MATHEMATICAL ASPECT OF ORGANISMAL UNITY

A mathematical and morphological understanding of organismal unity necessitates the concept of dynamic equilibrium.The organism’s capacity to maintain its unity over a lifespan, despite continuous cellular turnover.
This problem can be approach with mathematical theory of viability. Cell growth is a morphological equation -which depends on cell proliferation, differentiation, migration and apoptosis (PDMA)- and the various biological regulations are differential equations. The organism must maintain its regulations within a physiological equilibrium and its physical unity, and not significantly change the number of its cells during adult life.

The viability kernel is a fundamental concept in viability theory, it represents the set of initial states within a system from which there exists at least one trajectory (PDMA dynamics, physiological regulations) that can remain within a specified constraint set for all future times.

But when the viability of the organism is at stake, i.e. when the biological regulations deviate from a reasonable equilibrium, or when the environment changes drastically, the unity can also suddenly change the dynamics of its cells (PDMA) and then the trajectory exit the above viability kernel. The viability kernel of the unity evolve, the shape of the organism change but the unity remains. This domain is dynamically modulated by intrinsic and extrinsic factors, influencing the organism's developmental trajectory and ultimate fate.

This system is characterised in biology -the fibroblast/macrophage network and the fractones-.