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categories and supercategories in relational biology

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This topic entry introduces one of the most general mathematical models of living organisms called ‘organismic supercategories’ (OS) which can be axiomatically defined to include both complete self-reproduction of logically defined π -entities founded in Quine’s logic and dynamic system diagrams subject to both algebraic and topological transformations.

0.1 Organismic supercategories (OS)

OS mathematical models were introduced as structures in higher dimensional algebra that are mathematical interpretations of the axioms in ETAS- a natural extension of Lawvere’s *elementary theory of abstract categories* (ETAC) to non-Abelian structures and heterofunctors.

When regarded as categorical models of supercomplex dynamics in living organisms OS provide a unified conceptual framework for relational biology that utilizes flexible, algebraic and topological structures which transform naturally under heteromorphisms or heterofunctors. One of the advantages of the ETAS axiomatic approach, which was inspired by the work of Lawvere (1963, 1966), is that ETAS avoids all the antimonies/paradoxes previously reported for sets (Russell and Whitehead, 1925, and Russell, 1937). ETAS also provides an axiomatic approach to recent higher dimensional algebra applications to complex systems biology ([?], [?] and references cited therein.)

0.2 Examples of OS applications to relational and complex systems biology

Whereas super-categories are usually defined as n-categories or in higher dimensional algebra, organismic supercategories have flexible, algebraic and topological structures that transform naturally under heteromorphisms or heterofunctors. Different approaches to relational biology and biodynamics, developed by Nicolas Rashevsky, Robert Rosen and by the author, are compared with the classical approach to qualitative dynamics of systems (QDS). Natural transformations of heterofunctors in organismic supercategories lead to specific modular models of a variety of specific life processes involving dynamics of genetic systems, ontogenetic development, fertilization, regeneration, neoplasia and oncogenesis. Axiomatic definitions of categories and supercategories of complex biological systems allow for dynamic computations of cell transformations, neoplasia and cancer.

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