Heredity (2006) 96, 419–420

www.nature.com/hdy

BOOK REVIEW

The changing role of the embryo in evolutionary thought: roots of Evo-Devo

The Roots of Evo-Devo

Ron Amundson
(Cambridge Studies in Philosophy and Biology)
Cambridge University Press, Cambridge; 2005. 294pp. £45, paperback. ISBN 0521806992.

Heredity (2006) **96,** 419–420. doi:10.1038/sj.hdy.6800802

Reviewed by A Minelli

In this thought-provoking book, Ron Amundson, professor of philosophy at the University of Hawaii at Hilo, illustrates two sides, historical and philosophical, of what he regards as the unbridgeable contrast between the Evolutionary Synthesis and today's evolutionary developmental biology, or Evo-Devo. Repeatedly, through the pages of this readable work, the author equates this contrast to other dichotomies such as function *vs* form, population *vs* ontogeny, adaptationism *vs* structuralism, and even transmission genetics *vs* developmental genetics. However, as aptly remarked by Jason Scott Robert (2005), there is much more to modern evolutionary biology than the adaptationism of 40 or 50 years ago against which Stephen Jay Gould and Richard Lewontin launched a famous attack with their spandrels paper (Gould and Lewontin, 1979). Furthermore, Evo-Devo is far from monolithic, and there is much more to it than developmental genetics. As a consequence of these simplifications, the book fails to cover the issue in the full range of its aspects. Nevertheless, it opens avenues to a well-deserved revisitation of many points of received wisdom, in both the historical and the conceptual aspects of the debated field. As for the historical dimension, Amundson blames Ernst Mayr and other prominent representatives of the Evolutionary Synthesis for having deliberately forged a biased perspective through which the history of 19th-century biology has been severely distorted. The most pernicious consequence of this Synthesis-dominated historiography is the support it provided to the forced removal of development from evolutionary biology.

Several aspects of the long history of the divorce between the science of heredity and the science of development have been told many times in the past. In particular, it is well known how Morgan's writings impacted on the eventual disappearance of development from the science of heredity, which for a long while was little more than transmission genetics. The whole history, however, is much more complex. Amundson focuses on four dichotomies that neo-Darwinists have used as arguments against the relevance of development to understanding evolution: Johannsen's contrast between genotype and phenotype, Weismann's germ/soma dichotomy, and Mayr's two further distinctions between proximate *vs* ultimate causation, and typological *vs* population thinking. The two latter arguments are basically of philosophical relevance, but in the case of the concepts originally introduced by Weismann and Johanssen, the key point is one of history. Amundson provides evidence that in the course of several decades the original concepts underwent manipulation so as to eventually become arguments to exclude development from evolutionary biology. This is perhaps the most striking part of the argument Amundson articulates around the idea that contending that development is not relevant to evolution was largely a strategy adopted in order to advance a precise agenda: in the case of Morgan, in order to establish the primacy of transmission genetics; in the case of Mayr, in defense of the naturalists' approach to evolution.

So much for history. On the philosophical side, Amundson starts from his advocacy of the relevance of development to evolutionary biology; that is, from his choice in favor of evolutionary developmental biology, a discipline whose agenda is precisely focused on reconciling developmental biology with evolutionary biology. In Amundson's opinion, the kind of evolutionary biology that will be eventually integrated with developmental biology in a future fully fledged Evo-Devo will necessarily be other than the evolutionary biology of the modern Synthesis. The two approaches to biology (adaptationist *vs* structuralist) are incompatible: 'Adaptationists see structure as a mere consequence of previous adaptations; structuralists see adaptation as merely making adjustments on pre-existing structure. Function and structure, the chicken and the egg.' Adaptationists blame Evo-Devo biologists for not paying attention to individual variation, hence they are typological, a good reason to reject their views. However, as Amundson remarks, the adaptationist perspective has a limited horizon. In focusing on natural selection of individual variations within a population, it cannot ask questions about the origin and evolution of features shared by distantly related species. Intraspecific variation is the only kind of diversity transmission genetics can explore: by definition, the genetic base of intraspecific differences is not accessible through crossing experiments. Of course, today there is much more to the science of heredity than transmission (and population) genetics. The limitations of Mendelian genetics have been overcome by developmental genetics. We have long lists of genes controlling exactly those traits of animal and plant form that correspond to the 'invariant' pillars of the body architecture: the regions of the body, the segments of the trunk, the parts of the flower, and so on.

There is, however, one more point that deserves consideration. This point escapes from Amundson's analysis, as he basically portrays Evo-Devo as centered on the analysis of organic form through the lens of comparative developmental genetics. The point is that the gene-centered view of evolutionary developmental biology, the one which has attained the largest visibility through research papers and book-size treatments alike, risks the same pitfall as the Evolutionary Synthesis did in Amundson's opinion. It risks becoming a victim of its own success. It is the old story of Achilles and the tortoise. Seen from within, the story is perfect. Seen from outside, it is clear that the model only describes a self-consistent part of the world, and perhaps not a very large

one. Just as there is more to evolution than natural selection, so there is more to development that the strict determinism of a putative genetic 'program'. Let's avoid pursuing too narrow an agenda, successful as it might be today. Let's avoid a history of monopoly repeating itself.

References

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