The Dialectics of Life

Towards a Unification of Biology and Philosophy

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Outline

- Part 1: Background: The Extension of the Modern Synthesis
- Part 2: The Organisational Perspective
- Part 3: The Return of Dialectics of Nature
- Part 4: Conclusion: Another Kind of Naturalism, Another Kind of Science?

Part 1: Extending the Modern Synthesis

- Modern synthesis: Darwin + Mendel.
- Evolution defined as: 'the change in allele frequencies in a population'
- Betty Smocovitis: *Unifying Biology* (1996): 'A delicate balance'
- Positivistic ideal of unifying science balanced against autonomy of biology:

> 'If biology were to preserve its independent existence as a science, it could in some measure by dependent on, but could not be fully reducible to, physics and chemistry' (Smocovitis 1996: 104).

- Began as a rather pluralistic research program in the early 1930's but was later hardened

Smocovitis (1989: 47)

Three main points of agreement:

1) the primacy of natural selection

2) the gradual rate of change, ‘operating at the level of small individual differences’

3) a ‘continuum between microevolution and macroevolution’

Moss (2003): The Phylogenetic Turn

> The intent of this phrase is to highlight the idea that as the gene and genetic program became understood to be the principal means by which adapted form is acquired, the theater of adaptation changed from that of individual life histories, that is, ontogenies, to that of populations over multiple generations, that is, phylogenies. As the **genetic program moved to the explanatory center stage**, the individual organism, with its own adaptive capacities, began to recede from view. (Moss 2003:4)

- Relocates agency from organism to external force: natural selection

Challenges to the MS

- Epigenetics
- Niche construction
- Plasticity-driven evolution
- Symbiosis
- Facilitated variation
- Natural genetic engineering
- Extended inheritance
- Multilevel selection
- (Ecological-)evolutionary-development biology

The Extended Evolutionary Synthesis

Can the Modern Synthesis assimilate the insights of twenty-first-century biology?

- **Revisionists** (Shapiro 2011; Laland et al. 2015; Noble 2017): by ignoring various activities of individual organisms, the MS provides a impoverished understanding of evolution
- **Traditionalists:** (Wray et al. 2014; Charlesworth et al. 2017): natural selection operating on genetic factors adequately explains evolutionary change

Table 8. SET versus EES core assumptions

SET assumptions	EES assumptions
The pre-eminence of natural selection	Reciprocal causation
Genetic inheritance	Inclusive inheritance
Random genetic variation	Nonrandom phenotypic variation
Gradualism	Variable rates of change
Gene-centered perspective	Organism-centered perspective
Macro-evolution is explained by microevolutionary processes	Macro-evolution is also explained by additional evolutionary processes, e.g., developmental bias and ecological inheritance

(Chui 2023: 45.)

Part 2: The Organisational Perspective

- A **theoretical kind of systems biology**, seeking organisational principles for biology
- Modern form of organicism
- About 'the interdependence of the parts and their relation to the whole' (Montévil and others 2016: fn12, 39).

Constraints and Processes

- Boundary conditions which selectively harness matter to perform functions (Pattee 1972)
- Holonomic and non-holonomic
- Constraints channel the flux of energy and matter while remaining locally unaffected by the process they constrain, 'at the time-scale in which it takes place' (Bich, Mossio, and Soto 2020: 5)
- Processes are the whole set of changes, physical and chemical, that sustain an organism

The Organisational Perpective

- Inert versus living systems
- Against the genocentric view
- Explaining function by reference to contribution to maintenance of organisation
- Three theoretical principles: 1) the default state of cells, constitutive proliferation with variation and motility, 2) variation and 3) organisation

The Default State

- Centered around the cell as the origin of all organisms
- Contrast to the notion of inertia in mechanics
- Historically emergent constraints move cells away from this default state
- The primary generator of variation – produced at each cell division

(Soto et al. 2016)

Variation

- Principle of variation: 'Biological organisms are **specific** objects'
- Randomness and historicity
- The adjacent possible
- Occurs on all levels of biological organisation
- Extended criticality

(Montévil et al. 2016)

Organisation

- Organisational **differentiation**:

  'the system itself generates distinct structures contributing in a different way to self-maintenance' (Mossio, Saborido, Moreno 2009: 826)

- Organisational **closure** qua *closure of constraints*:

  'the existence of each constraint depends on the existence of the others, as well as on the action that they exert on the dynamics. In this kind of situation, the set of constraints realizes **self-determination as organisational closure**' (Mossio & Montévil 2015: 181)

- Organisational closure *and* thermodynamic openness
- Grounds teleology and normativity

From Entailment to Enablement

- Interdependence:
  - Organisation: condition for variation, favors its propagation
  - Variation: condition for the maintenance and adaptation of living organisation and the generation of functional innovations.

- Physical systems are **generic**
- Biological systems are **specific**
- Enablement and differential causation

Historicity at the Heart of Biology

[T]he very phase space of evolution changes in unprestatable ways. In consequence […] we can write no equations of motion for the evolving biosphere, nor know ahead of time the niche boundary conditions so cannot integrate the equations of motion which we do not have. No law entails the evolution of the biosphere (Longo, Montévil, and Kauffman 2012: 7).

Part 3: The Return of Dialectics of Nature

- ‘From Disparagement to Appreciation’ (Ferrini 2007)
- Two predominant readings: Either as purely a priori or as empirical
- A philosophy of life, grounded in experience
- Philosophy relies on science but cannot be reduced to science

Gambarotto and Illetterati (2020)

Three points of convergence:

- 1) The nature of biological organisation
- 2) The role of teleology in biological explanation
- 3) The relation between life and cognition

- 4) Reciprocal interdependence between organism and environment
- 5) Notion of randomness

What is Dialectics?

- Not limited to thinking but inherent in nature itself
- Three laws: (a) the law of the transformation of quantity into quality and *vice versa*; (b) the law of the interpenetration of opposites; and (c) the law of the negation of the negation
- Seeming opposites are co-constituted and new properties emerge continuously
- Processual view
- Moderate holism: interdependence between parts and whole

The Dialectical Biologists

- The original organicists, *The Theoretical Biology Club*, were inspired by dialectics
- Ecology was formulated through the application of dialectics (Foster 2020)
- In recent times, influential biologist such as Stephen Jay Gould, Richard Lewontin, and Richard Levins employed dialectical principles
- The Organism as Subject and Object of Evolution
- *The Triple Helix* prefigures niche construction

The Living Organism

- The organism is ‘essentially process’
- A process of *self-differentiation*, of *unity-in-multiplicity*
- First stage of nature: ‘geological organism’
- Second stage of nature: plants
- Third stage: living organism
- In living organisms, parts are *members*
- Attunement, habitutation

The Science of Logic:

In so far as the object confronts the living being at first as something external and indifferent, it can affect it mechanically, but without in this way affecting it as a living thing; and in so far as it does relate to it as a living thing, it does **not affect it as a cause but it rather excites it**. Because the living being is an impulse, externality impinges upon it and penetrates it only to the extent that in principle it is already in it; hence the effect on the subject consists only in that the latter finds that the externality at its disposal accords with it. (Hegel 2010: 685)

Subjectivity and Teleology

- First sense of subjectivity: **Concrete unity**
- Similar to the organisation definition of function
- Second sense of subjectivity: **Autonomy**
- The living organism is constrained by natural forces but sublates them into its own functioning.
- Autonomy and dependence
- Self-determination and agency

Lack and Self-feeling

- Third sense of subjectivity: **Self-feeling**
- Sense of lack is fundamental to life
- Feeling of lack leads to ‘activity of deficiency’
- Subject as a process which is spurred by feeling of lack and strives to overcome it
- Similar to enactivist notion that biological systems are always in a **precarious state** in relation to their environment

From Kant to Hegel

- Kant: Teleological judgements: a heuristic
- Intrinsic teleology: Kant's 'second greatest service to philosophy'
- **Dialectics versus determinism**
- Concepts as embodied by organism-environment systems
- The realism of purposes
- From Kantian wholes to dialectical wholes

The Impotence of Nature

- Unable to to control its own becoming
- Nature: *The idea in its otherness*
- The contingency of nature sets limits to philosophy and science
- Inexhaustible
- The discrepancy between nature and concepts
- Contingency and randomness

Summary: Hegel's naturalism

- The organism is the embodiment of the Idea
- Bridges the gap **between constructivism and realism**
- Life: precondition of knowledge and cognition
- Similarities with pragmatism, enactivism, and ecological psychology

Part 4: Another Kind of Naturalism, Another Kind of Science?

> Does science itself, as one such social institution, and as one set of cultural practices, remain the same within this different kind of naturalism?
>
> (Gallagher 2018: 117)

- Limits on philosophy and science
- Dialectical principles apply both to scientific practice and its objects

The Blind Spot

- Experience as a scientific ‘blind spot’ (Frank, Gleisner, and Thompson 2024)
- Hegel addresses this blind spot, as his philosophy is grounded in experience
- Mossio (2024): Organisation as scientific blind spot
- Illetterati (2020): Non-naturalistic naturalism

Dialectical (Philosophy of) Science

- Not only about the **content** but also about the **form** of science
- Both a philosophy of nature and of science – *and* philosophy itself as a science
- Continuity between theory and practice
- Apply the results of science to understand scientific practice itself

Example: Niche Construction

- de Oliveira, van Es, and Hipólito: **'Scientific practice as ecological-enactive co-construction'** (2023); Rouse: 'Niches and Niche Construction in Biology and Scientific Practice' (2024)
- Niche construction 'the process whereby organisms actively modify their own and each other's evolutionary niches' (Odling-Smee et al. 2003)
- Naturalistic turn in philosophy of science
- Applied as a **resource** to explain other topics
- 'an interactive, iterative process' of 'co-construction of scientific knowledge'
- Joseph Rouse (2016): Science as material engagement with the world

Theorizing is […] an embodied cognitive practice—but, then again, any practice is also necessarily embodied, and any embodied activity is necessarily a manifestation of, and a means to developing, our epistemic relation with the world. Scientific knowledge (as a relation and activity) and scientific theory (as a practice) are thus **neither socially constructed nor human re-constructions of mind-independent reality, but they arise dialectically, interactively and iteratively**, through human niche construction activity, as joint co-constructions of organism-environment systems. (de Oliveira, van Es, and Hipólito 2023: 26)

Philosophy *in* Science?

- Seismic shifts in biology
- New disciplinary interactions and boundaries
- Requires deep engagment with the **history** of philosophy *and* science
- Institutional requirements?
- Emancipation of science?

Another Kind of Unification?

- Historicity
- A science of science
- Against synthesis?

Thank you!

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