

In this article I discuss the finding of Michael Levin's group related to morphogenesis and also the general ideas inspired by this work. The findings demonstrate that the hypothesis that genotype fixes the phenotype apart from adaptations is wrong. Already epigenesis challenges genetic determinism and the view emerging from the experiments is that the patterns of membrane potentials of cells of early embryo determine patterns of electric fields in multicellular length scales and that code for the outcome of the morphogenesis. One can say that these patterns code for the goal directed behavior and have the basic properties of memory. The manipulations of these patterns in the early embryonic stage can modify the outcome of the morphogenesis so that one can speak of a novel organism. Also the manipulations of say gut cells can produce organs such as ectopic eye.

One can regard multicellular systems as predecessors of neural systems. Ion channels and pumps are present in both systems. In nervous systems synaptic contacts replace the gap junctions. Nerve pulse patterns are replaced by waves associated with gap-junction connected multicellular systems.

Levin introduces notions like cognition, intelligence and self not usually used in the description of morphogenesis and represents a vision about medical applications of the new view

The TGD view of morphogenesis is compared with Levin's vision. The basic picture relies on the notions of magnetic and electric bodies, to the phases of ordinary matter with effective Planck constant $h_{eff} = nh_0$ behaving like dark matter and making possible macroscopic quantum coherence, and to zero energy ontology (ZEO) providing a quantum measurement theory free of the basic paradox. ZEO is implied by almost deterministic holography forced by general coordinate invariance. Holography implies that structure is almost equivalent to function.

This framework explains the basic finding that the goal of the morphogenesis is determined by the patterns of electric fields during the early embryo period. TGD also suggests the universality of the genetic code and several variants of the genetic code- Morphogenetic code might reduce to a variant of genetic code realized by cell membranes and larger structures instead of ordinary DNA. TGD predicts the analog of nerve pulse with the increment of membrane potential in mV range. These patterns would play a key role also in neural systems.