

Edmund Beecher Wilson and Frank R. Lillie and the relationship between evolution and development

Charles Darwin did not attempt to construct complete phylogenies from embryological data, but his work inspired many of his contemporaries to do so. One of the first scientists to realize the evolutionary importance of von Baer's laws (see Chapter 1) was Elie Metchnikoff. Metchnikoff appreciated that evolution consists of modifying embryonic organisms, not adult ones. In 1891, he wrote:

Man appeared as a result of a one-sided, but not total, improvement of organism, by joining not so much adult apes, but rather their unevenly developed fetuses. From the purely natural historical point of view, it would be possible to recognize man as an ape's "monster," with an enormously developed brain, face and hands.

—Elie Metchnikoff, translated in Chernyak and Tauber, *From Metaphor to Theory: Metchnikoff and the Origin of Immunology*. Oxford University Press, New York, 1990

But if changes in embryonic development effected evolutionary changes, how did these developmental changes take place? During the late 1800s, many investigators attempted to link development to phylogeny through the analysis of cell lineages. They meticulously observed each cell in developing embryos and compared the ways in which different organisms formed their tissues.

In 1898, two eminent embryologists gave cell lineage lectures at the Marine Biological Laboratory at Woods Hole, Massachusetts, that served to emphasize the two ways in which embryology was being used to support evolutionary biology. The first lecture, presented by E. B. Wilson, was a landmark in the use of embryonic homologies to establish phylogenetic relationships. Wilson had observed the spiral cleavage patterns of flatworms, mollusks, and annelids, and he had discovered that in each case, the same organs came from the same groups of cells. For him this meant that these phyla all had a common ancestor. Indeed, modern research using DNA sequences has confirmed Wilson's conclusion and placed these three phyla together.

The other lecturer was F. R. Lillie, who had also done his research on the development of molluscan embryos and on modifications of cell lineages. He stressed the modifications, not the similarities, of cleavage. His research on *Unio*, a mussel whose cleavage pattern is altered to produce the "bear-trap" larva that enables it to survive in flowing streams, was highlighted in Chapter 8. Lillie argued that "modern" evolutionary studies would do better to concentrate on changes in embryonic development that allowed for survival in particular environments than to focus on ancestral homologies that united animals into lines of descent.

In 1898, then, the two main avenues of approach to evolution and development were clearly defined: to find underlying unities that link disparate groups of animals, and to detect those differences in development that enable species to adapt to particular environments. Darwin thought these two approaches to be temporally distinguished; that is, that one would find underlying unities in the earliest stages of development, while the later stages would diverge to allow specific adaptations

(see Ospovat 1981). However, Wilson and Lillie were both discussing the cleavage stage of embryogenesis. These two ways of characterizing evolution and development are still the major approaches today.

Literature Cited

Lillie, F. R. 1898. Adaptation in cleavage. In *Biological Lectures from the Marine Biological Laboratory, Woods Hole, Massachusetts*. Ginn, Boston, pp. 43–67.

Metchnikoff, E. 1891. Zakon zhizni. Po- povodu nektotorykh proizvedenii gr. L. Tolstogo. *Vest. Evropy* 9: 228–260. Quoted and translated in Chernyak and Tauber, *From Metaphor to Theory: Metchnikoff and the Origin of Immunology*. Oxford University Press, New York, 1990.

Ospovat, D. 1981. *The Development of Darwin's Theory*. Cambridge University Press, Cambridge.

Wilson, E. B. 1898. Cell lineage and ancestral reminiscence. In *Biological Lectures from the Marine Biological Laboratories, Woods Hole, Massachusetts*. Ginn, Boston, pp. 21–42.

All the material on this website is protected by copyright. It may not be reproduced in any form without permission from the copyright holder.

© 2023 Oxford University Press