

# Reviving the Organism

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If you have ever watched horror movies, you will have experienced the shock of seeing what you thought was an inert and inanimate object begin to move—glide sinuously across a surface, or raise itself upright, or slowly open an unsuspected eyelid. Such scenes play upon the fact that, when something moves of its own accord, we naturally see it as living. According to Aristotle, *self-motion* is a defining feature of animals.<sup>1</sup>

Despite the fact that the fastest way to kill a conversation among scientists may be to begin by saying, “According to Aristotle ...,” nothing about his insight is foreign to modern biology. More than one eminent authority has argued that the organism is not a collection of things, or parts, but rather is, most essentially, an activity. Canadian-born theoretical biologist Brian Goodwin could even refer to the *familiar proposition* that “life is process and transformation.”<sup>2</sup> The twentieth-century cell biologist and National Medal of Science recipient, Paul Weiss, put it decisively when he wrote:

Life is a dynamic *process*. Logically, the elements of a process can be only elementary *processes*, and not elementary *particles* or any other static units.<sup>3</sup>

The idea is a radical one—or would be, if only we could take it seriously and hold to it consistently. It suggests that we miss life entirely if we imagine it to result from a combination of particular things, or parts, whether they be portions of a DNA molecule, or neurons, or organs, or bones. The organism is not a material result, but an initiating power. It is constrained by material conditions, not produced or explained by them. As a being expressing its own specific nature, it grows, forms, and uses its bodily structures. Whatever is capable of forming and using a collection of “parts” cannot be a mere result of them.

So here is a simple and self-evident idea that has by no means been altogether hidden from the community of biologists: *the organism is an activity*. So far as I am aware, its truth has never been explicitly disputed, as opposed to being ignored. And its implications are both huge and unsettling, which may help to account for its being ignored.

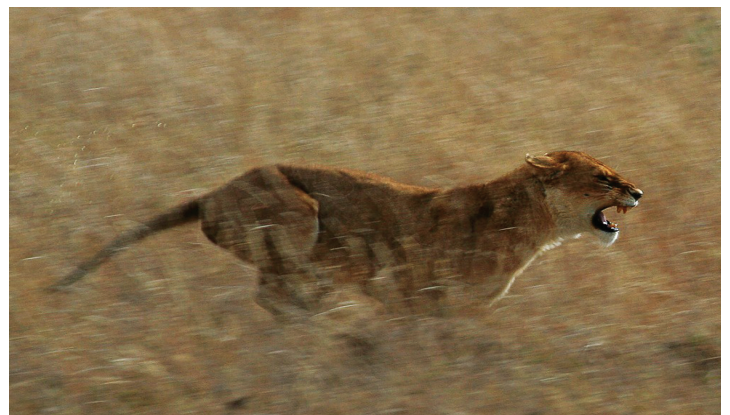
Anyone who reflects upon the idea for a while might think it would strike with explosive force into any contemporary conversation about the life of organisms.

Surely, in this era of molecular biology, the question pressing upon researchers is, “How do we reconceive our own work when we must understand the organism, not as a product of its molecular constituents, but rather as an originating activity and a power of self-expression?”

But, no, if any such inquiry is being reported in the standard literature today, I have missed it. Happily, however, nothing prevents us now from taking a few moments to consider the organism as an activity—which is to say, the organism as actually *living*.

## On Moving and Being Moved

If we turn a machine off, it remains the same machine, undiminished. It hasn't temporarily disappeared. When we turn it on again, it will continue doing whatever it was designed to do. Its active identity, given by its physical parts and the way they have been articulated together, endures despite the temporary shutdown. *The parts are primary; they determine the machine's activity.*



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If, on the other hand, an organism discontinues its activity, it is no longer there. It ceases to exist. A live organism just *is* its living activity, and even when it appears to be still, we assume it must be doing something—it is resting (something the heaviest boulders don't do), or perhaps preparing to pounce. *The activity of the living being is primary and determines the parts—by growing them.*

The difference could hardly be more fundamental. Yet the necessity for considering it does not lie in esoteric metaphysical cerebrations. It arises from our straightforward experience.

When an animal moves, we never doubt that, in physical terms, its performance is unexceptionable. There is no lack, no gap, anywhere in the web of lawful physical relations. Yet we cannot help seeing in the movement something that is, in a sense, incommensurable with the physical laws and causes—something “over and above” them. No matter how closely we examine the lawfulness of the animal’s limb movements, organ activity, metabolism, and so on, we cannot get from *that sort of lawfulness* to our most routine understanding of what the animal is actually doing.

Even when an animal is responding to a clear and precise physical stimulus, its response is not in any evident way *physically* demanded by the stimulus. As a useful picture of this fact, we need only consider how the negligible force producing an image on the retina—say, the image of a charging lion—can set the entire mass of a quarter-ton wildebeest into thundering motion. There certainly is a continuity of physical causation between that retinal impact and the subsequent muscular upheaval. But nothing within that continuity tells us what is happening from the animal’s point of view. Its movements seem to *originate* within itself in a way that we do not see in inanimate objects.

So the physical laws that tell us how one object impinges upon another are inadequate to the explanatory task. Activity originates in the organism; it has no physical explanation of the sort we seek in the inanimate realm.

## Not Just Movement, But Meaning and Motivation

This last fact can lead us further. E. S. Russell, a British marine biologist who reflected deeply upon the character of organisms during the first half of the twentieth century, wrote that what the organism is responding to “is not the stimulus *qua* physico-chemical, but the stimulus as perceived, and not the stimulus merely as perceived, but as interpreted. Response is really to the meaning ... of the perceived stimulus, not to the stimulus itself.”<sup>4</sup>

In other words, an organism’s activity is *motivated* rather than physically caused. While physical interactions are clearly involved, they do not explain the *reasons* for the activity. The image of a charging lion on the retina means a very different thing to the wildebeest from what it means to another lion, even if the immediate physical stimulus is very much the same. Specific actions are always giving expression to the “force” of the complex meanings in terms of which the organism experiences its world, and the actions in turn contribute further to that world of accumulating significances.

In the 1960s the American philosopher, Susanne Langer,

wrote that “the only way an external influence can produce an act [in the organism] is to alter the organic situation that induces acts; and to do this it must strike into a matrix of ongoing activity, in which it is immediately lost.”<sup>5</sup> Then there arises a response that, as we have just seen, is physically and causally incommensurable with the environmental stimulus leading to it.

Yet, if we look at both stimulus and response in terms of their *meanings* for the organism, we find them harmonious and unproblematic; nothing at all is “lost.” Perhaps this tells us something about the most appropriate sorts of explanation for living, as opposed to inanimate, processes.



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## What Is Meant by an “Intentional Agent”?

I like to say that every organism is spinning out a kind of biography—the story of its life. The truth in this seems to me more literal than metaphorical.

An organism perceiving the world in light of its own interests and carrying out narrative intentions rooted in its own particular needs and expressive tendencies—its own *character*—is what we might reasonably call an “intentional agent.” Its activity suggests both a kind of wisdom and skill, and also a directed, willful striving. But while we can certainly think of intentional agency in terms of such features, I am content here to define the phrase as open-endedly as possible: an intentional agent is simply “that which exercises a power to weave the kind of narrative every organism makes of its life.”

The narrative, implying also the power to weave it, is there for us to see. It is an inescapable given, and is already enough for our understanding to work with. We do not need to speculate about things we neither directly perceive nor understand—archetypes, souls, vital forces, entelechies, or whatever—in order to recognize and rigorously characterize a meaningful story when we see one.

At the same time, we should be as clear as possible about what we are in fact seeing, because it has dramatic implications for biology. While the events of a story can be presented truthfully, if narrowly, as nothing but a series of physical interactions in a reductionist sense, reading them this way misses the story entirely. Narrative threads are never mere chains of physical causation, and their meaningful coherence cannot be explained by such causation. Rather, they testify to motivation and unfolding intentions, which in turn express character.

This narrative of character is the only explanation we have for the overall coordination of the physical events of a life. (Go ahead and try coming up with a different sort of explanation.) The organism's intentions govern its physical interactions, all the way down to the molecular level. The interactions do not in the same sense govern the intentions.<sup>6</sup>

## We Find Governing Intentions Even at the Molecular Level

Biologists certainly do recognize stories, even if the recognition is repressed in their conscious theorizing. Looked at closely, biology turns out to be *nothing but* meaningful narrative. Molecular biologists are always concerned with how means are coordinated in the service of ends—how tasks get accomplished, how stories get told. Organs need to be formed and to function properly; cells must replicate their DNA and then divide; molecular complexes within cells—whole galaxies of them—must interact in just the right way to perform tasks whose intricate movement toward the desirable, tortuously interwoven results is very often beyond the current capacity of the human mind to survey.

These directed activities are what researchers explore, as long as they are doing biology rather than physics and chemistry. That's why no one raises an eyebrow when the abstract of a technical paper, not unlike thousands of others, routinely begins,

The ability of a cell to transform an extracellular stimulus into a downstream event that directs specific physiological outcomes, requires the orchestrated, spatial and temporal response of many signalling proteins.<sup>7</sup>

Scientists do not talk in the same way about the *abilities* of ocean waves or clouds or mountain ranges. Nor do they talk about how puddles or solar systems *signal* each other or orchestrate *responses*. And they would never say that inanimate physical entities *direct outcomes*.

Nor again would any scientist refer to the *discernment* of an inanimate system. But: "The coordinated development of multicellular organisms requires that cells be able to discern their relative position within the organism."<sup>8</sup>

Then there is this:

In three of the cases covered in this article, the cell under study has to "make" decisions that will determine its developmental fate and function . . . In all three cases, a choice is determined by the balance between epigenetic silencing and activation, but the mechanistic details differ depending on specific regulatory needs.<sup>9</sup>

The authors understandably put scare quotes around "make," since it would surely be absurd to consider a cell as a conscious center for making decisions. Yet we shouldn't forget that the "choices" confronting the cell are nevertheless skillfully negotiated. While the cell is certainly not like a human decision-maker, it just as certainly is *caught up within* the play of an agency with extraordinarily skillful powers of meaningfully directed activity, however we choose to understand the sources of this agency or its center of action.

You will have noted that the authors neglected to put "choice" and "needs" inside quote marks, although exactly the same justification applies to these terms as to "making decisions." This neglect is understandable, however, since it would be unbearably tedious to quote all such terms. Whether more or less explicit, they are omnipresent in every biological text.

So the nagging question becomes: don't we owe our science and our public a disciplined reckoning with the kind of language we find ourselves forced to use—the kind we can forsake only at the cost of unconvincing circumlocutions and biological irrelevance? Without such a conscious coming to terms, are we not pushing a great deal of our science outside the bounds of responsible awareness?

## There Is No Escape from the Most Difficult Questions of Science

A further consideration gives these questions even greater force. Beyond activity, motivation, intention, agency, and character, there is the issue already implicit in all these: can we reckon with—or are we forbidden from reckoning with—the intelligence, willful striving, and mindlikeness implied by these terms?

And here, too, it's not as if no one has ever pointed to the problem. In fact, sometimes the pointing seems much too easy, as when botanists speak, as they increasingly do

these days, of the “mentality,” “learning,” and “decision-making” of plants.<sup>10</sup> They almost invariably mean by this something like the programmed performance of a machine. But a *living* intelligence, capable of *being aware in the present* (rather than merely having been programmed in the past) and engaging in fresh judgment moment by moment, even if quite unlike conscious human judgment, never seems to be recognized as a problem to come to terms with.

We can recognize the problem in Sir Roger Penrose’s description of the mindlike intelligence in organisms without neurons. For example, the “humble paramecium” swims about, “darting in the direction of bacterial food which she senses using a variety of mechanisms, or retreating at the prospect of danger, ready to swim off in another direction. She can also negotiate obstructions by swimming around them. Moreover, she can apparently even learn from her past experiences, though this most remarkable of her apparent faculties has been disputed by some.”

Penrose, who is an Oxford physicist, goes on:

How is this all achieved by an animal without a single neuron or synapse? Indeed, being but a single cell, and not being a neuron herself, she has no place to accommodate such accessories.

Yet there must indeed be a complicated control system governing the behavior of a paramecium—or indeed other one-celled animals like amoebas—but it is not a nervous system. The structure responsible is apparently part of what is referred to as the cytoskeleton. As its name suggests, the cytoskeleton provides the framework that holds the cell in shape, but it does much more. The cilia themselves are endings of the cytoskeleton fibres, but the cytoskeleton seems also to contain the control system for the cell, in addition to providing “conveyor belts” for the transporting of various molecules from one place to another. In short, the cytoskeleton appears to play a role for the single cell rather like a combination of skeleton, muscle system, legs, blood circulatory system, and nervous system all rolled into one!<sup>11</sup>

A key point here is that the usual reduction of mindlike capacities to the functioning of networked neurons doesn’t work for an organism like the paramecium.<sup>12</sup> In fact, as we have already seen, it doesn’t work even for the intelligently directed molecular activities within your and my cells.

Yet Penrose can’t seem to help himself: he demands a physical “control system” for the paramecium’s intelligence, and if neurons can’t do the job, he will look for that control system somewhere else. And he finds it in the cytoskeleton.



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A group of paramecia (*Paramecium caudatum*)

Yes, the cytoskeleton is centrally caught up in manifestly intelligent, mindlike activity. But it is necessary to recall yet again that “mindless” physical interactions cannot give us the reasons and coherence—the expressive qualities and meanings—we require in order to make sense of intelligent behavior.

We make sense of all natural occurrences by recognizing their ideal (relational, conceptual, ideational) contents, whether those contents are the mathematical laws and relations in terms of which we often try to understand physical events, or the more qualitative idea-complexes we discover underlying the behavior of each particular sort of organism. Never, whether in physics or biology, do we find ourselves able to explain the ideal content—the laws or motivations—by invoking the substance given form by that content.

## How Then Should We Proceed?

All this reminds us that the so-called “mind-body problem” confronts us, not just in human psychology, but in every cell of our bodies and at the very roots of all biological inquiry. Already when we consider the wildebeest responding to the image of a charging lion, we are up against the seemingly miraculous fact that animals *perceive* their environment, which is to say, they encounter the environment within consciousness.<sup>13</sup> There is nowhere

else for the encounter to take place. Even bacteria have their own, remarkably intelligent forms of perception and cognition:

It is now realized that bacteria facilitate surprising collective functions. They can develop collective memory, use and generate common knowledge, develop group chemical identity, distinguish the chemical identity of other colonies in their environment or even higher organisms, learn from experience to improve their collective state and more.<sup>14</sup>

It is no minor issue. Any honest researcher working in the field of cognitive science will readily admit that no solution to the problems of mind and body, perception and consciousness, thought and object of thought—no consensus of even a minor sort—is currently within sight. The entire discipline of cognitive science is in a state of ferment amid a wide-open search for possibly new and unexpected solutions. This has now been the case for decades, with no prospective end to it.

No one can doubt that, depending on how the mind-body problem is resolved, biological theories dealing with everything from the molecular performances of cells to human cognition could become unrecognizable relative to the unadventurous philosophical rigidity of today's routine biological thought. We have every right to wonder about this rigidity, and to ask how it is distorting current thinking. Where is the scientific open-mindedness required in the face of questions no one pretends to have resolved?<sup>15</sup>

*The foregoing is the main part of the introductory chapter Steve has written for a forthcoming book consisting of translations into Norwegian of a number of his articles written over the past several years. The publisher is Paradigmeskifte forlag: <http://paradigmeskifte.nu>.*

## Notes

1. I do not speak of plants here, but it is worth noting that plant growth is also a kind of self-motion. As for Aristotle, he considered motion in general to be of four kinds. Philosopher Sarah Byers elaborates:

“motion” (*kinêsis*) means change (*metabolê*) generally, and has four distinct senses, two of which are locomotion and alteration. Thus we find: “It is always with respect to substance or to quantity or to quality or to place that what changes changes.” In other words, something may “move” by coming into or passing out of existence (movement/change with regard to substance), by diminishing or increasing in overall size (movement/change with regard to quantity), by altering its state (movement/change with regard to quality), or by changing its location (movement/change with regard to place). (Byers 2006)

According to Byers, Aristotle considered the forms of self-motion particularly definitive of living things to be locomotion, growth/diminution, and alteration (or nourishment, which can be thought of as metabolism). But since Aristotle saw both locomotion and growth/diminution as presupposing nourishment, he viewed self-nourishment as the basic power distinguishing the living from the non-living.

2. Goodwin 1989.

3. Weiss 1962, p. 3.

4. Russell 1924, pp. 76-7.

5. Langer 1967, p. 283.

6. Many have recognized that if we were to try to understand biological events—say, the performance of the heart and circulatory system—solely by noting the motions and interactions of astronomical numbers of molecules, we would find it impossible to discover various biologically significant, higher-level regularities. But those who say this almost always still believe that, regardless of the level of observation, there is nothing but “meaningless physical interactions” to describe. The biologist is simply offering a “higher level of description.”

My own point here is quite different. The intentions of an organism-agent are not physical forces; they are more like shaping ideas. But they are necessary to account for the observed narrative coherence of biological phenomena. Or, rather, the intentions, or ideas, *are* the coherence. We have no basis for claiming that the physical interactions, considered in the usual way as utterly meaningless and conceptually empty, are the cause of the observed coherence. See also the two paragraphs (beginning “Yes, the cytoskeleton...”) in the main text above.

7. McCormick and Baillie 2014.

8. Benkovics and Timmermans 2014.

9. Lomvardas and Maniatis 2016.

10. For discussion of some rather startling recent work on plants—and the problem of mindlike intelligence in biology generally—see Talbot 2015.

11. Penrose 1994, pp. 357-8.

12. This ought, in the first place, to unsettle all discussion of brain-based intelligence. If intelligence is not essentially and necessarily a product of neural activity, what *is* the relation between intelligence (mind) and brain? Given the primacy of every organism's intelligent activity over fixed structures, shouldn't we consider the likelihood that this activity not only grows the brain expertly, but also employs it for its own thoughtful purposes? This is indeed the relation between the whole organism and all its other organs.

13. Actually, the environment is not something “just there,” which the organism then looks out upon. What counts as its environment is determined by the organism's capacities and predilections for perceiving. “When one speaks of the living individual as responding to environment one really means by environment that which is sensed by the individual organism” (Russell 1924, pp. 59-60).

14. Ben Jacob 2006.

15. In this regard, see “Let's Loosen Up Biological Thinking!” (Talbot 2014b).

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