How to Better Explain and Develop Evolution Today

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Abstract

Studies over the past two decades have provided important information on evolution. An essential discipline gradually formed called evolutionary developmental biology, or evo-devo combines the principles of evolutionary biology and developmental biology to investigate the genetic and environmental factors that affect the development of organisms and how these elements affect evolutionary change. In this discipline, evolution can be explained by genetics, cell biology, and developmental biology. These fields provide crucial insights into how genetic variation, cellular processes, and developmental mechanisms contribute to population changes over time. With the popularity of emerging information technologies such as mobile Internet and big data, the global digital economy is booming. The development of gene sequencing technology has led to the rapid growth of genomic data, and the combination of large-scale genomics, metabolomics, and functional research systems, known as "big data" and bioinformatics, has brought about a "technological revolution" in evolutionary research. Therefore, enhancing the interconnection between scientific research in various fields is extremely necessary and will be effective.

Keywords: Evo-devo; genetics; cell; developmental biology; big data

Introduction: Evo-devo is an abbreviation of evolutionary developmental biology and is a science field that studies how changes in the biogenesis process promote the evolution of a new species and body structure.[1] It was made famous by Ernst Mayr (1961), and the difference between the cause and the ultimate causal relationship in biological interpretation is widely regarded as the key principle of evolutionary theory and the principle of evolutionary research.[2]

Evo-devo aims to understand how alterations in the genetic regulatory networks and developmental pathways can lead to the evolution of novel traits. It explores how variations in genes and their expression patterns can impact an organism's development and ultimately drive species' diversification.

By studying the development of different organisms, including model organisms like fruit flies, zebrafish, and mice, evo-devo researchers seek to uncover the underlying mechanisms that generate evolutionary changes. This field has shed light on various evolutionary phenomena, such as the origin of body plans, the evolution of specific organs or structures, and the modification of existing traits throughout evolutionary history. For example, understanding the evolution and genetics of the genus Equus and its extant species is beneficial to veterinarians working in equine practice as well as those interested in conservation.[3]

Overall, evo-devo provides insights into the intricate relationship between development and evolution, helping us understand the underlying processes that have shaped our planet's incredible diversity of life.

Four perspectives to explain evolution: Evolution can be explained in genetics, cell biology, and developmental biology, and these fields provide an important view of how genetic mutations, cell processes, and developmental mechanisms promote population change in populations. Here's a breakdown of their contributions:

Genetics: Genetics studies genes, heredity, and genetic variation. It provides a framework for understanding how genetic information is passed from generation to generation and how gene variations can arise through mechanisms like mutation and recombination. In the context of evolution, genetics helps explain how new genetic variations can be introduced into a population, how they can spread or become fixed over generations, and how they can lead to evolutionary changes. In the past 20 years, scientists investigated how the evo-devo study emphasizes the mechanism of combining genes (genotypes) and structures (phenotypes). This is very important because the gene does not make a structure. For example, all animals (subsequently shown for all plants and fungi, too)share genes that contain a 180-bp sequence known as the homeobox, and these genes, known as homeobox, homeotic, or Hox genes, are responsible for determining that animals have an anterior and a posterior, a dorsal and a ventral side, and specific regions (often as repeated segments)along the body axis—head at one end tail at the other, thorax in front of the abdomen, wings on a specific pair of segments(Lewis 1978; Gehring 1985,1998; Averof 1997; Grenier et al.1997; Carroll 2008)[4]

Cell Biology: Cell biology explores the structure and function of cells, which are the basic units of life. Cells contain the genetic information necessary for an organism's development and functioning. DNA replication, gene expression, and protein synthesis occur

within cells. Evolutionary cell biology explores the origin of cell features and regulatory networks, principles, and core functions through evolutionary perspectives. [5] Understanding cell biology helps us comprehend how genetic information is stored, replicated, and translated into functional molecules, essential for individual development and evolutionary changes. Integrating our growing molecular understanding with cellular mechanisms or other levels (tissue, organ, whole body, biological, environmental interactions) has always been important. It remains the main goal and challenge of evo-devo.[4]

Developmental Biology: Developmental biology investigates how organisms grow, develop, and differentiate from a single cell into a complex organism. The study of morphology is considered the most advantageous material for elucidating the problem of evolution, and it is considered that the essence of the truth of morphology is the most obvious in embryology. Genetic and environmental factors affecting the growth of organisms and their various structures (e.g., organs and tissues) were examined. Therefore, all animal scientists with aspirations are embryologists, and one of the topics of vocational dialogue is evolution. (BETSON 1922, 56 pages)[4] Each new morphological change in the evolutionary process must be associated with changes in the developmental program, and the whole development mechanism itself is the product of evolution (Russell 1916).[6] Developmental biology is crucial for understanding how changes in developmental processes can lead to phenotypic variations, which can be acted upon by natural selection and contribute to evolutionary changes.

By integrating these areas, it is possible to clarify how genetic mutations are inherited and how they affect the growth of organisms. This knowledge can help us understand how evolution changes occur over time and shape the diversity of our planet.

Conclusion: On the one hand, evo-devo reveals a universal maintenance mechanism, indicating that some universals of evolution and development have stability and necessity. On the other hand, evo-devo believes that the evolution and development of life forms are more accidental than we previously assumed, giving us contingency and non-generalizability regarding evolution and development phenomena.[7] In the past, we were more inclined to study the relationship between a single discipline and evolutionism. The relationship between each discipline and evolutionism has made some progress, but due to the development of technology, the research results from a single perspective may be biased. Now, in the era of the digital economy, big data is shared. Big data is not a technology or product but a new concept with four characteristics: large volume, multiple types, low-value density, and high processing efficiency. These four characteristics can fully meet the requirements of computer network database construction. Therefore, big data technology can be widely applied in constructing network databases. Using big data technology in constructing computer network databases can significantly improve the processing efficiency and quality of data information and standardize the classification and processing analysis of massive information, greatly increasing the application value of database information. Suppose we can use big data to establish a more comprehensive database and comprehensively use samples, data, and conclusions in every aspect. In that case, Comprehensive analysis will make the description of evolution more detailed, specific, and accurate. In this way, scholars from different fields, such as morphology, genetics, and cytology, can learn from each other and restore the truth of evolution.

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