Natural Selection and the Purposes of Life

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The following is half of a chapter in "Evolution As It Was Meant To Be — And the Living Narratives That Tell Its Story." Already written parts of the book are available on the Nature Institute's adjunctive website, bwo.life (also accessible as BiologyWorthyofLife.org). The full version of this chapter is at bwo.life/bk/evotelos.htm.

Biologists often think of purposiveness, or teleology, under the concept of function, as when they say that a trait is "for the sake of" this or that, or an organ exists "in order to" achieve a particular end. And so, as philosopher David Buller has summarized common usage, "the function of the heart is to pump blood, the function of the kidneys is to filter metabolic wastes from the blood, the function of the thymus is to manufacture lymphocytes, the function of cryptic coloration (as in chameleons) is to provide protection against predators."

All this poses difficulties for a science that would honor its materialist commitments, since the concept of function, as Buller observes, "does not appear to be *wholly* explicable in terms of ordinary causation familiar from the physical sciences."

Whereas kidneys may continually adjust their activities and their own structure *in order to* do a better job of filtering metabolic wastes from the blood, no physicist would say that falling objects adjust their activities and their own structure *in order to* reach, as best they can, the center of the earth. More generally, organisms may strive to live, but physical objects do not strive to maintain their own existence. Organisms, so it seems, have intentions of their own, whereas physical objects are simply moved from without according to universal law.

Biologists have long worried about how their language of purpose might be explained, or explained away, in a respectable, materialistic manner — that is, explained without having to acknowledge that organisms really are purposive beings.[1] But their problem has, in recent decades, been resolved — or so we are told. Buller, who was writing at the turn of the twenty-first century, was able to point to a "common core of agreement" representing "as great a consensus as has been achieved in philosophy" — an agreement that "the biological concept of function is to be analyzed in terms of the theory of evolution by natural selection." More particularly, "there is consensus that the theory of evolution by natural selection can provide an analysis of the teleological concept of function strictly in terms of processes involving only efficient causation" — the kind of "purposeless" causation physical scientists accept as applicable to the inanimate world (Buller 1999).

So we no longer need to think of organisms as having genuine intentions, purposes, or aims of their own — no longer need to struggle with the problem of teleology, or end-directed activity. Teleology, we must believe, has been tamed, leaving biologists safe in their world of lifeless thought.

To put the most common version of the idea very simply (and not many working biologists seem worried about the need for a more sophisticated formulation), organisms are said to possess teleological, or purposive, features *because those features are present by virtue of natural selection*. That is, they were selected for the very reason that they effectively serve the organism's crucial ends of survival and reproduction. And since natural selection is a perfectly natural process — meaning that it involves nothing "mystical" like *real* purpose, intention, or thought — we can know that the functionally effective traits given us by natural selection are straightforward exemplars of physical lawfulness and nothing else, whatever they might *look* like.

If this feels as though it is cheating a bit, then you might want to trust your intuition — for more than one reason. I will briefly touch the issue from three different angles.

(1) The Arrival of the Fittest

To say that natural selection preserves traits promoting the survival of organisms does nothing to explain how the teleological character of those traits might be compatible with materialist thought. The preservation of a trait is an entirely different matter from its nature and origin. The proposed explanation does not show how functional, or end-directed, traits could initially occur in organisms previously bereft of teleology. Claiming that teleological features or activities already existed at some time in the past and then were preserved by natural selection merely pushes the problem back to an earlier time, without solving it.

We heard about this in the chapter, "Let's Not Begin With Natural Selection," where prominent figures in evolutionary biology over the past century and more complained that natural selection — even if it explains the survival of the fittest — cannot explain the arrival of the fittest. The arrival of traits is simply assumed, with natural selection then playing a role in their preservation and their spread throughout a population. Yes, purposive features are "good" for the survival of organisms and therefore may be preserved. But how does this bare fact make these features, in Buller's words, "explicable in terms of ordinary [physical] causation"?

Given the historical persistence of the complaint by leading biologists about natural selection and the arrival of the fittest, it is remarkable that the arguments today about how natural selection explains teleology generally proceed without so much as an acknowledgment of the problem.

(2) Circular Reasoning

It is important to realize that purposiveness runs through *all* biological activity. It is reflected in the coordinating principles that account for the integral, interwoven unity of the organism's life. The complexity theorist and philosopher of biology, Peter Corning — who appears to hold a conventional, materialist view of life — was nevertheless gesturing toward this purposive unity when he wrote that living systems "must actively seek to survive and reproduce over time, and this existential problem requires that they must also be goal directed in an immediate, proximate sense … Every feature of a given organism can be viewed in terms of its relationship (for better or worse) to this fundamental, in-built, inescapable problem" (Corning 2019).

Rather than being just one more discrete trait that might have been neatly evolved at some particular point in evolution, the *telos*-realizing capacity of organisms reflects their fundamental nature. It is what "living" means. We are always looking at a live performance — a future-directed performance, improvised in the moment in the light of present conditions and ongoing needs — not a mere "rolling forward" of some blind physical mechanism set in motion eons previously.

Here we encounter a staggeringly obvious problem. You will recall from the chapter, "Let's Not Begin With Natural Selection," that selection is supposed to occur when three conditions are met: there is variation among organisms; particular variations are to a sufficient degree inherited by offspring; and there is a "struggle for survival" that puts the existing variants to the test. But — and this is the crucial point — *all* the endlessly elaborate means for the production of variation, the assembly and transmission of inheritances, and the struggle for survival just *are* the well-regulated, end-directed activities whose teleological character biologists need to explain. So the basic conditions enabling natural selection to occur could hardly be more thoroughly teleological.

In other words, the purposive performance of an organism is a pre-condition for anything that looks at all alive and capable of being caught up in evolutionary processes of trait selection. So the common form of the argument that natural selection explains the apparent purposiveness of all biological activity appears to assume the very thing it is supposed to explain. This is argument in a circle. It would be truer to say that teleology explains natural selection than that selection explains teleology.

Although this problem in the explanation of teleology has been almost universally ignored among biologists, it has not been entirely overlooked. Georg Toepfer, a philosopher of biology at the Leibniz Center for Cultural Research in Berlin, has stated the matter with perfect directness:

> With the acceptance of evolutionary theory, one popular strategy for accommodating teleological reasoning was to explain it by reference to selection in the past: functions were reconstructed as 'selected effects'. But the theory of evolution obviously presupposes the existence of organisms as organized and regulated, i.e. functional systems. Therefore, evolutionary theory cannot provide the foundation for teleology. (Toepfer 2012)

(3) The Lure of the Machine

Those convinced that natural selection explains teleological traits (rather than the other way around) do occasionally make at least passing reference to the problem of the origin of the traits. For example, Buller writes that "natural selection explains the presence of a trait by explaining how it was preserved after being randomly generated." Organisms, he says, "are built by genes," and genes undergo random mutation, whereby new traits arise.

Of course, random activity does not by itself explain anything at all. So we can be sure that this activity is assumed to take place against a (perhaps largely unspoken) background that contributes essentially to the supposed explanation of teleology. A foundational feature of this background is the assumption that an organism is no more than a kind of material structure — preferably a machine, or mechanism, that we can imagine is controlled by a genetic program.

Evolution then "works" by tinkering[2] with at least some part of this physical structure until, over geological time, entirely new sorts of structure take form. The tinkering works mainly upon randomly occurring variations — usually, it is said, *genetic* variations, or mutations. And, despite the word itself, *tinkering* is not admitted to be something the organism or any other agent *does*. Nor does it reflect any sort of wisdom playing through living beings. Rather, the contriving of complex, sophisticated new features is something that blindly *happens* to the organism.

But finding things that blindly happen to the organism is hard to do.

The nonrandomness of mutation. To demonstrate that last point, we need only consider the unexpected reality of those genetic mutations upon which natural selection is supposed to work. The crucial observation was made by Oxford University biophysicist Norman Cook in 1977: far from being random, these mutations are actively managed by the organism. "Biological intervention through enzymes and enzyme systems is the principal mechanism of *in vivo* mutation," he wrote. He went on to point out that if changes in the genetic material are indeed mediated by other cellular molecules, then the idea of randomness loses its meaning (Cook 1977).

Furthermore, as British radiologist B. A. Bridges remarked: even studies of radiation-induced mutation in bacteria have shown that cellular repair systems are "necessary for nearly all of the mutagenic effect of ultra-violet and around ninety percent of that of ionizing radiation" (Bridges 1969).

That is, outcomes depend at least in part on what the organism does with the influences impinging upon it. You might think that radiation mostly causes very local alterations in DNA, corresponding to the immediate location of damage. Yet the great majority of radiation-induced mutations involve large regions of DNA, often encompassing many thousands of nucleotide base pairs, or "letters," of the genetic sequence. This is greater than the length of many genes (Elespuru and Sankaranarayanan 2006). The organism making such changes is apparently prepared to respond as best it can and in its own way when it engages the potentially harmful, mutagenic effects of its environment.

All this raises fundamental questions about the idea of an evolutionary process rooted in chance mutations. Where do we ever see random, wholly undirected change as opposed to an organism's *response* to its external and internal environment?

Activity precedes structure. However, the decisive issue goes far beyond responses to mutation. There remains the larger truth that every organism, in its entire being, is first of all an activity — a truth we have seen amplified throughout the first half of this book. When we look at an elaborately choreographed molecular activity such as RNA splicing (see the chapter on "The Mystery of an Unexpected Coherence"), the explanatory challenge lies in the fact that, unlike in a silicon chip, there are no precisely incised channels in the watery medium of the cell's plasm. Likewise, there are no finely machined gears, switches, levers, springs, or hinges[3] to forcibly shape the carefully sequenced and well-aimed activity of the hundreds of molecules engaged in the extended task of splicing. The fluid realm of the cell is one where a kind of freedom reigns. There is also a continual exchange and transformation of substances, which means there is little in the way of a stable and rigidly fixed structure of any sort.

Where, then, do we even glimpse in the organism a machine-like object to begin tinkering with? Can one tinker with a power of activity?

So one way to pose the problem of natural selection and teleology is to ask: How can we relate natural selection to the evident teleological constraints upon all the molecules involved in RNA splicing, DNA replication and repair, or gene expression? What keeps these intricate processes — and countless others like them — "teleologically on track" to perform intricate and extended tasks despite what would be, in strictly physical terms, an overwhelming invitation to disorder? Can we possibly imagine that the cell's living activity is controlled, step-by-step, by mechanistically enforced instructions issuing from the genome?

It's not just that no one even pretends to have discovered genetically encoded instructions specifying what each of the molecules involved in RNA splicing should do, moment by moment. Even if there were such instructions, and even if they were so surpassingly complex and subtle that they could manage every moment's need in perhaps trillions of differently contextualized cells throughout an organism's unpredictable lifetime — still, these instructions would have no way of being continuously conveyed to the virtual infinitude of molecules needing them.

So the first thing we require is not some way to explain teleological activity based on evolutionarily tuned structures. Rather, we need a way to understand how all the heritable molecular structures in a reproductive cell are teleologically formed and elaborated in the first place.

In sum, we do not even know what "tinkered with" could mean, given that tinkerable structures must first be derived — and continually derived again — through teleological activity. There is a well-known "central dogma of molecular biology" (articulated by Francis Crick in 1958 and re-articulated in 1970) that concerns the one-way passage of information from DNA to protein. For all its fame (and infamy), it is much less cited today than it was in the past, perhaps

because its relevance to the actual life of organisms is so limited. In any case, a much more profound principle would read something like this:

> All material structure in an organism derives from, and must be maintained by, the organism's activity. The structure, once originated, is put into the service of this activity — and in this sense becomes a constraining shaper of activity. But *activity always precedes both structure and constraint*.

An Aversion to Meaning

The theory of natural selection gives us no argument against the self-evident purposiveness of organisms. To the contrary, it confirms the theorist's largely unacknowledged recognition of this purposiveness. For we can make sense of natural selection only after we have thoroughly internalized, from childhood on, a vivid awareness of the lively agency, whether of cats and dogs, birds and squirrels, worms and fish, or of the animals in our laboratories. The scientist can take this agency for granted without having to mention or describe it, since everyone else also takes it for granted. And so one speaks ever so casually of individual "development," or the "struggle for life," or the "production of variation," or "reproduction and inheritance" — all in order silently to import into theory the full range of the living powers that made biology a distinct science in the first place, but that few are willing to acknowledge explicitly in their theorizing. In this way, amid contradiction, circular reasoning, and what I have called the biologist's "blindsight" (see the chapter entitled "The Keys to This Book"), the materialist preserves his preferred picture of a meaningless existence . All he needs to do is appeal to natural selection, that "universal acid" (Dennett 1995) capable of dissolving all objections to what one wants to believe.

Several decades ago the British biologists Gerry Webster and Brian Goodwin had already noticed that "the organism as a real entity, existing in its own right, has virtually no place in contemporary biological theory" (Webster and Goodwin 1982). Goodwin later elaborated the point in his book, *How the Leopard Changed Its Spots*:

> A striking paradox that has emerged from Darwin's way of approaching biological questions is that organisms, which he took to be primary examples of living nature, have faded away to the point where they no longer exist as fundamental and irreducible units of life. Organisms have been replaced by genes and their products as the basic elements of biological reality. (Goodwin 1994, p. vii)

The banishing of organisms from evolutionary theory was also an obscuring of biological purposiveness. It may even be that the banishing happened, in part, *for the sake of* this obscuring. Yet who can doubt that, if we ever do take the organism's purposiveness into account at anything like face value, the results could be of explosive significance for all of evolutionary theory?

It is difficult to pinpoint whatever lies behind the extraordinary animus the biological community as a whole holds, not only toward teleology, but indeed toward any meaningful dimension of life or the world. But the animus seems as deeply rooted as it could possibly be. Michael Ruse, who might be regarded as a dean of contemporary philosophers of biology, once briefly referred to an article by the highly respected chemist and philosopher, Michael Polanyi, in this manner:

> Polanyi speaks approvingly, almost lovingly, of "an integrative power … which guides the growth of embryonic fragments to form the morphological features to which they embryologically belong."

And what was Ruse's response?

> One suspects, indeed fears, that for all their sweet reasonableness the Polanyis of this world are cryptovitalists at heart, with the consequent deep antipathy to seeing organisms as being as essentially physico-chemical as anything else … Shades of entelechies here! (Ruse 1979)

The real antipathy appears to be on Ruse's part. One wonders exactly what violation of observable truth he saw in Polanyi's reference to "an integrative power" that "guides" embryological growth. No biologist would dare deny that embryological development is *somehow* integrated and guided toward a mature state. And it is difficult to understand how any actual integrating and guiding could be less than the expression of an effective "power," however we might end up understanding that term. Just think how much less justification there is for all the conventional references to the "power," "force," and "guidance" of natural selection! (On that, see the chapter, "Let's Not Begin with Natural Selection.")

As for Ruse's shuddering at the term "entelechy" (sometimes rendered as "soul"), the scholar who is perhaps the foremost interpreter of Aristotle today translates the Greek *entelecheia* as "being-at-work-staying-itself" (Sachs 1995, p. 245). What better characterization of an organism and its distinctiveness relative to inanimate matter could there possibly be? Every biologist who uses the conventional term "homeostasis" (a system's maintenance of its own

stability) or, better, "homeorhesis" (a system's maintenance of its characteristic activity) is already saying something similar to "being-at-work-staying-itself." It's the way of being of any organism. The Aristotelian term is useful for reminding us that an organism is first of all an activity, and its activity is that of a centered agency possessing a remarkable coordinating and integrative power in the service of its own life and interests.

On our part, we will now do our best to read the organism and its activity back into evolutionary theory. In doing so, we will ignore the strange taboo against accepting living powers and purposiveness as relevant to the theory.

The full (and much longer) version of this book chapter is available at https://bwo.life/bk/evotelos.htm.

Notes

1. Part of the worry about purposive activity has to do with the fact that it is future-oriented, and therefore seems to involve something like conscious human planning, which we can hardly attribute to an earthworm. Nor do we need to. I deal with this issue in another chapter (not available at this writing). The present chapter deals only with the relation between teleology and natural selection.

2. The idea of tinkering — that evolution is a tinkerer rather than an engineer — traces back to an influential article by the French biologist, François Jacob (1977). "Tinkering" is now one of the tropes of evolutionary theory.

3. I am, with more than a touch of irony, echoing a statement by the Harvard cognitive psychologist and evolutionist, Steven Pinker, where he says:

> The stuff of life turned out to be not a quivering, glowing, wondrous gel but a contraption of tiny jigs, springs, hinges, rods, sheets, magnets, zippers, and trapdoors, assembled by a data tape whose information is copied, downloaded, and scanned. (Pinker 1997, p. 22)

We might hope that by now Pinker has awakened from his culturally induced trance and has realized that, as far as our current, rapidly expanding knowledge goes, the "quivering, glowing, wondrous gel" (if we discount the hyperbolic ridicule intended by the phrase) is actually closer to the truth than is the picture of all those wonderfully familiar, but terribly unbiological, machine parts.

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