

Life Is: A Molecular to Circumplanetary Synthesis

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Abstract: Life is perplexing, yet is perhaps comprehensible. Comparing Life and the life sciences illuminates the power and limitations of techno-reductionism. Life — better described as the process of Living — transcends the cellular-genomic conventions of organismal and neodarwinian biology. A novel synthesis — a simple description with broad explanatory power and explicit testability — is outlined herein, and in a unique collection of hand-rendered conceptual figures that propel its effective communication.

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A structure-first view of Life is at the foundation of organismal-genomic Life definitions and may be empirically falsified. Problematically, the ubiquity of reductionist methods and pedagogy in the biological sciences occur alongside a seeming tyranny of mechanical metaphors and systems (cybernetic) representations. Many explicit contradictions may be explicitly described. Life definitions are tautological, arising from while perpetuating erroneous assumptions, characterizations, predictions and applications. Though not the focus of this short description, many explicit and false presumptions about life may be described. These circumstances may be attributable to noun-to-verb acquisition of human language and the resultant-to-reciprocal entrenchment of nouny cognition. In fact, nouny cognition widely prevails in the natural and social sciences, where structure-first, physics-up and thermodynamics down conceptual, mathematical and computational norms are perpetuated as a self-referencing and self-validating cognitive and institutional tyrannies. In a broad and explicit sense, these circumstances may suggest proximity and possibility of a cognitive transformation in our perception and empirical study of Life. Such cognitive transformations are well-evidenced in history and are non-magical, occurring along forecastable pathways. In fact, a new view of Life shall require and perpetuate a new empirical practice, the illumination of deep blindness and empirical error, and new possibilities for human civilization inside a new biocentric worldview.

Beyond and rather cryptically underneath what can be explicitly shown to be a prejudicial and erroneous worldview, technomechanism perpetuates and widespread blindness about the lack of a sufficient and comprehensive Life description. For example,

three Dictionaries of Biology (Oxford, Penguin and Collins) are resting beside me as I type. Look in any of them: Life is not listed. Look at any other dictionary, how is Life listed? As a noun.

Life is verby. Looking broadly and deeply, Life autoregenerates, coevolves and self-repairs (equals healing). Napalm a forest and come back in 1000 years; another forest. Take an ancient dessicated seed from Herod's tomb and wet it; germination as an autocatalytic and autoregenerative process — the process of Living— begins. Although membrane, metabolism and nucleic acid replicator are widely presumed as minimal requisites for Life (Living), qualitative rigor may be employed to draw robust and foundational distinctions: the processing-patterning of dynamical Living (e.g. ecophysiology, climate self-regulation and changing, cellular “trafficking” (note mechanical metaphor), meiosis, mitosis, quorum sensing in “bacteria” and every human heartbeat) may be distinguished from genomic governance of how some particular characteristics (e.g. brown or blue eyes) are manifested.

To extend more deeply beyond nouny cognition, a useful description of Life equals the process of Living. Living occurs along a broader continuum of dynamical emergent complexity. Complexity is not complicated. Complexity describes spontaneous patterning — dynamical processing-patterning — and the non-magical empirical fact of irreducible functionalities. Nature manifests complex phenomena that widely perpetuate structuring that evolves (changes through time) and reciprocally coevolves. Complicated systems arise from mechanical intricacy. We can over think the details, but robust empirical distinctions may be very explicitly drawn. Simple pendulums and dynamically distinct from hinged

pendulums, physics-governed versus dynamically-governed trajectories may be clearly distinguished and robots will never be people, even if their technological mimicry may exceed some of Nature's functional capacities. Complexity arises along exergy gradients where processing-patterning (dynamical form) arises and manifests irreducible functionalities. To comprehend this simple shift in empirical perspective, Google "time lapse clouds" and watch videos.

More explicitly, Living is a dynamical organization that patterns, constructs, maintains, regulates, repairs and perpetuates itself. Living arises and occurs as nested, reciprocal and self-similar functionalities that may be explicitly described. These representations generate falsifiable hypotheses that perform well under empirical testing. Living is a self-referencing, self-constituting and self-perpetuating loop of processing, patterning, structuring and evolving. Modern biology is explained with systems generalizations and mechanical analogies. Structural homologies (compare skeletal structure and ontogeny of whale fluke, bat wing and human arm/hand) evidence deep evolutionary unities; though rarely taught or discussed in the Life sciences, homologies may propel deeper understanding of the Life phenomenon. In fact, the functional unity of Living as a molecular-to-circumplanetary phenomenon may be evidenced in functional homologies of explicit autoregenerative loops, including 1st to nth order hypercycles.

Several distinct manifestations of Living may be characterized.

Consortial Life (CL) includes prion consortia, cellular trafficking, microbial consortia (e.g. gut microbiota), eco-"systems" and the biosphere. CL lacks membrane-enclosure, is collectively patterned via distributed governance, and internally recycles resources/wastes. CL self-regulates amongst ≥ 2 quasi-stable steady states, manifests flexible yet reproducible development patterns, evolves

perpetually through adaptive cycles, and does not die. Phenotypes, gene pools, clades and evolutionary faunas arise and evolve as CL, with intervening organismal manifestations.

Organismal Life (OL) includes each bacterium, eukaryotic cell and metazoan phenotype. OL self-generates a bounding membrane, specific manifestations (e.g. brown or blue eyes) are centrally (genome) governed, and must release metabolic wastes. OL self-regulates around a single central tendency, is specialized and efficient, displays highly predictable development trajectories (ontogeny) and dies. The OL category, may be further subdivided: every bacterium is a *true organism*; eukaryote protists and metazoan phenotypes are *fused organismal consortia* (think symbiogenesis).

Bounded Consortial Life (BCL) manifests a particular set of OL and CL characteristics. BCL self-generates a bounding membrane and manifests distributed governance between ≥ 2 dynamical steady states. BCL includes microbial consortia and their coevolving biofilms, microbial mats/stromatolites, colony-constructing social insects, and the climate consortium. The history and continuity of Life on Earth requires and perpetuates the climate consortium (CC), a unique conceptual construct describing the atmosphere as a planetary biofilm.

References

1. c.f. <https://gsa.confex.com/gsa/2014AM/webprogram/Paper243043.html> and <https://eco.confex.com/eco/2014/webprogram/Paper48474.html>.
2. Modified after Invited presentation to Special Symposium 7: "Earth Stewardship: Exploring Connections Between Microecology and Macroecology", Annual Conference of the Ecological Society of America, Portland, August 2012 (<http://www.esa.org/portland>).

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