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

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Abstract

The infusion of biology, like of the other natural sciences, by postmodern ideas is under harsh criticism. The reason behind this position is that the postmodern stance advocates for relativism and subjectivity, which are in sharp contrast with the aspired objectivity in the nature of the scientific method and the universality of the derived conclusions on which the sciences rely. Biology, though, is unique among the natural sciences in the fact that while it relies on the laws of chemistry and physics, when its distinct subject matter emerges, the one that is conceived as biological, it is based on random events that acquire their universality on the grounds of historicity. This offers biology a unique connection with the postmodern stance that instead of being hunted, it should be favored.

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Almost a decade ago, the NSF of the US advocated for research that pursues the identification of the "*Rules of Life*" as one of its 10 Big Ideas[1]. This notion is exactly aligned with the modern position regarding biology, which, like all other natural sciences, should rely on general and universal principles that are widely applicable in a manner that transcends space and time, and should be valid without exceptions. Due to its nature, though, biology deviates from such an approach. The classic statement that "*Nothing in Biology Makes Sense Except in the Light of Evolution*" (Dobzhansky 1973[2]) illustrates precisely the nature of the subject matter of biology: That is actually a construct that developed over time via a series of events, that had occurred stochastically during biological history and transiently persisted, because it materialized something that was just more efficient than what pre-existed[3]. Through this process, universality acquires a meaning that is completely different from that of the other natural sciences. In the former, laws are universal, are expressed by mathematical equations, and are expected to apply always and in everything, even in entities that have yet to be discovered. Deviation does not reflect exceptions but rather inadequate model systems and measuring techniques. For example, a new element or a new planet may be discovered, but they would still have to obey the same exact principles that apply to the ones that are currently known. Otherwise, the whole frame of the natural science will have to be re-established, to integrate these exceptions as well, and explain them at the same time.

In biology, however, the notion of universality is quite distinct. What is perceived and interpreted as universal is universal just because it can be traced back to a common ancestral event. This applies to the gene networks that control the development of limbs in mammals, or even to the genetic code that is universal for all existing life forms. Universality just denotes common history and does not preclude the validity of other plausible alternatives. For example, even for the genetic code, we can easily speculate that different stochastic events could have occurred or may occur, and lead in the future or in other places in the universe, to life forms that are based on sulfur, or forms having a genetic code that could have engaged different amino acids and be a doublet or a quartet, instead of a triplet. More than that, the exact same concept of the genetic code can be of doubt since it could have been drastically different, if different stochastic events had occurred. A similar notion may also apply to life *per se*, which could not have evolved if a specific combination of random events had not occurred. Thus, what we perceive as a subject matter of biology remains a construct, the outcome of a series of events, that may simply have not occurred. A plausible argument could be that, because it is drastically different, this alternative biology is not biology anymore, but rather another discipline that still studies self-propagating forms but employs an entirely new framework unknown to us[4].

As such, biology is inherently related to historicity, which in turn represents a primal notion within postmodern thinking. We come to examine the subject matter of biology, the different organisms as individuals or as groups, by taking into consideration what led to their onset, and by accepting *a priori*, that what we study is just a single outcome among many possible. Furthermore, we try to identify universal principles by knowing that they are universal, just because they obey a principle that emerged early in evolutionary history, and persisted after that, just because of luck, or because of the lack of equally efficient alternatives.

Furthermore, we are fully aware that variations, and no exceptions, of these principles may occur, and indeed, they are

rather common. This exact point also represents an inherent controversy that exists in biological sciences and, by extrapolation, within the collective mindset of all modern science. Simultaneously, as we endeavor to identify universal principles that have the weight of a law or a general rule, we also celebrate diversity in how life is organized, compromising, by definition, the universality of the laws we may have just described. In more practical terms, this is highly related to the value of the experimental systems in biology and whether the information that they convey is indeed general or is only pertinent to the exact system used. It is also acknowledged that we place value on personalized strategies, for example, in therapeutics, admitting that each individual represents a system of its own.

Relevant to these notions are two points that differentiate biology from the other natural sciences, and place it closely to the postmodern critique:

First, the fact that we are incapable of delivering accurate predictions of biological systems' behavior, but we are rather effective in manipulating biological systems, even to the depth of interfering with the operation of their fundamental principles[5]. This relates to treating biology as a technological endeavor, as a construct, rather than as a science[6]. In the other sciences, we can accurately deliver precise predictions, but we are not capable of interfering with their universal principles, because they are indeed universal and cannot be compromised.

The second point that relates biology to postmodernism is that of teleology, irrespective of whether this is related to theological, evolutionary, or developmental concepts. Again, in all these approaches, intrinsic remains the notion of function that attains a goal. Such a notion is foreign to the other natural sciences for which the principles that underscore them remain goal-less. In biology, though, a goal always emerges that satisfies specific demands, albeit it can change over time. In these cases, the goal is defined by the context, another idea of value to postmodernism, and may constantly vary depending on the scale. It is present, though always, impacting the efficacy by which the goals are attained[7]. For example, it can be the efficacy by which certain energy-producing molecules are metabolized, the speed of an animal, or the number of offspring it produces[8]. The attainment of such goals can impact a specific process in opposite directions, introducing a system-based strategy, yet a teleological constituent exists that is ultimately expressed in evolutionary terms. As such, it maintains both historicity and relativism, and through this lens is interpreted and vetted. That an entity cannot be studied and evaluated outside its context is equally valid for biology and for postmodern thinking.

Acknowledging that biology substantially deviates from other natural sciences, and that it bears a unique connection with what is perceived as the postmodern stance, may fuel discovery and help us to better integrate the biological findings into our lives as species. Such an approach may relieve biology from the burden of modernity and may assist in compromising controversies that are inherent to biological sciences.

Notes

[1] https://www.nsf.gov/news/special_reports/big_ideas/index.jsp

[2] Originally published as Dobzhansky, Theodosius (March 1973), "Nothing in Biology Makes Sense Except in the Light of

Evolution", American Biology Teacher, 35 (3): 125--129, doi:10.2307/4444260, JSTOR 4444260,

[3] Through selection.

[4] The self-propagation is chosen as an essential characteristic of life, but it could be everything else to describe life as we know it and understand it.

[5] Genetic engineering strategies can alter basic manifestations of life, interfere with fundamental principles, and are in the trajectory to do this more efficiently in the near future.

[6] Evolutionary processes represent the first level of constructivism in biology, that of unintentional. Genetic manipulations in the lab may represent a second level, that of intentional. In the first level, aspects that ultimately led to our cultural evolution as a species, may also be included.

[7] This relates to biological fitness, a measure of the success of specific genotypes to produce offspring.

[8] In all cases there is a trade-off between cost and benefit. Occasionally, albeit not always, cost and benefit are understood as the biological scale changes with the larger scale receiving the benefit and the lower receiving the cost: For example, cost for the cell benefits the organisms, and cost for the organism benefits the population.