

On the Adequacy of Neo-Darwinism: A Reply to Daniel Paksi

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In this article I respond to Daniel Paksi's attempt to justify Michael Polanyi's claim that neo-Darwinian thought is inadequate to account for the emergence of life itself and increasingly complex forms of life because it lacks an ordering principle (which for Polanyi is the potentiality of a stable open system). I argue that presupposed in any dynamic system, of which neo-Darwinianism is an example, is some notion of stable self-organization, that Polanyi's distinction between randomness and significant order introduces an inappropriate anthropocentric bias into evolutionary theory, that neo-Darwinian thought has within itself ample resources to account for the emergence of life in all its richness, and that therefore Polanyi's (and Paksi's) critique of neo-Darwinian theory falters.

It is gratifying to have one's article taken seriously enough that a reader is willing to spend time writing a response to it. So I thank Daniel Paksi for his response. As the title of his article suggests, he defends Polanyi's theory of evolution against what he thinks is my mistaken critique. However, in my view his response highlights what is problematic in the account of anthropogenesis Polanyi gives in Part IV of *Personal Knowledge*. I feel that Polanyi's attack on neo-Darwinism is the weakest aspect of one of the 20th century's greatest works of philosophy.

The core of Paksi's critique of my views seems to center on four charges: that I (and neo-Darwinians) have a materialistic view of evolution, that I (and neo-Darwinians) deny any form of teleology and have a deterministic view, that I think Polanyi is a vitalist, and that I have an inadequate understanding of the role of emergence in Polanyi's thought. In the following discussion I shall try briefly to highlight what I see as problematic about Polanyi's (and Paksi's) criticism of neo-Darwinian thought and why the appeal to the suggested ordering principle of evolution is unhelpful and misleading. As my account unfolds, I hope it will become evident why I believe that each of Paksi's four charges is off target.

Polanyi and Paksi suggest neo-Darwinian thought postulates a mechanical system that can explain random change but not the significant change that produces emergent phenomena, and in particular, life. Here I want to point out what I think is a basic flaw in Polanyi's argumentation, a flaw not specifically pointed out elsewhere so far as I am aware. The problem centers on his notion of what is significant in "significant order" and the nature of "randomness" and "accident." It extends further to an inconsistency in his use of Gestalt theory.

The chief function of Chapter 3, "Order," in PK is to underscore the ability of humans to recognize significant order. Polanyi uses an example of white pebbles arranged in words to greet people arriving in Wales (PK 33-34), in contrast to these pebbles scattered after they had been ignored for many years. He accredits our capacity to recognize significant order in the first case and not in the second. But the significance of the spelled out rather than the scattered pebbles prioritizes as significant that which is explicated in language, that which has become explicit and focal. Why is the particular arrangement in the second case not seen as resulting from

another, perhaps more tacit, sort of significant order, the complex ordering effect of rain, erosion, the playful use of pebbles by children, wind, etc.? More generally, by limiting the significant to what is directly perceived as relevant to a line of inquiry governed by some human interest, doesn't Polanyi incidentally disestablish the associated tacit background information, which he assigns to the insignificant realm of the random and the accidental? I believe this is the case, and this step has deleterious consequences for his assessment of neo-Darwinism. What is of interest to him is the rise of life followed by the development of new species and ultimately the rise of homo sapiens; these are classed as significant, while the contextual circumstances and laws that in fact make possible these events are considered, as being merely random, not to have sufficient power to explain biological emergence.

The negative consequences of his view for neo-Darwinian thought are apparent when he denies that "the different living species [could] have come into existence by accidental mutations" (PK 35). Mutations in DNA may not be predictable via our present research capabilities, but presumably they are causal events arising in highly unusual circumstances. When Polanyi states that "no highly significant order can ever be said to be solely due to an accidental collocation of atoms," and then concludes "that the assumption of an accidental formation of the living species is a logical muddle" (PK 35), one must challenge the way he uses "accidental." Again, presumably the circumstances within which life first developed were highly organized at a certain chemical level (perhaps a concentrated mass of organic molecules struck by lightning, but at present we can only speculate). To call these circumstances "accidental" is to disqualify them because we currently have no explicit, verified understanding of the process, no comprehension of the *intrinsic* ordering principles (PK 39) involved. In claiming that the emergence of life and of new species is significant while implying that other changes (supernovae, transition of solid to liquid, etc.) are only random, Polanyi is imposing a bias upon natural processes that seems to shift the conversation away from scientific explanation toward anthropocentric meaning. An implication of this shift is that he no longer treats neo-Darwinian thought as a scientific theory in which different forces and different materials at different levels impact each other in equally valued ways such as is emphasized in ecology. Instead he narrows the examination of evolution to value as significant only those principles pertaining to "the rise of man" while regarding other evidence as random or accidental.

In his further discussion of order in the same chapter, Polanyi uses Gestalt language to distinguish between figure and background in acts of visual perception. "No feature of the background may be linked in an orderly manner to the figure. Hence all relations of the background features to the figure must be random, and this will be best safeguarded if the background is random in itself" (PK 38). Gestalt theory postulates that color, line, pattern and other figural elements are fused into perceptual recognition through an act of equilibration. In his theory of knowing, however, Polanyi adds an active element to Gestalt perceiving in order to distinguish between illusion and knowing (PK 342). An effort must be made by a subject to achieve rightness of perception. By including background knowledge and skill that enables a person to distinguish right from wrong, and by distinguishing between the subsidiary and the focal, Polanyi moves decisively beyond Gestalt equilibration and the significant/random dichotomy. That is, Polanyi emphasizes that the background subsidiaries in which we dwell and which we integrate to form focal meanings are much more than random. Through his theory of tacit knowing, he acknowledges that our indwelt background influences include the learned and the innate, the social and the skillful. These attuned tacit elements contribute in essential ways to the formation of our explicit knowledge. I believe the figure-background theory and its associated notions of what is random and accidental ought to be viewed as an unproductive line of Polanyi's thought, one to be replaced by his powerful theory of tacit knowing. An implication is that his critique of neo-Darwinian thought, based as it is on the significant/random and background/figure distinctions, should also be superseded.

Paksi claims that Darwinian natural selection is based upon two conditions: the existence of variants and insufficient means for living. But the neo-Darwinism that Polanyi felt to be insufficient contains much richer resources today than just these two conditions. I'll briefly describe five additional factors within neo-Darwinian thought that can contribute to evolutionary development and the emergent rise of new species: mutations, genetic drift, exaptation, migration and species isolation, and dynamic species-environmental interaction.

Mutations in germ line cells are heritable, and the resulting genetic changes can be harmful, neutral or beneficial to a species. When beneficial, animals (and analogously, plants) with the changed genetic makeup are liable to thrive, and their altered configuration of DNA may give them traits such that mating with their ancestor species is unattractive or infertile. The resulting speciation is not just change, but results in the *emergence* of a separate species. Genetic drift does not produce new alleles like mutations do, but bring about random change in allele frequencies that may affect the ability of a species to survive in the long run. Exaptation involves the hijacking of a trait that had survival value in one setting for a novel use. This notion (developed especially by Stephen Jay Gould after Polanyi wrote) helps explain how something like bird feathers and then wings might have developed through long states of nonfunctionality; feathers originally helped dinosaurs insulate themselves against cold weather. It is consistent with Polanyi's understanding of emergence to see birds as an emergent development beyond dinosaurs, not simply a random change. Further, when a population migrates and becomes adjusted to environmental conditions not experienced by its ancestors, genetic changes fostered by natural selection occur over time. This process, which Darwin explored in the Galapagos, may lead to the rise of new species.

The last factor of neo-Darwinian theory I alluded to, dynamic species-environmental interaction, deserves a somewhat more extended treatment, because it illuminates especially well what is problematic about Polanyi's interpretation of evolution. Polanyi speaks of a phylogenetic field that guides evolutionary development as a process of "maturation along the gradients of phylogenetic achievement" (PK 400). In essence, this claim treats species development as a pre-ordained achievement comparable to the gene-guided maturation of an individual living being, and it completely ignores the role of the unpredictable changing environmental conditions to which species must adjust. The concept of an unfolding field inappropriately imposes upon the evolutionary process as a whole a telic aspect. Paksi is right to claim that natural selection has a teleological element locally (the behavior of individual plants and animals is oriented toward survival as an end). He understands that the global process has no teleological gradient toward some specific achievement. However, Paksi is wrong to think this implies that natural selection cannot contribute to evolutionary emergence. Natural selection in concert with mutations and the other factors I have mentioned are collectively the basis of evolutionary advance, not natural selection plus an ordering principle alone.

Paksi has grounds for questioning my calling the ontogenetic and phylogenetic different "levels" of reality, but the point I am making about their fundamental difference still stands. The difference between the ontogenetic and phylogenetic is not only a matter of distinct processes. They are also distinct in terms of number, scope, and context. The differences number can make can be seen when comparing the properties of an atom of water with the properties of the trillions of atoms in, say a pond. An atom of water cannot form ice, cannot dissolve entities, etc. Likewise, the maturation of an individual animal (ontogenesis) has no necessary predictive relevance to the fate of its species (phylogenesis). In sum, Polanyi's attempt to model phylogenetic emergence on ontogenetic maturation is not good science and is misleading as an analogy.

Next, let us consider Polanyi's claim that neo-Darwinian thought is incomplete and perhaps even incoherent by itself. He thinks an ordering principle of evolution is needed to supplement neo-Darwinism and account for emergence rather than just random change. I am puzzled as to why Polanyi, who so brilliantly shows how independent actions can lead to spontaneous order, should refer to the adjustments made to an environment as "random" and leading only to change rather than a dynamic order. There is nothing random or accidental about what traits best allow a species to survive in an environmental niche. Nevertheless, what is the nature of the ordering principle he thinks is necessary? Polanyi states, as Paksi notes, "that the *ordering principle* which *originated* life [and sustains evolution] is the *potentiality* of a stable open system" (PK 383-384). Paksi quite appropriately notes that "Polanyi so little elaborated this point it is hard to tell what he was implying when he wrote this." Is this vague point sufficiently important that it justifies denying the adequacy of neo-Darwinian thought?

No, because *any* systemic explanation (like evolution) of how a dynamic process unfolds must assume the process continues until some form of stability or equilibrium is reached. The ordering principle Polanyi sees as needed is suggestive of the self-ordering drive to stability found in complexity theory. There is no single law or principle underlying all the examples to which complexity theory applies; each system achieves self-organization and stability in a way appropriate to the forces, properties, and other components of its "habitat." Polanyi's criticism of neo-Darwinian theory because it lacks a sense of self-organization is superfluous because such a drive is inherent within the assumptions supporting evolution as a systemic theory and inappropriate because neo-Darwinian thought is rich enough to account both for change and emergence.

That Polanyi critiques evolutionary theory because it does not make explicit the non-telic goal of stability it tacitly assumes¹ is both ironic and unfortunate. It is ironic because Polanyi argues that what is missing in evolutionary theory is an *active* principle that is necessary to explain the emergence of novel centers in the course of geological history. "Random impacts can *release* the functions of an ordering principle and suitable physico-chemical conditions can *sustain* its continued operation; but the *action* which *generates* the embodiment of a novel ordering principle always lies in this principle itself" (PK 401). But in explaining the ordering principle as the "*potentiality* of a stable open system" Polanyi both introduces a finalistic character to evolution and offers what seems to be a passive outcome rather than an active force as his explanatory tool.² When an active principle is called for, generally it is assumed that it would be a kind of force, which is what Bergson postulated in his version of vitalism. Now I do not think Polanyi is some kind of vitalist relying on a mysterious active substance à la Bergson, as I have made clear on other occasions.³ I referred to the vitalistic aspect of his thought because *Polanyi describes himself* (in the passage I [and Paksi] quoted from PK 390) *as a vitalist* insofar as he thinks a principle beyond the laws of physics and chemistry is what is necessary to explain evolution. My point is neo-Darwinian thought provides all the principled richness necessary to account for evolutionary emergence and does not deserve censure on this point.

To be sure, the potentiality Polanyi postulates can be seen as a kind of lure comparable to Aristotle's Unmoved Mover, but that still seems different than the actively generating principle he calls for. It would also add a metaphysical element to Darwinian science. Polanyi's proposal is ironic in that his major advance in epistemology/ontology beyond Gestalt theory was to argue for an active quest for contacting and understanding reality rather than settle for the thrust towards equilibrium characteristic of Gestalt theory. Yet the ordering principle he calls for prioritizes equilibrium.

Polanyi's criticism of neo-Darwinian thought is unfortunate not only because it is unnecessary, but also because it apparently gives the support of an eminent scientist to those who wish to support non-scientific

accounts of evolutionary theory, or who wish to replace evolutionary theory with a metaphysical or religious alternative. In the North American context a few years ago, this opening led to the creation of a center that argued for intelligent design rather than evolutionary process and legitimated this center with Polanyi's name.⁴

Finally, I would like to return to an assumption Paksi, following Polanyi, makes which is crucial to his point of view but which I think does not stand up to close inspection. He claims that because the evolutionary process as a whole (specifically, natural selection) is seen in neo-Darwinian thought not to be teleological, that therefore no evolutionary advance is possible. All must remain locked in meaningless transition within the realm of physics and chemistry. But it is precisely to challenge such an argument that the notion of emergence comes into play. Out of chemical processes life emerges in gradually more complex steps. The integration of chemical and biological materials and processes into conscious thought is an example of an ongoing process of emergence employed in writing and reading this article. Elsewhere I have described two genuinely and one inappropriately considered types of emergence and shown how they operate differently in three different ontological orders.⁵ One conclusion that may be drawn from these reflections upon emergence is that various types of emergence are immanent within the very structure of reality. Consequently, one task of the scientist and the philosopher of science is to show how such emergence operates within a domain the scientist studies. Neo-Darwinian theory does just that.

It should now be evident that my argument is much more with Michael Polanyi than with Daniel Paksi. Paksi is generally accurate in expounding Polanyi's thought about neo-Darwinism. In the final analysis, I believe, as I hinted at in the article Paksi critiques, that if Polanyi's theories of tacit knowing and emergence replaced the significant/random contrast and the elements of teleology and progressivism in Polanyi's treatment of evolutionary theory, his philosophy would in fact be consistent with the best neo-Darwinian thought.

Endnotes

¹I use the term "goal" here, but obviously this is not a teleological goal that the non-living world strives for. Paksi acknowledges this in his quote from Ayala 42. Individual living beings, however, are repositories of telic drives, as Paksi also acknowledges, for instance when he quotes Polanyi to the effect that "all physiology is teleological" (PK 360). However, just because beings with drives and purposes can emerge from non-teleological sources does not necessarily imply that the whole world process must therefore be teleological, as Polanyi seems to claim. The fact that the world includes the capacity for producing emergent features can be seen as an aspect of its factuality.

²I elaborate further on this point in "On Structured Societies and Morphogenetic Fields: A Response to Joseph Bracken," *Tradition and Discovery* 31:2 (2004-2005), 34.

³See, for instance, my "Response to Clayton: Taxonomy of the Types and Orders of Emergence," *Tradition and Discovery* 29:3 (2002-2003), 35.

⁴On the home page of the Polanyi web site, see the entry entitled "Information on Polanyi and 'Intelligent Design.'" See also the book by Barbara Forrest and Paul R. Gross, *Creationism's Trojan Horse: The Wedge of Intelligent Design* (New York: Oxford University Press, 2004), which was reviewed by Phil Mullins in *Tradition and Discovery* 32:2 (2005-2006), 52-53. An associated web site, www.creationismstrojanhorse.com contains many further resources, including an essay by Richard Gelwick, "Polanyi Scholarship and the Former Baylor Polanyi Center."

⁵"Response to Clayton," 32-47.