly opposite, but equally fundamental truths. On the one hand, a great many quirks of animal (not necessarily human) anatomy make sense only when seen through the lens of evolutionary developmental biology. On the other hand, the field of Evo-Devo has just begun to be explored: Held's list of unresolved puzzles, well searchable through the book's analytical index, includes as much as 113 entries. Chap, come on board.

REFERENCES

- Held, L. I. Jr. 1992. *Models for Embryonic Periodicity*. Karger, Basel, VIII+119 pp.
 Held, L. I. Jr. 2002. *Imaginal Discs*. Cambridge University Press, Cambridge, XV+460 pp.