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The mother of mothers

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Commentary on
Gilbert, SF, 2017, "Developmental biology, the stem cell of biological disciplines", *PLoS Biol*, 15 (12): e2003691.

When developmental biology was born, in the 1850s, everyone was far from imagining what the new discipline would give rise to in a little more than the one and a half century to come.

Etymologically, development means "getting out of an envelope", i.e. coming out of a shapeless state and acquiring an organized form. In its most restricted biological meaning, the term refers to embryonic development, through which the zygote produces a new organism. As such, biology of development comes directly from embryology, particularly from the ancient interest in the process of embryonic development described for many centuries through the anatomic study of variously staged embryos. Aristotle himself was known to observe embryos analytically and get clues about a general theory to explain the making up of such natural entities (2006; 2008).

Embryology remained descriptive till the birth of experimental studies on embryos, by the end of the 1800s, aimed at deciphering guiding mechanisms of development. Soon, it was clear that genetics would represent an important allied of the nascent discipline. However, although the idea that the nuclear content of the cells bears instructions necessary to build up an entire organism, little was known of the nature of genetic information. Therefore, a strong separation was first created between genetics, which was thought to hold the biological information, from embryology, which would instead consider the expression of such information. Later, however, genetics gained full authority after the discovery that some mutant animals or plants display developmental defects, and, in the 1970s, genetics, molecular and cell biology joined embryology to provide a more powerful approach to organismal development.

Development Biology was introduced as a new discipline in a correspondence between Paul Weiss and Norman J. Berrill (Gilbert, 2017). Berrill proposed this name to indicate a science that included embryology, cell differentiation, movements and regeneration, and other areas related to development. From that time on, all aspects of the entire process - including metamorphosis and the production of adult cells or tissues - have been re-examined with the methods that gradually were made available, and thanks to the integration with many other disciplines.

Scott Gilbert wisely describes the fascinating history and evolution of developmental biology in his elegant assay, coming to various conclusions, which all of us interested in various aspects of the discipline are aware of.

In the first place, the extreme specialization of each field budded from developmental biology has marginalized the original role of the discipline on the long run, leading to the impression that today it is an old fashioned one. Developmental biologists call themselves according to their specific fields of interest and their curricula rarely mention the parental discipline. It is true, in fact, that developmental biology is not defined as immunology or cancer biology of molecular/cell biology. There is, however, an opposite side of the coin, because for the same reason developmental biology includes all these disciplines, extends to several levels of organization and can be studied in an incredible variety of systems and species. It is driven by questions and is therefore the science of those with a truly inquisitive disposition, who are fascinated by the possibility of writing down developmental stories and unveil puzzling biological scenarios. As defined by the Author, "developmental biology remains pluripotent". It is a "mother of mothers", capable of regenerating itself and generating new disciplines, while allowing her "descendants" to develop and produce their own "progeny".

For all of us involved in any one of the fields of developmental biology this is an undisputed fact, as for those interested in gametogenesis/early embryogenesis is the statement "*Omne vivum ex ovo*" attributed to William Harvey and Ernst Haeckel (Farley, 1977), which describes the centrality of the egg for every living organisms, prokaryotes excluded, and thus in developmental biology.

A second aspect needs to be considered at a time in science in which the approach to several aspects of basic and applied research is changing. Today, questions in biology, neuroscience or medicine are being pursued under a holistic perspective. In this view, several of the daughter disciplines are going back home, returning to a developmental framework. The focus of their action is less oriented to the mere observation but rather to the whole process behind and the relations with other processes, from the defined context(s) to the general mechanisms.

In sum, ontogeny is now pursued by a multidisciplinary approach, representing a synthesis of biological disciplines and developmental biology can be considered the epitome of systems biology. By integrating all levels of analysis into a working model of how organisms function, the mother of mothers is returning to get full credit for its contributions to our knowledge of life.

References

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