

The potential of Goethean science in the 21st century – reasons why modern life sciences and Goethean science are approaching each other

Report on a Workshop at the Evolving Science conference at the Goetheanum Sept. 30 – Oct. 4, 2015

Is evolution a random process or does it follow a definite trajectory? Bernd Rosslenbroich, director of the Institute of Evolutionary Biology at the University of Witten-Herdecke in Germany, reported on the thesis of his recent book *On the Origin of Autonomy - A New Look at the Major Transitions in Evolution*. In his book – which was thoroughly peer-reviewed by his colleagues in mainstream biology before its publication by Springer – Rosslenbroich was able to demonstrate that macro-evolutionary development involved incremental progress toward biological and behavioral autonomy.

In early vertebrate evolution fish are confined to an aquatic environment. They are dependent on its temperature, and reproduction generally takes place externally in the water. Amphibians gain autonomy by achieving a limited ability to live on land, an ability fully achieved by reptiles. Mammals are capable of maintaining their own temperature, which allows for a more active metabolism, and by internalizing the reproductive process and nurturing their young they achieve not only greater independence of the environment but also the ability to develop flexible skills through childhood play. Finally, humans, by achieving upright posture, liberate their hands from locomotion and their mouths from grasping and develop intelligent use of tools and larger brains along with the capacities of speech and thought. These new capacities coupled with a prolonged period of childhood development and the possibility of life-long learning allow for ever-increasing autonomy. Rosslenbroich stressed the importance of play in the evolutionary process. Though the thesis of his book has been generally accepted, its deeper implications have not yet been taken up by mainstream biologists.

Johannes Wirz, who holds a PhD in molecular genetics and is co-director of the Science Section at the Goetheanum, described recent developments in epigenetics that show that all the “master” (hox) genes associated with the body plans of vertebrate animals can be discovered in their primitive ancestors. This leads to the conclusion that these genes, which are associated with the development of specific organs, do not determine their shape and structure but are only necessary conditions for their formation. A striking example is an experiment with flies in which the master gene associated with their eye (a compound eye) was replaced with a human gene associated with the (very differently structured) human eye. Using the “human” gene, the flies developed their normal compound eye. From this and other similar experiments, researchers conclude that master genes do not determine the shape and structure of organs but act as enablers which allow

the organism to create specific organs. This discovery corresponds with Goethe's "two-fold law," according to which the form of an organism is determined by: 1. the *inner* nature of the organism itself, which is understood to be an active, formative agency, and 2. by *outer* circumstances, which include not only its environment *but also its inherited genome*.

In both of these recent developments – the idea of evolution toward autonomy, and the idea that an organism is not merely the result of its genome but must also be seen as an active agency – current biology, Goethean science, and spiritual science are indeed approaching one another.