SEMINAR ANNOUNCEMENT FROM THE MECHANOBIOLOGY INSTITUTE (MBI)

Implications of Complexity Theory for Thinking About Biology

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The complementarity principle of Niels Bohr has been extremely important for the development of quantum theory. We show here that, as Bohr himself believed, it is also of great importance to biology. Modern systems biology reveals that, as in the quantum realm, experiments by themselves limit our capacity to understand a biological system completely because of scale dependent "horizons of knowledge." Specifically, we suggest that selection of an observational stance is inseparable from descriptions of biology, i.e. the impact of our minds' actions through such observational selection may be inherently, irreducibly coupled to the observed biology as it is, likewise, in the quantum realm. Practical examples demonstrating will be drawn from the speaker's own research domains, in particular from liver and gastrointestinal pathology and adult stem cell biology. Principles to be described:

1. Biological systems are a nested hierarchy of complex systems from lowest to highest levels of scale.
2. Biological beings comprise all scales of superimposed components/processes in holistic overlay.
3. Boundary selection in biological experiments inevitably leads to uncertainty, incompleteness.
4. Observational stance is irreducibly coupled to observed biology as it is in the quantum realm.
5. Biological complementarity is a correlate of quantum complementarity as predicted by Niels Bohr.

We conclude that we are on the threshold of a profound paradigm shift that will have practical as well as theoretical implications for harnessing the behaviors of biological systems: Future biological sciences will be understood as describing systems of systems, working together in complementary relationships, relationships within a holistic framework representing a form of superposition of all possible and actual, scale and perspective dependent, limited views.

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