

Foreword

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This is a collected volume of papers derived from reports from the conference “Morphogenesis in individual and historical development: stability and variability” held at the Borissiak Paleontological Institute from 21 to 23 April 2015. This was the fourth conference in a series of meetings organized by the Borissiak Paleontological Institute and Koltzov Institute of Developmental Biology of the Russian Academy of Sciences on morphogenesis in the individual and historical development of organisms. The purpose of this and previous conferences was a free exchange of results and ideas between developmental biologists and paleontologists on the patterns and evolution of the morphogenetic processes.

The conference of 2015 was on the problem of stability and variability of morphogenesis, a key problem for both developmental biology and paleontology. Many hypotheses of the theory of evolution are based on morphogenetic studies. The effect of the environment and its global changes on the character, stability, and changes of the morphogenetic processes is an important field for combined efforts of paleontology and evolutionary developmental biology. Concepts of stability and instability formed a basis for Waddington’s theory of self-organization and the epigenetic landscape. The study of stability and variability, norms and variations in ontogeny, and their connection with evolutionary processes still remain pertinent problems of the evolutionary theory. Can the stability of development be explained solely by the precision of some structural details of the developing system, or is the system in fact explained by the stability of “contours and interactions” allowing a considerable degree of freedom of dynamic components of the system? This is a fundamental question in the study of ontogeny and phylogeny of organisms. The solution may lie in the combination of the restricted diversity of morphogeneses with the infinite diversity of the terminal morphological forms. The study of this problem in turn enables an understanding of convergence and parallelism, ubiquitous in the evolution of the organic world. The similarities and differences between organisms can be manifested not only morphologically, but also at the molecular level. Morphological parallelism is commonplace in the evolution of many taxa. At the

molecular level, this phenomenon is much more poorly studied, but its investigation is very important in solving many contradictions between morphological and molecular taxonomies. How are parallelisms and convergences related at the morphological and molecular levels? The answer to this question remains pertinent for evolutionary biology and systematics.

An interesting viewpoint on these problems was presented in a small paper “Molecules, morphology, and phylogeny,” sent to the conference by a leading embryologist of Russia, Professor Olga Mikhailovna Ivanova-Kazas, who worked for many years at the Department of Embryology of Leningrad State University. She was a student of the well-known zoologists Professor V.A. Dogel and Assistant Professor A.P. Rimsky-Korsakov, and the eminent histologist Academician A.A. Zavarzin. She was also connected with Academician Artemii Vasilievich Ivanov, an acclaimed zoologist. Her papers made a big impact in the Russian science of embryology and comparative morphology of invertebrate animals due to the high precision and broad scope of her numerous studies, and primarily her seminal monograph “Comparative anatomy of invertebrate animals,” the six volumes of which were published from 1975 to 1981. These volumes became textbooks for embryologists and zoologists studying invertebrates. Despite her considerable age, Olga Mikhailovna remained an active researcher and followed the latest achievements in biology. In her conference paper she wrote on one of the burning issues of modern evolutionary biology—the contradiction between evolutionary morphology and molecular biology. She considered it to be very important that morphological and physiological processes are based on processes at the molecular level but showed in several examples how neglecting the data from evolutionary morphology can lead to serious mistakes. Unfortunately, Olga Mikhailovna did not live to attend the conference and died on January 17, 2015 at the age of 102. We here publish her abstract and dedicate this collected volume to her memory.

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Translated by S.V. Nikolaeva