Review of: "[Commentary] Biology as a postmodern science: Universals, historicity, and context"

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Potential competing interests: No potential competing interests to declare.

Review of **Biology as a postmodern science: Universals, historicity, and context,** https://www.qeios.com/read/981956

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First of all, I thank the author for the conciseness of his challenge. Reading the title, I felt a Sokal hoax flavour, but the brevity of the article convinced me to see its arguments.

This *epistemological* paper raises three questions: the principles of the living, the peculiarity of biology as a science, and the meaning of “postmodern”. There are plenty of studies treating each of them, but it was nice to see such a brief summary of the intertwining of the three aspects.

A. *To the first*, the answer is given by the history of biology[1], i.e., by the*concepts* and *principles* (so abstractions of abstractions) of:

- *unity* of the living organized structures (or societies, as Whitehead called them), constituted not only of parts but also of properties,

- internal *interdependencies* containing both *subordination* of “each part to the whole (making) the organism”[2] (in the same manner as Kant explained in his *Dissertation* of 1770), *coordination* at the level of *parts*, and at the level of the organism, but also of *properties*, at both levels,

- the biggest number of systems – not only parts, like the cells, but also as levels of reality and/with levels of reactions – constituting the individual unity (organism), generating the biggest number of embedded functions situated both anterior and posterior to the functions related to the fitness of systems and of the organism (for example, the quantum processes as informational carriers within the fulfilment of functions),

- *equifinality* (Ludwig von Bertalanffy), not as a predetermined goal and path to this end-state – balance, adaptation, generation – (a “mechanistic” view of teleology) but as *creation* of the fittest goal / end-state through chosen fittest paths / strategies, this creative goal/goal though creation being an energy organiser,

- *relative autonomy* of all structures and levels, but

- In order to differentiate between any inorganic system – for instance, a machine characterizable also as unity, parts,

properties, subordination, and coordination – and a living one, there must be *morphological functions* which are and create the "*boundary conditions*" of the organism by the fixing and transmission of *information* shaping its identity, so, by superior functions to those of the basic physical and chemical ones; the boundary condition is the structure – the assemblage – that imposes on the lower, physical, and chemical processes a shape; thus, the living system has dual controlling mechanisms, lower (physical and chemical) and superior, these ones manifesting in more functions, but being limited (having boundary conditions) by the lower mechanisms[3]; therefore, the living system is characterised by a *dialectical* hierarchy of functions and creation of boundary conditions – so, of relationships between the different levels and functions within the organism, these relationships borne by birth and transmission of information giving rise to *teloi*, goals imposed from the superior levels and functions to the inferior ones –, and this hierarchy includes consciousness with the creation of meanings[4] as exterior to the mechanisms of functions, as a new, external *telos*, integrating the living peculiarity of the organism and *within it* in a new entity, namely, through physical-chemical processes,

- *interdependencies organism-its environment* with both inorganic and living systems,

- *circular / feedback* interdependencies,

- *adaptation* to the environment[5] giving the process of

- *evolution* ***[6]***,

- the constitution and manifestation of *functions* in both their *exergonic* and *endergonic* metabolism as a process giving the *process* form of the living[7],

- *self-propagation*,

- the *cognitive* feature in order to maintain / adapt[8], with the different levels of information gripped by systems of different complexity, and fulfilled through connectivity, thus also of the *sensory* feature and the "*computing*" one (neurons and neuronal channels), all of these systems revealing both models of the inside functions of the organism and models of the external world fitting one to the other, as well as internal and external limits of the reachable and attainable – so, of knowable[9],

- *anticipation* of change (Nadin[10]), and bottom-up and top-down avenues of communication and structuring of balance of systems, cognition meaning anticipation and self-awareness, already present in / as *access consciousness* or "sentience" "making distinctions on the basis of qualia"[11]; access consciousness means reactivity[12],

- *self-sustainability*, via different possible developmental paths,

- dialectic of *genetic fixity* (morphogenesis through transmission of information in DNA) and *heredity*, and *plasticity* of all living units in the living structure (of *epigenetic inheritance* and limits of heredity),

- *selection* as both origin and result of life,

- *creation*,

- *etc.*, for example, of populations as systems;

- and thus, of creativity in the conception of principles (methodology, paradigms) of biology.

The above aspects show their *unitary* development: the living cannot be emancipated from the material, energy, and informational contents, taken in symbiosis. But the “mechanisms” – deployment of functioning according to the physical-chemical laws – cannot be reduced to laws[13], because they also include the superior “bricks” (information) and their specific *leading* involvement. (Information as a producer of *telos*). Also, that the understanding of the development of living systems is the result of *theory construction*: where theories about the still unknown phenomena but grasped as new have first a reductionist aspect – the new being consonant with the existing explanations (let's say, universals) – but then “it turns out that a new, more adequate theory is not reducible to an old, less adequate theory”[14].

Just because of the *many, intertwining and superposing causal* relations within the internal circular organisation of the organism as well as the relations with the environment, we face the difficulty to understand the living and the “multiplicity of explanations”, as an epistemological principle of the knowing of nature (Lucretius). This is the reason for arguments for both the impossibility of reduction of biological explanations to explanations in physics and chemistry, and for the possibility of this reduction[15].

Throughout history, this difficulty manifested in the culture of biological knowledge through various dominances of paradigms grasping different *meta* looks over the living organisms, from the standpoint of their material structuring and / or that of their autonomy of moving and thus, of their “freedom,” ability to pursue self-referencing ends, thus, of creation – not only of reaction – and anticipation. Inherently, these paradigms were categorical, generating contrasting perspectives in biology, and myths in the common knowledge. However, the always present position towards the contrasting, excessive theories generates a balanced systemic approach in the philosophy of biology[16] and the focused biological technical studies.

B. *To the second* question – and on the basis of the tacit premise of scientific objectivity being “a description of that which is known”[17] – the answer is that biology is a special science because the universal laws it discovers in the living are different than the universal laws emphasized by physics, for instance.

However, by calling this peculiar feature of biology a sign of “postmodernity,” one passes to a metaphorical description. Actually, it is more important to describe biology as a very mobile science, and a science that reveals *both* the origin and result of physical and chemical processes and the unique jump into a new, original level and structure of reality. Biology is the science of this level and structure, whose complexity is explored – actually, as in every science, and more, in every common knowledge – by both demonstrations (the specific of scientific knowledge, manifested or necessary even in philosophy, as Kant showed) and, at least at the beginning of inquiries, a hermeneutical approach. The metaphors are means of both, but the problem is always to not explain – to not present the *knowledge* (and not the “meanings”) – in metaphors. The *understanding* (of meanings not yet clear etc.) is not only at the beginning of the process of scientific investigation but also at its end, but here it is the *result* of knowledge, while at the *beginning* it is before it. We cannot use the same metaphors when we make conjectures and hypotheses as when we already tested them and arrived to

construct a consistent theory (that is never The Truth etc., but that is efficient and heuristic, supporting the development of knowledge of new aspects). *Knowledge* is not impression.

Then, *objectivity* is the correspondence of our knowledge to the real facts and itis the *ideal* of science, so, even from the second half of the last century on. But at least from the 19th century, the researchers knew that in order to give reliable cognisance, they must test their hypotheses and work hard to verify every aspect: this is the *practice* of science. Both the objectivity ideal and the medium term between cognisance and facts (this is practice) continued in the last century and its second, "postmodern" half: more profoundly, because then and now, science became aware that the scientific practice involves theory construction, that is, the subject as (a "new") medium term between facts and scientific knowledge. Therefore, the conditions of the subject (epistemic, psychological, social) give the lens through which both facts and cognisance are conceived. Remaining only at the epistemic conditions, the more or less tacit suppositions (paradigms, worldviews, theories) assumed by the researchers would be the lens of theory construction.

However, the subject as a "new" factor of scientific knowledge does not lead to a "subjective", namely, arbitrary, relative science: because science has its fundamental element of construction, its specific *practice*. On this basis, science gives objective knowledge as a *tendency* in its historical process of collective debates and verification.

Consequently, neither putting face to face this objectivity and the concrete particular theories/truths in a moment – so, when they are based on concrete subjective viewpoints – we cannot deduce "subjective" arbitrary theories.

Farther, historicity of facts *as we know them* is historicity of knowledge. But this historicity of known facts must reflect the historical character of the original "generation and corruption" of biological events and processes: "must," because scientific knowledge is verified and proved. And as the original historicity of biological processes is not "postmodern," so the biological sciences are not. But every science is historical in that its knowledge changes, criticises itself, develops. Accordingly, every science contains historically known facts which have historical validity. More, the historically known facts describe primordial characteristics and relations of phenomena with *time*: so, their historicity.

But are there not differences between the historicity of physical and chemical phenomena and that of biological ones[18]? There are, and they are caught by the concept/feature of universality. *Universality* (deriving from the universals, i.e., abstract concepts naming classes of phenomena, and characteristics and relations) is, first, a requirement of viable scientific knowledge: about the same things, it must be the same "*en-deçà et au-delà des Pyrénées*" (Pascal). Then, concretely, this condition is transposed to the ground of causation. And finally, it is certified by the quest for and discovery of physical and chemical laws.

Well, since biological phenomena have a far higher level of complexity, causation is more complex. But does it not exist? It does, both as *tendential* laws and as laws as *patterns* of precise peculiar "local" behaviour of biological elements or entities. All these biological types of laws are universal: they consider the "exceptions" – actually, all the concrete biological situations are exceptions because every one of them is unique, formed by unique states of elements, configurations, and relations – and the "deviations" from specific states and configurations; more, the deviations are considered normal. Without taking into consideration all of these, we cannot speak about biologically valuable knowledge,

thus laws. If in physics newly discovered phenomena do not fit the structures on the basis of which explicative models as laws were created, these models are reviewed and changed. Even big laws, such as gravitation – in cosmology – were reviewed (Einstein). And even in physics, the "exceptions" – situations newly discovered and theorised – generated new laws, universal.

I discuss the biological laws from another standpoint than the author: as *meta* rules of organisation of the bios (as evolution, etc.) (epistemologically, paradigms) and as specific "local" rules. These rules are epistemic constructions reflecting natural regularities. Actually, the physical and chemical laws, too, reflect natural events: which are, obviously, historical, but which can be considered as origins of the physical and chemical configurations and situations. But when we speak about physical and chemical laws, we emphasise the patterns of organisation and behaviour of a type of elements, configurations, and relations, *like when we speak about the biological laws*. Here I think it's necessary, and it would be fruitful, to explore the distinction between paradigms and laws, something that the author only suggested, obviously. But the scientific construction is a process, and when putting forth a (new) type of hypothesis/ principle/law that eventually contradicts the existing principle or law, we do not posit another biology, "incommensurable" with the existing one, because the scientific creation (debate, verification, etc.) does not permit the coexistence / the parallel existence of two biologies: the old and new principles, etc., are scrutinised and the biological science rejects or integrates the "alternatives." Physics, too, explains the physical (actually, the physical-chemical) constitution of the world as depending on different histories, on specific "ancestral events." Alternative pictures of life based on sulphur or different combinations of genetic code show that we need more universal features of life, but, on the basis of scientific cognisance of the known "life-world," we can understand, creating universal principles and models, what the bios is. Biology is the science of life forms, and it can but expand. If universality, as all other concepts, is historical (change), it is not less true that universality of laws is not opposed to historicity: neither in physics nor in biology. It's clear-cut that the life forms – as the forms of inorganic – are only possible outcomes within the emergence of existence. And they are so for us. Variation and diversity of life do not, however, destroy the ability to construct universal features and patterns of functioning. On the contrary, these variation and diversity can be seen with the help of universal patterns, i.e., grasping the universal in variations and also what is general in the varied and diverse forms.

Indeed, biology raises new problems for scientific knowledge as such, and for its practice. The difference between paradigms and laws, the expanse of each of them – to which system does each of them correspond – is important for all sciences. Perhaps biology, but physics and chemistry, and even other sciences, too, draw attention to a *hierarchy of knowledge from the standpoint of generality*.

But science means generality. The possibility to produce predictions of future behaviours and events is, obviously, more difficult the more the domain – life, for instance, but also society and man – is complex, farther from the physical-chemical. But just because science has arrived at and developed the universals, predictions are possible in these domains, too. Because of the complexity of causation – and obviously, because of our imperfect information – these predictions present *tendencies*, which are, nevertheless, capital.

If so, the fact of theory construction does not contradict the predictive ability of science. When this ability is *used* in order

to oppose the laws/tendencies emphasised by science, it means that science is *instrumentalised* as a "construct": and this infringement at the level of "academic occupations" reverberates in the whole society, and not in a beneficial form. And not only starting from biology (and economy, psychology, sociology): the universal laws of physics and chemistry can be, and are, harnessed in the same harmful way.

C. As is known, the term *postmodern* was coined in reference to art and especially to literature. There were changes in both the flesh/contents of art and its forms/manners.

The image of the *postmodern* contained the idea that contemporary culture would be vague, undefined, and undefinable, fluid, porous – made of exceptions and without any rule – unconventional and non-conformist. And it's interesting that in the same period, science developed within clear paradigms (such as evolution in biology), at the same time allowing both a positive avalanche of discoveries of new/unknown phenomena and new *meta*, methodological, and epistemological reflections related to it. Briefly, these new reflections, concretised in new *perspectives* (new local but fundamental major theories), were the result of accumulation in "normal" science, and the whole scientific endeavour gave the impression of "order out of chaos" (if I may borrow Prigogine and Stengers' formula), so of the possibility of rational *knowledge* even though this knowledge is historical and is about historical facts. (Obviously, I discussed this only in an epistemological key).

But the term *postmodern* became notorious not because of arts, but because of philosophy. Postmodern knowledge was characterised by Lyotard (*La Condition postmoderne: rapport sur le savoir*, 1979) as abandonment of the grand narratives: in social sciences, not in the natural ones. Which were these grand narratives? The *Enlightenment* paradigms of social advancement through *mass education*, formation of *autonomous and critical thinking*, and of *utopian liberalism*; and *Marxism*, with *historicity*, ideology as *context dependence* of ideas, including dependence of class position, and *structural-functional* economic *determinism* of modernity as the first *world* society (this involving a holistic view of society), generating the *evolution* of class/power relations and the *possibility* of communism as *"real movement* which abolishes the *present state* of *things" (German Ideology).*

This idea of abandonment of metanarratives was taken over also by some ones philosophizing about, say, physics: they considered the endeavour of modern science (not necessarily Newton but the 19th century one, Faraday, etc.) as mechanistic and false, towards the 20th century's observer dependence science. This idea is, of course, absurd: Einstein's theories were not a negation of classical mechanics but a different approach to physics, at different levels of reality; the dialectic of objective processes and the place of the observing subject, as well as that of determinism in the quantum world, were revealed in the collective effort of contemporary science. Biological studies are not an exception in this process of development of new perspectives, self-correction, and rapid change. We may conjecture that there is a difference between science and this type of philosophy: the first does not deduce from the context and observer dependence research the impossibility of true theories. While the second just tries to legitimise the moral relativism of *neo-liberalism*, becoming dominant from the 70s, by resorting to hard sciences.

Historicity of things and their scientific approach is not tantamount to the relativism of values, because the scientific approach involves *criteria* and their *demonstration*. In this, science is *rigorous* (even philosophy must be, said Kant), and if

without the examination of suppositions and criteria – and results, and not only immediate and narrow – it is not worth making and trusting science (we paraphrase Socrates' maxim in *Apology*, 385a), it's clear that, strictly from a *cognitive* standpoint, science is not "relative". Scientific theories are confronted not only with new information and results but also with different, even adverse hypotheses and perspectives, leading nevertheless to some demonstrated truths. Their historical character does not dissolve them *hic et nunc*, because without them it's impossible to continue the scientific inquiry as such.

Everything in science is permanently questioned, including the big paradigms, and, as in biology, they is substantiated in new manners, but these new manners do not confirm the "choice dependence" of paradigms.

However, science is a *social*, socially dependent endeavour, and first of all, power relations dependent. Accordingly, it is marked by these relations and, as we all see, by the tendency of some ones to impose a relativistic approach covering the freedom to judge every moment and element of science/knowledge.

The vagueness of the term *postmodern* – I do not refer to the discussions about cultural creation – allows it to be used not only as an innocent metaphor but also as an envelope of the *neo-liberal* relativism absolutely far from the features of historicity, specific also to biology. In this sense, I suggest the author put the word "postmodern" in quotation marks. Neither the context nor teleology is a postmodern idea. On the contrary,

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Actually, I was interested in the principles of biology, but I insisted on their linking to the term *postmodern*. Why? Because it could suggest that characterising even science as postmodern, all its manifestations of neo-liberal rejection of rational analysis, of the neo-liberal ideological treatment of social phenomena, would be okay and acceptable. Philosophically speaking, just because our theories are constructed, we are responsible for their *telos*. But the quotation marks would bring a joking air (as I dare to suspect in the article), and the sense of humour in our own positions in front of the received concepts and *clichés* is more necessary than ever. Anyway, I thank the author for the problems he raised.

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I apologize because I had no time to read the other reviews, and I apologize for the possible repetition of some of their ideas.

[1] See Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution and Inheritance*, Massachusetts, London: The Belknap Press of Harvard University Press, 1982.

[2] Humberto R. Maturana, *Autopoiesis and Cognition: The Realization of the Living*, Dordrecht: D. Reidel Publishing Co., 1980, p. 5.

[3] This permits molecular biology.

[4] Michael Polanyi, “Life's Irreducible Structure”, *Science*, 160 (3834), June 1968, pp. 1308–1312.

[5] See the fascinating example of movements of plants (nutation) according to external information processing, Vicente Raja, Paula L. Silva, Roghaieh Holghoomi & Paco Calvo, “The dynamics of plant nutation”, *Scientific Reports*, 10, 2020, Article number: 19465.

[6] See as a mirror the relations between ontogenesis and phylogenesis, reflecting the environmental constraints: Alan A. Cohen, “Aging across the tree of life: The importance of a comparative perspective for the use of animal models in aging”, *Biochimica et Biophysica Acta* (BBA) – Molecular Basis of Disease, Vol. 1864, Issue 9, Part A, September 2018, pp. 2680-2689; Beth A. Reinke et al., “Diverse aging rates in ectothermic tetrapods provide insights for the evolution of aging and longevity”, *Science*, 23 Jun 2022, Vol 376, Issue 6600, pp. 1459-1466; João Pedro de Magalhães, “The longevity bottleneck hypothesis: Could dinosaurs have shaped ageing in present-day mammals?”, *BioEssays*, Willey periodicals, November 2023.

[7] Humberto R. Maturana, p. 11.

[8] I*bidem*, p. 13.

[9] Cesare Marchetti, “Notes on the Limits to Knowledge Explored with Darwinian Logic”,*Complexity*, Volume 3, Number 3, pp. 22-35, 1998.

[10] For example, *Anticipation and Medicine* (Mihai Nadin editor), Springer International Publishing Switzerland, 2017; also, Ana Bazac, “Anticipation: Learning from the Past. The Russian/Soviet Contributions to the Science of Anticipation”, *International Journal of General Systems*, Volume 47, Issue: 04, 2018, pp. 374-393. The review detects / expresses *principles* of (anticipative) behaviour of physiological, neurophysiological and psychological systems, as they were studied from 1870 to1980 in *Anticipation: Learning from the Past. The Russian/Soviet Contributions to the Science of Anticipation*, Mihai Nadin editor, Springer International Publishing Switzerland, 2015.

Anticipation is a form of imagination: a representation of something not present.

[11] Spyridon A. Koutroufinis, “Beyond Systems Theoretical Explanations of an Organism’s Becoming: A Process Philosophical Approach” (pp. 99-132), in Spyridon Koutroufinis (ed.), *Life and Process. Towards a new Biophilosophy*, 2014, Berlin, Boston: De Gruyter, 2014, p. 120.

[12] Phenomenological consciousness intentionality related to meanings.

[13] A proof is the different types of mechanisms, cyclic and oscillatory (see William Bechtel and Adele Abrahamsen, “Complex Biologıcal Mechanisms: Cyclic, Oscillatory, and Autonomous”, in Cliff Hooker (Ed.), *Philosophy of Complex Systems*, Amsterdam: Elsevier, 2011, pp. 257-285

[14] James Griesemer, “The Relative Significance of Epigenetic Inheritance in Evolution: Some Philosophical Considerations”, 331-344, in Snait B. Gissis and Eva Jablonka (Eds.), *Transformations of Lamarckism: From Subtle Fluids to Molecular Biology*, Cambridge, Ma., London, England: The MIT Press, 2011, p. 341.

[15] Francisco J. Ayala and Robert Arp (eds.), *Contemporary Debates in Philosophy of Biology*,

Wiley-Blackwell, Malden, MA, 2010, the studies: Evelyn Fox Keller, “It is Possible to Reduce Biological Explanations to Explanations in Chemistry and/or Physics” pp. 19-31; John Dupré, “It is Not Possible to Reduce Biological Explanations to Explanations in Chemistry and/or Physics”, pp. 32-47.

[16] Olivier Sartenaer, « La vie dans la matière. Repenser la controverse entre vitalisme et matérialisme », *Klesis – revue philosophique* – 2013 : 25 – *Philosophies de la nature*, pp. 37-50.

[17] Humberto R. Maturana, *ibid.*, p. 5.

[18] As in the previous paragraphs, also social and psychological, of course.