INNOVATION

EDITORIAL

Introduction to the Theory of Form

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Form is the primary, if not the most essential, tool by which we recognize and interact with the world around us. Biological forms, in particular, play a fundamental role in our life. It is our identity and how we recognize individuals of our species or other species. Form has been central to art, poetry, love, hate, and almost every aspect of our society. Throughout history, judgment and discrimination have been made based on biological form. Through the relation between the changing forms, we understand evolution and ancestry. Change in form has been the diagnostic tool in diseases, syndromes, and malformities. Understandably, correction of form has been the center of attention for several branches of medicine.

It is only logical that a comprehensive study of form should include different perspectives from multiple disciplines. While most studies on form are descriptive, some have tried to explain form in general and biological forms in particular. The mechanistic studies of biological forms either attempt to understand the mechanism of creation of form at the level of cellular behavior or focus on pattern formation during the embryonic stages and the interaction between populations of cells at the tissue level. The studies of form after birth have captured the attention of clinicians, anatomists, anthropologists, and physiologists. Still, they are primarily descriptive, with few theories aiming to explain the overall pattern of growth and development of a specific tissue. Due to the system's complexity, form after birth was never considered the best tool for biologists to extract the principles of form creation. However, many geneticists have tried to find a relation between particular genes and biological form. Of all the tissues, skeletal form received the most attention from clinicians, anthropologists, and evolution biologists, primarily due to its impact on the general form of humans and the preservation of skeletons over time. These studies, however, mainly focus on the effect of environmental factors, mechanical stimulation, and lifestyle on skeletal form. While fruitful in demonstrating form can be modified, these studies fell short of defining the general principles of form beyond skeletal tissues.

Very different conclusions have been made about the factors behind form creation, depending on which level of creation was the focus of the studies. At the cellular and molecular levels, scientists could easily find a relationship between developing forms and their interaction with their surrounding physical and chemical factors. By inducing genetic mutations and observing their effect on pattern formation during embryonic development, developmental biologists shed light on the effect of the genes on the form. Molecular biologists and cell biologists investigate the regulatory machinery that controls DNA transcription, pushing our understanding of form beyond the genes. Studies by anthropologists mainly focus on the effect of the environment through mutations and natural selection. Their studies help us understand the evolution of form in different species, especially the origin of modern humans. Similarly, population geneticists were able to explain the prevalence of a particular form in the population, mainly through understanding genetic drift, migration, marriage between populations, and many other factors that could affect gene variability.

All these studies produced two generally conflicting views on form. Some scientists believe that biological form is pre-determined by our genes and, like destiny, we need to wait until our unavoidable fate unravels. Yet other scientists emphasize physical and chemical factors as the central guides in creating form, trying to find mathematical relations between these factors but falling short of recognizing the role of the genes.

Many questions about form are still unanswered. Finding answers to these questions is not just an intellectual curiosity but plays a significant role in treating deformities as clinicians. From a diagnostic point of view, it is not clear why we have so many deformities. Nasal septal deviation, disproportionate jaws, asymmetric skull, long faces, short faces, crowding of the teeth, open bites, deep bites, lack of chin, prominent chin, exostosis, missing teeth, and extra teeth are among the long list of deformities that commonly exist in the craniofacial area. These deformities are separate from well-known syndromic deformities that can only be seen in a very small percentage of our population, and for which we have a clearer understanding of their origin, whether it is a mutated gene or developmental defect.

If these common deformities are caused by genetics, we should focus on finding the mutations that cause these deformities. However, that effort has not been fruitful, and we could not find a clear cause-effect relation between genetic mutations and these frequent malformations. In addition, many questions remain unanswered, for example, why natural selection did not eliminate deformities? Does civilization protect the deformities? Could these deformities result from mixed population genetics and, therefore, should be considered side effects of migrations? Should deformities be considered normal variations even when they are harmful? And if these deformities are part of our population genetics, why can we still correct them or prevent their occurrence by treatment? More importantly, is it possible that these malformities are primarily deviations in form creation and not necessarily carved in our genome?

Our proposed ideas do not have diagnostics value alone but are significant in treating deformities. If deformities are genetic, then they are not modifiable, and we should only be able to correct them by surgery. On the other hand, if we believe deformities are developmental and occur during different stages of form creation, they should be preventable, and we should invest heavily in their prevention. Even if we miss the opportunity to prevent these malformations, we could still focus treatment on re-establishing the biological process of form creation instead of cutting and reassembling imperfect tissues.

We believe that the answers to questions about biological form require that we abandon the focus on detailed aspects of form and move toward an integrated view of form that combines our current understanding of basic science and clinical findings. We understand that no scientist or clinician can collect enough data to answer all these questions in their lifetime. Therefore, a theory of form, similar to any theory in any discipline, reflects the view of its authors based on their interpretation of the cumulative results of their and the work of others. While theories on form go back to our earliest thinkers, we believe our input will add perspectives needed to keep the fire for the search for truth alive.

Our theory of form summarizes our current findings and understanding of form as scientists and clinicians, attempting to explain many unanswered observations. The concepts in our theory have been borrowed from different disciplines and modified to clarify the creation process of biological forms. In a series of articles, we will provide a general view of the characteristics of the form without going through details or examples of their mechanism of action so we can quickly establish a framework for further analysis of the form. Later, we will focus on different aspects of the biological forms and study them in the context of our Theory of Form.