Life Is Not a Machine or a Ghost: The Naturalistic Origin of Life's Organization and Goal-Directedness, Consciousness, Free Will, and Meaning

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ABSTRACT: Due to a widespread belief in mechano-reductionism, most intellectuals reject the idea that nonconscious living beings act toward goals. Proposing otherwise is mostly rejected as unscientific anthropomorphizing or necessitating appeals to a supernatural power. This false dichotomy has stymied biology and its related sciences. Herein, I present a new naturalistic gestalt on the nature of life—one based on facts and evidence. It incorporates Ludwig von Bertalanffy's and Arthur Koestler's theories of systems and hierarchies with the ideas of Aristotle, Hans Jonas, and Ayn Rand, to identify fundamental formulations on the nature of life, consciousness, free will, and meaning.

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Ayn Rand and Philosophy of Biology: Can Rand's Use of Goal-Directedness Be Founded in Fact?

Ayn Rand maintains that her ethics is based on the choice between life and death, and the argument at the base of her metaethics depends upon the ideas that life is a goal-directed process and that human life is an end in itself. Her outlook here is biocentric, dependent on life having certain characteristics. But philosophy of biology is not a topic upon which she dwells. Despite the Darwinian/Existentialist sound of "the choice between life and death," at first glance her ideas about biology do not seem to comport perfectly with the typical philosophy of biology that one encounters in book after book today.

Contemporary thought about biology has an odd squeamishness about life being goal-directed or an end in itself and seems less than comfortable with the idea of life being a continuing effort to avoid death. This discomfort manifests itself in apparently paradoxical positions, which we will explore herein, with an aim to point out the need for theoretical reform to avoid self-contradictory claims.

As we will see, in contemporary thought, living things are often thought of as acting "as if" they had goals, but with a qualification that this is merely an "as if" imposed by the human mind, not a true underlying reality. The irony is that everyone knows that living things act to survive and reproduce, but then many claim their processes are just inanimate chemical and physical actions. So, which is it? Are the processes of living things *actions*, or are they just a bunch of *reactions*? The contradiction is so well-accepted, few are aware of it. Rand's approach seems to line up with an Aristotelian view that goal-directedness is not an imposed human interpretation, but an underlying metaphysical fact. Still, the question remains, in a non-deistic universe, which Rand's universe certainly is, how might goal-directness arise or be understood?

Harry Binswanger has led the way in calling for a reformed, Objectivist-compatible understanding of the goal-directed nature of living things, with a book-length treatment, *The Biological Basis of Teleological Concepts*. I would like to begin by exploring Binswanger's attempt to anchor goal-directedness in a contemporary understanding of biology, particularly in a neo-Darwinian context.

Binswanger's Defense of Goal-Directedness

In a 1995 discussion on the Moderated Discussion of Objectivist Philosophy list, I published a review of chapter 6, "Goal Causation," of Harry Binswanger's book *The Biological Basis of Teleological Causation* (1990). In this review, I examined Binswanger's attempt to explain nonconscious goal-directed (teleological) action within the neo-Darwinian framework. And I found deep problems with his explanation.

In his chapter on goal-causation, Binswanger outlines his theory of how nonconscious actions can be teleologically caused. He defines an action as teleological when the goal causes the action for the sake of achieving the goal. This is what he calls "goal-causation." The fundamental question is: how can nonconscious action, that is, vegetative action, occur for the sake of a condition—the goal—that exists later in time than the action? Without consciousness, by what means does the action move toward the goal? A kind of "action at a distance" problem.

Purposeful action of conscious beings is Binswanger's paradigm case for teleological action. Binswanger thinks that, ontologically, our idea of teleological action derives from our direct introspective experience. We know that we can imagine an end or value, desire it, and put in motion the actions to obtain it. In purposeful action, the awareness of a desire or value causes the agent to undertake the action toward the goal. This is how a future condition can motivate a present action.

Vegetative action has no awareness of values by which to cause it; therefore, how is the benefit of the goal a cause of the action? By what means is the value of a future state causing present action?

Once again, Binswanger looks to purposeful action to get his cue with regard to the vegetative; he claims that all purposeful action is based on past experience, whether it be memories or perceptions, ideas, imaginings or associations. Men imagine the future by recalling past experiences, valuable objects and conditions achieved, and projecting them as occurring again, although perhaps rearranged somewhat.

Likewise, he claims that current vegetative action is entirely dependent on the forms and organization of the organism already in place, as a result of previous value-seeking activity of the organism or its ancestors. Binswanger claims there are three elements or proximate causes (see a summary of Aristotelian causes later in this essay) to any vegetative action: the fuel that allows the action to be self-generated; the "directive mechanism" (81) that controls the utilization of that fuel; and the triggering stimulus that initiates the use of the fuel.

> On the vegetative level, the stimulus is able to trigger the action because of the way the mechanism for the action is organized. The mechanism has certain *terms of operation* dictated by the nature of its directive mechanism(s). The way in which the mechanism is organized determines what will or will not trigger its behavior. (81)

According to Binswanger, the *ultimate* cause of vegetative action is that which causes the fuel and the directive mechanism to exist, thereby enabling the organism to take the action. The ultimate cause is the explanation for the proximate causes. In Binswanger's view, there is no means and therefore no possibility for a traditionally conceived ultimate or final cause to draw the organism's action to the future in vegetative action; in reality, according to him, the final cause must be a different kind of efficient (proximate) cause.

He proposes that, for any vegetative action, the value-significance of past goals, which have shaped and determined the nature of the fuel used, the directive mechanisms and the response to triggers, is the goal toward which present action is aimed. Just as past conscious experience serves to motivate the goal-seeking behavior of humans, so past vegetative experience determines the goal-seeking activity of vegetative action.

> Putting all these points together, we can say that a vegetative action will qualify as teleological if it can be shown to be a self-generated action caused by a mechanism whose existence, organization, fuel, and terms of operation result from the survival benefit that past instances of the goal have provided the organism in similar previous circumstances. (88)

Put in simpler terms, Binswanger's argument is: organisms act like they do because that's what they did before. In his view, organisms are not pursuing current goals for their own sake, but because they are similar to past goals, and because pursuing such goals has worked in the past.

According to Binswanger, a current vegetative action is goal-directed because the organism took this action before—*somehow*—and the action resulted in a value for the organism. Once taken, the action became an individual or evolutionary habit, and we can call the organism's actions *goal-directed* because it is aimed at the *past* goal.

I don't think so.

The organism and its descendants may have been "smart" enough to learn from their actions—but how did the first organism manage to take those actions the first time? Was it completely random, an accident, or what? Does he mean to imply that the whole history of life is one long series of felicitous accidents?

While I appreciate the problem that Binswanger is addressing, namely, how can a nonconscious organism be moved by the future, I find that his theory does not sit well with my knowledge of the nature of living things. What is distinctive about life as opposed to the actions of inanimate matter? Its *goal-directedness*—"a process of self-maintained and self-generated action" (Rand 1964, 16). It acts to maintain its existence. The goal of its actions is the perpetuation of life. And the essence of my difficulty lies in what I know to be the enormous creative power of life to fulfill that goal. His theory gives no explanation, other than the usual suggestions of accident or chance, as to how *new* adaptive actions arise. Without the answer to that question, I don't think Binswanger *has* solved the problem of vegetative action.

The history of life is the history of ever-changing forms, new ways of fulfilling life's goal of self-perpetuation. Its history is replete with the coming into existence of new forms, new characteristics, new abilities. Certainly, like the knowledge of a conscious being, these are not created *ex nihilo*, that is, there must be some relationship between the new forms and abilities and the old ones. But the mere repetition of old forms of action is not an adequate description of living action.

Ultimately, I believe Binswanger takes too reductionistic an approach to biology, as he takes a too behavioristic view of psychology. For example, he says, "A dog's desire for an affectionate pat from its master is a consequence of its memory of similar past instances of affection" (77). These statements imply an associationist view of dog action. Surely, once the dog has received and enjoyed pats, the memory serves as motivation. But, for one thing, Binswanger's explanation gives no consideration as to why the dog sought pats *in the first place*. And yet, anyone who has observed animals knows that they initiate all kinds of actions—they seek, they explore, they try things out long before they know what the consequences will be. Purposeful behavior can be self-initiated in a way that doesn't necessarily depend *solely* on past experience, either personal or evolutionary.

And in his discussion of proximate causes, he frequently uses the word "mechanism" to describe living action. I think this use, and in general the mechanist approach to living action, is unfortunate. Machines operate automatically to achieve ends set by humans, they do not creatively change their actions to continue on their course to their goal of self-maintenance and self-generation, the way living things act.

Organic behavior is characterized by its variability in the face of obstacles, in order to reach its goals. A plant will grow in one direction, and then another and another in its attempts to go around a rock and reach the sun. Ludwig von Bertalanffy, who wrote extensively on general systems theory, called this characteristic the "equifinality" of living action: the means vary, the end remains the same. In fact, the exploratory actions of conscious beings are like the multiple attempts of vegetative organisms to reach goals. The constant in the actions is the attempt on the part of the organism to fulfill its needs, its pursuit of values.

Binswanger only touches on the issue of creativity in his comments on purposeful behavior: "In the case of novel goals conceived by human beings, the cause of the goal-idea is to be found in the psychological effects of the previously perceived constituents of the novel goal" (79). Note how, in this explanation, he avoids the problem of the generation of the new, by his hand-waving phrase "psychological effects," and how he attributes the creation of the novel to previous perception alone. While creative thinking is certainly *dependent* on previous experience, that alone does not account for it. Internally generated needs and values play just as important a role in the existence of creative ideas.

Let's look back at the nature of conscious action to see if we can understand how vegetative action operates. When an animal is born, it has an internally generated set of needs, and of actions it can take to fulfill those needs. It moves and acts in attempts to fulfill its needs. Often, the more intelligent animals explore—they try all kinds of things without apparent ends in mind, but with, apparently, the need to find out about the world in order to learn how to live in it. During their explorations, they discover that certain actions cause certain desirable, need-fulfilling results—like getting a pat on the head from their master. Consequently, they repeat these actions because they now know that they will have valuable results.

In my analysis of this sequence, the animal's original actions were *not* random or accidental in origin or *intent*—they were taken for the purpose of finding out how some need could be fulfilled. The exploratory actions were quite goal-oriented, that is, to the *internal* goal of fulfilling a need of the organism. Once the animal discovered by what means it could fulfill that need, it learned to take that series of actions again—its apparent goal became the pat on the head. But *ultimately, its goal still remains the fulfillment of its needs*—in the process of self-maintenance and self-generation.

This applies in a parallel manner to vegetative action. The organism (whether it be a plant or the vegetative levels of an animal's being) has a set of internally generated needs to fulfill, and of abilities or actions it can take to fulfill those needs. It moves and acts to fulfill those needs, it grows one direction to reach the sun, then another, then another, until it finds the direction of sunlight and gets around that rock. *The fulfillment of its internal needs is the goal toward which it is acting*, until it achieves the values that fulfill those needs. That is the nature of life.

Thus, the problem of the means by which vegetative action is directed to a future goal evaporates—because *the goal of vegetative action is always the fulfillment of the present needs of the organism.*

As far as the creation of new modes of action, just as organisms continuously rearrange the sequences of actions that they take to reach external goals, so I think they rearrange their internal sets of abilities to create new modes of action and new values. This is certainly the case in the development of creative thinking. And on the biological level, the origin of such complex systems as the liver are too unlikely to happen by a long series of chance mutations and are too obviously functional *as a whole system* in promoting the well-being of the organism to have been caused by accident.

Binswanger began his argument by saying that purposeful action was the paradigm case from which we get our idea of teleology. In his discussion of vegetative action, he even tended to use concepts of consciousness, such as "value significance" and "terms of operation." Ironically, I think that, in fact, purposeful action is just another expression of life's basic nature—its ability to act toward goals. It may be that *in the ontology of concepts, teleology comes from purpose, but in the ontology of being, purpose comes from teleology.*

Interestingly, in the arguments in which he attempts to explain the goal-directedness of vegetative action, his very description of the proximate causes *assumes* the existence of goal-directedness, as follows: "Likewise, on the vegetative level, teleological explanation, I will argue, is not an irreducibly separate kind of explanation, but is rather a less detailed form of ordinary mechanical explanation in terms of efficient causes" (39). "The view I am defending, on the other hand, *assigns causal efficacy only to efficient causes*, but distinguishes between two kinds of efficient cause: proximate and ultimate" (86).

But he then describes the proximate causes as (1) the fuel and (2) the *directive mechanism* "whose existence, organization, fuel, and terms of operation result from the survival benefit that past instances of the goal have provided the organism in similar previous circumstances" (88). And he quotes Simpson as saying, "To understand organisms, one must explain their organization" (82).

How is the mechanism directive? What does "organization" mean? *The Oxford English Dictionary* defines "organization" as "the action of organizing or condition of being organized as a living being; connection or coordination of parts for vital functioning." What do the terms "directive" and "organization" imply but goal-oriented functioning? This makes the proximate causes *already* goal-directed in themselves, apart from any consideration of any ultimate goals toward which they may be directed. It seems as if final causation, "ultimate" causation, is included in his very concept of proximate cause. And that is not surprising, because I don't think that one can, in fact, reduce the proximate causes to mere mechanical causation. Life isn't like that.

After Binswanger, a Neo-Aristotelian Defense of Goal-Directedness

Having explored Binswanger's strenuous defense of goal-directedness, and having found it wanting in various respects, I propose we restart and look at the problem afresh. Is there a way to maintain a secular, scientific worldview, which nonetheless embraces goal-directedness?

Frequently, we encounter efforts to establish goal-directedness that are very far from scientific: "The Universe Is Alive," "The universe has a living force in it," "Spirits exist," "The Force . . . is an energy field created by all living things." The scientifically minded eschew these ideas as poppycock. Science attempts to explain everything by reduction to the elemental characteristics of matter and energy, physics and chemistry, that is, by the inanimate—dead—actions of elements in the universe (this view is called material- or mechano-reductionism). And, certainly, the application of physical principles to understanding nature and to creating machines has been an enormous boon to mankind. To be clear, I can only agree with Paul Weiss (1969), who said: "Nothing that I am saying about molecular biology should be construed as a lack of appreciation of the tremendous advances made in that field. It's only a warning against the monopolistic position often taken there" (48).

Ditto, the rest of the life sciences.

Yet, if you look at living things in the most fundamental way, they tell us something wondrous about the nature of the universe, namely, that there is a *strong tendency, in some conditions, for matter to make itself into forms that collect energy and more matter in order to be self-perpetuating—to stay alive, to survive, flourish, and reproduce. These forms act toward ends, for example, goals, in order to stay in existence. Staying in existence is their ultimate goal and that is their essential nature.*

When I was a child, I eagerly looked forward to watching *Flash Gordon*, one of the first sci-fi programs, on TV every Sunday. In *Flash Gordon's Trip to Mars*, a villainess, Azura, uses a Nitron ray to transform men into clay, where they live in caves—the Clay Men. During the episodes, they emerge from the clay walls as whole beings. The nature of life reminds me of the Clay Men: at the start of the known universe, after the Big Bang or whatever created the current configuration, there was just inanimate matter. Yet millions of living things emerged from dead clay and rock.

Isn't it a marvel? I walk my dog and think of all these living things, like Mars's Clay Men, oozing out of the material of the Earth through their own self-organized energy. Just look around at your cat, your wife, the grass, and think of them as inanimate matter that has *organized* itself to become a *process* of self-perpetuated existence; that collects energy and uses it to put and keep itself in motion—this is the *organic*.

And a key implication of these facts is: since life exists at least on Earth and likely other places in the universe, then *the potential for life and consciousness and "spirit"*[1] *have always existed in the universe*.

One example, hydra, is a small sea creature: "Hydra's regenerative ability allows it to regrow complete body parts that become injured or amputated . . . [hydra are] known to be immortal; their stem cells continuously generate new cells to replace old ones" (Hartley 2017). Further, hydra reproduce asexually so that the colony of hydra are clones.

Life's ability to be goal-directed is *not* bizarrely unnatural just because it does not act *merely* by the known laws of physics and chemistry. *It acts through abilities that emerged from a natural process via life's special organization of elements.*

Under certain conditions, certain materials such as carbon, oxygen, hydrogen, and nitrogen have a strong tendency to form into dynamic configurations.

These configurations have a characteristic fundamentally different from inanimate matter: *they originate action from within themselves and act to sustain their configurations* and that of their kind. The fact that some elements of reality have *the strong ability and the tendency* to form living things are inexplicable by mechano-reductionist theory. Thus, proposing only a mechano-reductionist scientific view gives people reason to think that the universe has a mystical "life force" in it. Unfortunately, science's inability to explain how life happens encourages supernatural explanations. Can we discover naturalistic, nonmystical explanations for these facts?

Ayn Rand (1964) essentialized the nature of life as

> a process of self-sustaining and self-generated action. . . . If an organism fails in that action, it dies; its chemical elements remain, but its life goes out of existence . . . life has the capacity for self-generated, goal-directed action. On the *physical* level, the functions of all living organisms, from the simplest to the most complex—from the nutritive function in the single cell of an amoeba to the blood circulation in the body of a man—are actions generated by the organism itself and directed to a single goal: the maintenance of the organism's *life*. . . . I use the term "goal-directed," in this context, to designate the fact that the automatic functions of living organisms are actions whose nature is such that they result in the preservation of an organism's life. (16, 16n)

Here we have the essence of life—of biology—philosophically set out. Living things are goal-directed things, unlike the inanimate. The very thing that makes something alive is its consistent actions *to keep itself and its kind in existence*. Their entire beings are *organized* to do this, *ordered in a goal-seeking manner*. (Of course, humans can create machines or processes that act toward a human-designed goal, but these are not organized toward survival and are a result of human purpose.)

Let me be utterly clear: all living things are a structure and a process such that they can act toward the goal of maintaining the existence of their process. *This is what it means to act for their survival.*

This understanding is in stark contrast to that of the material determinists, which is the source of mechano-reductionism. Starting with the ancient Greek materialists, but especially since Descartes, Hobbes, and others at the time of the Scientific Revolution, thinkers have jammed living things into a mechanistic model. Descartes ([1633] 1972) stated: "I should like you to consider that these functions (including passion, memory, and imagination) follow from the mere arrangement of the machine's organs every bit as naturally as the movements of a clock or other automaton follow from the arrangement of its counter-weights and wheels" (108).

Living things are automata, as Descartes described them. His view that human "soul" was entirely supernatural in origin, while all else was determined material—his dualism—is one of the foundations of the spiritualist-materialist dichotomy rampant in Western thought. The mechanical outlook is so deeply embedded in current thinking, scientists and laypeople alike use it everywhere without recognizing that it doesn't describe living action. From scientific papers to podcast commentators such as Sam Harris and Wikipedia entries, academic and communications media are rife with terms such as "the mechanisms of the brain" and "DNA's mechanics."

For example, in a blog post on the "illusion of free will," Harris (2012) says:

> As sickening as I find their behavior, I have to admit that if I were to trade places with one of these men, atom for atom, I would *be* him: There is no extra part of me that could decide to see the world differently or to resist the impulse to victimize other people. Even if you believe that every human being harbors an immortal soul, the problem of responsibility remains: I cannot take credit for the fact that I do not have the soul of a psychopath. If I had truly been in Komisarjevsky's shoes on July 23, 2007—that is, if I had his genes and life experience and an identical brain (or soul) in an identical state—I would have acted exactly as he did. There is simply no intellectually respectable position from which to deny this. The role of luck, therefore, appears decisive.

And in another entry, Harris (2014) says:

> If there were evidence for dualism (immaterial souls, reincarnation), one could be a scientist without being a materialist. As it happens, the evidence here is extraordinarily thin, so virtually all scientists are materialists of some sort. If there were evidence against evolution by natural selection, one could be a scientific materialist without being a neo-Darwinist. But as it happens, the general framework put forward by Darwin is as well established as any other in science. If there were evidence that complex systems produced phenomena that cannot be understood in terms of their constituent parts, it would be possible to be a neo-Darwinist without being a reductionist. For all practical purposes, that is where most scientists find themselves, because every branch of science beyond physics must resort to concepts that cannot be understood merely in terms of particles and fields. [emphasis added]

In these quotes, Harris demonstrates his acceptance of the dichotomy between spiritualism and materialism, and his deterministic materialism leads him inevitably to a denial of free will while, at the same time, acknowledging that science has not been able to explain all through reductionism.

But viewing living things as machines is metaphorical thinking.[2] Living things move and act in a very different way from the mechanical. We easily and obviously distinguish between the actions of a machine and those of a living thing, so easily that even children recognize the difference in cartoons. A key feature of living organization is that the living thing does *not* act like an automaton, its actions are varied and can be adequately explained only by those concepts that imply acting toward ends, something extensively recognized by Aristotle millennia ago (as noted by Gotthelf and Lennox 1987, 213). There have been attempts to address this problem among philosophers especially with the issue of functions, some starting in the 1970s with the work of Larry Wright (1973), Robert Cummins (1975), and Jerry Fodor (1974). Yet the main quandaries remain.

The ability of living things to act toward ends is made possible by *the ability to direct their processes and actions from within themselves*. They are not like rocks or billiard balls, merely subject to the forces from without. Living things respond to outside forces in such a way as to keep themselves in existence. When a billiard stick comes close to hitting a mouse, the mouse doesn't just sit there like a ball, and get hit; it jumps over the side of the table to escape. This ability to act in response to forces in the environment is what is often called *adaptation*.

This ability implies that *the essence of life is creativeness: the ability to take elements of the universe and rearrange them to grow and maintain the particular life system of the particular organism.* The further implication of this is:

1. Evolution is a result of this creativity.
2. Human mental creativity is an evolutionary development of this ability.

In fact, the human ability to mentally direct what one is paying attention to, and to consequently direct one's thinking, responses, and actions, is the *evolutionarily latest manifestation, the latest development, in life's fundamental ability to direct its course of action.* This is the essence and source of free will, and the *very nature* of life is the source of values and meaning.

This sequence, from simple self-direction of unicellular organisms to the self-direction of the human mind, is the naturalistic contiguity of existence from inanimate elements to the power of the human mind to reshape reality for human needs and life. No supernatural power is needed. Self-direction is the basic function of living things.

This will be explained in greater detail, but first, let's examine more of what has made it difficult to recognize these basic facts.

Life and Energy

The first law of thermodynamics, the law of conservation of energy, states that the total energy of an isolated system is constant; energy can be transformed from one form to another but can be neither created nor destroyed. The second law of thermodynamics is stated variously. Planck's definition ([1897] 1903) is, "Every process occurring in nature proceeds in the sense in which the sum of the entropies of all bodies taking part in the process is increased. In the limit, i.e., for reversible processes, the sum of the entropies remains unchanged" (100). It is usually rephrased as, "Disorder (entropy) always increases in a closed system." Physicists usually take the universe to be a closed system that is ever increasing in disorder—entropy.[3]

Yet look at the life all around you, this natural phenomenon by which matter of certain kinds uses energy to stay in motion and matter around it to keep its formal structure in existence. Observe all the different forms and their immensely varied characteristics:

- The one-celled and primitive multicelled forms such as amoeba and slime molds, which incorporate matter and energy from their environment to maintain and reproduce their structures.
- The plant forms, ranging from algae to sequoia trees, which capture energy from sunlight and air and matter from the environment.
- The animal forms from dust mites to dinosaurs, which move around and acquire and incorporate matter and energy from other life-forms.

They all act to stay in existence; they act to stay alive, to survive. They do this by means of capturing energy and matter. They act against an apparently basic physical law of the universe; they are *anti*-entropic. PowerThesaurus.org lists "growth, creativity, improvement, regime" as the antonyms of "entropy." All are terms applying to living things.

The term "shapeless rock" highlights their difference with the inanimate—living things develop geometrically regular and symmetrical shapes to be part of their energy capture systems, their conservation process, it seems. Scientists have a raft of knowledge as to how living things materially accomplish these acts of self-maintenance and self-sustenance. Cells, lipids, proteins, and nucleic acids are all part of it, as well as structures such as organelles, leaves, and skeletons. From the multiplication of rabbits to the growth of artichokes, the regularity of Fibonacci sequences characterizes living organization.

Rand (1964) indirectly addresses this issue:

> There is only one fundamental alternative in the universe: existence or nonexistence—and it pertains to a single class of entities: to living

> organisms. The existence of inanimate matter is unconditional, the existence of life is not: it depends on a specific course of action. Matter is indestructible, it changes its forms, but it cannot cease to exist. It is only a living organism that faces a constant alternative: the issue of life or death. (15)

A rock, of course, can be destroyed, go out of existence. But it doesn't "face" existence, that is, *it has no power to keep itself in existence*. A living thing *does*, and that makes all the difference. A living thing has a structure that enables a process of self-maintenance and self-generation. Life is fundamentally creative.

Now, when you look around at all the trees, birds, flowers, dogs or watch a National Geographic show about the multitude of animals on the African plain or marvel at the billions of tools in a hardware store created by living things, you can see them as the forceful expression of the creativity of life, reshaping the material of the inanimate and the animate into what sustains them.

I want to underline this as a gestalt shift position: the ability to form into self-perpetuating, goal-directed entities is a natural quality of matter in certain conformations (carbon in particular in combination with other elements, apparently because of their specific physical conformation and properties).[4]

This tendency is amazingly strong as shown by the fact, discussed in detail on the Human Origin Project website, that life has been wiped out almost entirely on Earth, and partially destroyed, multiple times, and yet has come back with more, new, and different forms. The Earth formed approximately 4.5 billion years ago (U.S. Geological Survey 1997). The first life on Earth showed up 3.7 billion years ago in Greenland, then a seabed, and it wasn't until 2.1 billion years ago that photo-synthesizing cyanobacteria reveal themselves in the fossil record, producing oxygen. Nine hundred million years later, multicellular organisms evolved, and then 540 million years ago, Earth experienced the Cambrian explosion in which huge numbers of species developed, including animals with skeletons. By 440 million years BCE, most of life was wiped out in the Ordovician-Silurian mass extinction. It came back, and then at 365 million years BCE, the Devonian Extinction wiped out many tropical marine species. After re-populating, the Permian-Triassic extinction killed many vertebrates around 250 million years ago.

But by 200 million years BCE, dinosaurs dominated the planet. Then, 66 million years BCE, the Cretaceous-Tertiary event wiped out the dinosaurs, and tiny mammals had room to evolve into a diverse group. The last extinction event, 10,000 years ago, Younger Dryas, wiped out most of the megafauna on Earth, such as woolly rhinoceros, giant beavers, and Glyptodons—and humans were reduced to a population of about 12,000—almost gone!

Yet, here we are today, 7.9 billion and counting, our ability to reason enabling us to rearrange our environment in a plethora of ways for our flourishing. Life keeps coming back, again and again, and faster in all kinds of old and *new* forms. Life keeps itself alive.

Almost all species that have ever lived on Earth—once estimated at five billion (McKinney 1997, 110)—are believed to be extinct (Stearns and Stearns 2000). Miller and Spoolman (2012, 62) estimate that there are between 10 million and 14 million today, but only 1.2 million have been documented and 86 percent have not yet been described (Mora et al. 2011). However, a report from the National Science Foundation (2016) estimates that only one-thousandth of one percent of the one trillion species currently on Earth have been described. The bee pollinating flowers, the anaerobic thermophilic bacteria living in the Marianas trench, the tardigrade that lives in almost any environment—life is *everywhere we can see on Earth in a variety of forms.*

Once this self-generating, self-maintaining process got started, it was amazingly self-sustaining, creatively changing to fit vastly different conditions and develop different modes of survival from ctenophores to sloths to halobacteria. A remarkable illustration of this is the fact that ctenophores use a different set of neurotransmitters and have a different neural organization than other creatures. Moroz and Kohn (2016) state:

> We conclude that acetylcholine, serotonin, histamine, dopamine, octopamine and gamma-aminobutyric acid (GABA) were recruited as transmitters in the neural systems in cnidarian and bilaterian lineages. By contrast, ctenophores independently evolved numerous secretory peptides, indicating extensive adaptations within the clade and suggesting that early neural systems might be peptidergic. Comparative analysis of glutamate signalling also shows numerous lineage-specific innovations, implying the extensive use of this ubiquitous metabolite and intercellular messenger over the course of convergent and parallel evolution of mechanisms of intercellular communication. Therefore: (i) we view a neuron as a functional character but not a genetic character, and (ii) any given neural system cannot be considered as a single character because it is composed of different cell lineages with distinct genealogies, origins and evolutionary histories.

And the fact that life came back again and again after planet-wide extinction events demonstrates the strength of its forces, and its tenacity. Until life's ability to act toward ends is understood as a natural power, as scientific a fact as $F = ma$, humans will continue to have myriad confusions and feel the necessity to posit an outside power—a god or supernatural force—to explain this obvious fact of life. As long as the materialist paradigm reigns, scientists and others who do not think the evidence shows that supernatural powers exist will insist on ignoring or rationalizing obvious conclusions about how life works because its characteristics don't fit the paradigm. This will continue to be *a negative force in the development of science.* Furthermore, it will continue to negatively affect human culture because people will either be unable to find meaning in life as "merely matter" or feel the necessity to create gods to give them meaning, purpose, and morality.[5]

The consequence: a breakdown in the scientific grounding for ethics and, ultimately, politics—and therefore society and a good human life. As Dostoevsky's character Ivan says in *The Brothers Karamazov*: "Without God and the future life? It means everything is permitted now, one can do anything" (1990, 589). Existentialism, postmodernism, and all those philosophies that eschew objectivity in knowledge, values, ethics, and the human spirit will continue to pull civilization down the rabbit hole of depression, destruction, and chaos, which is culturally rampant today. *An impoverished sense of existence will reign.*

So, what led science to this situation, and how do we approach the problem? From a hardheadedly scientific and rational point of view, is there anything to the claims that there is a living force?

From a hardheadedly rational view, yes there is—but not in the way in which it has been conceived of up to this point.

More on the Problems with Material Reductionism

Scientific blindness in the face of overwhelming evidence results from the false dichotomy between scientific material reductionism versus mystical origins or God-created purposefulness of life. This blindness is facilitated by numerous expositions of scientific dogma such as Richard Dawkins's *The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe without Design* (1986). In this book, Dawkins argues against William Paley's 1802 watchmaker analogy in *Natural Theology*: *or, Evidences of the Existence and Attributes of the Deity.* Instead of a deity designing the course of evolution, Dawkins argues that randomness combined with natural selection can lead to cumulative changes over the course of time such that, for example, a simple light/dark photoreceptor can be evolved into the complexity of a human eye. (The problems with this argument will be addressed later.)

Material/mechano-reductionism claims that all living processes can be reduced to and explained by the mere physical and chemical processes of their constituent parts. In this view, a system is merely the sum of its parts.

But consider the following:

1. Living things are able to contend with their environment in highly creative ways, whether it's monk parakeets from Argentina flourishing in the frigid

winter temperatures of Chicago by building nests in electrical towers (as detailed in Wood 2019) or a paramecium partially dividing then uniting again as it attempts to deal with loss of water (Feynman 1985).

2. As Bertalanffy (1952, 2) notes, Driesch made the astonishing discovery that a sea-urchin embryo that he divided at a very early stage (just a few cells) does not die and forms not into two halves of a sea urchin but rather into two perfect, whole animals—basically identical twins.
3. *That* evolution happened is clear from the evidence, and natural selection is almost universally accepted as the main *how*, but natural selection works on living things that *already have particular characteristics*. How *new* characteristics arise is mostly a mystery. The standard, mechano-reductionist explanation is through a long accumulation of random mutations of genes. A deep problem with this hypothesis, which has been known for over one hundred years, is that random mutations are almost always deleterious. How does a long series of deleterious mutations add up to characteristics that are beneficial and advance life? A recent study (Sawyer et al. 2007) once again demonstrates it with *Drosophila* genes. In fact, as discussed by Fitzgerald and Rosenberg (2019), there are recent arguments against random mutation and for mutation to be, instead, an organismic response to the organism's needs.
4. Fleming (2016) points out that forms as bizarrely different as the octopus and the human have monocular vision, one of many examples of the remarkable fact of homologous evolution—different paths to the same *goal of function*.
5. Abiogenesis—how life started—is an unresolved question, despite considerable knowledge about life's most basic elements, such as RNA and DNA. The exact path is unknown; the most widely accepted hypothesis argues that there were multiple events early in Earth's history, a series of molecular developments that included the beginnings of self-replication and self-assembly, autocatalysis, and the development of cell membranes.
6. Life still has not been artificially created.
7. Heck, the actions of rats have not been consistently predicted!

Yet modern science continues to view life through the mechanistic lens. The use of the term "mechanism" to describe the processes of life is ubiquitous. Modern science is painfully Procrustean, cutting off its legs to jam itself into the bed of materialism. It displays remarkable pretzel twisting to avoid admitting that

- living things act toward ends
- consciousness exists
- humans have free will

Part of the problem is that each of us can see how our minds imagine a goal and guide our actions to obtain it, *but scientists cannot figure out how a non-conscious being could do the same.* At least, they haven't been able to figure it out merely with reductionist tools. So instead, explanations of living phenomena via the goal-directed nature of living action are denied, often as "anthropomorphic."

Some Neo-Darwinian Contortions

Around 1991, I was at a conference on evolution in Chicago at the Field Museum led by lights of evolutionary theory such as Ian Tattersall. I was amused to hear speaker after speaker talk about evolution and life using such terms as "directive mechanism," "seeks," and "ends"—in other words, terms implying goal-directedness—then stop midsentence to disavow the terms with comments such as: "I'm being mistakenly anthropomorphic here!"

On the other hand, ironically, theorists treat "natural selection" as if it's a force unto itself. For example, in the current Wikipedia entry on natural selection: "Natural selection acts on the phenotype, the characteristics of the organism which actually interact with the environment, but the genetic (heritable) basis of any phenotype that gives that phenotype a reproductive advantage may become more common in a population." Note how "natural selection" is active: it "acts" on the phenotype, as if it were a process apart from the actions of the living thing.

As defined in the National Geographic Resource Library (2019), natural selection is

> the process through which populations of living organisms adapt and change. Individuals in a population are naturally variable, meaning that they are all different in some ways. This variation means that some individuals have traits better suited to the environment than others. Individuals with adaptive traits—traits that give them some advantage—are more likely to survive and reproduce. These individuals then pass the adaptive traits on to their offspring. Over time, these advantageous traits become more common in the population. Through this process of natural selection, favorable traits are transmitted through generations.

In this account, organisms that have traits that allow them to survive are able to reproduce and pass on their traits. An example often used: black squirrels rather than gray are more likely to survive in a sooty environment. Plants such as cacti and aloe, living in desert environments, developed fleshy leaves that store water for them. As do the humps in camels' backs. It is the characteristics of the life-forms that enable it to remain alive.

These characteristics are called "adaptations." Consider the uses and meanings of "adaptations." In the *Cambridge Online Dictionary*, the entry for "adapt" says the following:

> To change, or to change something, to suit different conditions or uses:
> *Many software companies have adapted popular programs to the new operating system.*
> *The recipe here is a pork roast adapted from Caroline O'Neill's book "Louisiana Kitchen."*
> *We had to adapt our plans to fit Jack's schedule.*
> *The play had been adapted for (= changed to make it suitable for) children.*
> *Davies is busy adapting Brinkworth's latest novel for television. . . .*
> If a living thing adapts, it changes slightly over time so it can continue to exist in a particular environment.
> *Species have adapted to climate changes throughout history.*
> *The ways in which organisms have adapted to survive in this extreme environment are not well understood.*

Note that all the examples in the initial definition are of actions humans chose in order to fulfill a human need or want, that is, goal-directed action. And notice that *in the biological examples, passive voice is not used*, for example, "Species were adapted to climate changes throughout history," which would imply an outside force caused the adaptive change. Rather, "adapt" is used in the active sense, that is, *the species are acting to change themselves to fit the environment.* (Ironically, the second species example says it all—*how* organisms adapt isn't well understood!)

My point being that the biological conception of "adaptation" is all very confused and muddled. Biologists do not seem to be thinking clearly about the situation. By using the word "adapt" in the definition of "natural selection," *the sense of the living thing having active goal-directedness is implied but not acknowledged.*

"Natural selection" is used as if *it* is a selecting process, as if the *environment* were a goal-directed selector when in fact *it's the organism's actions to survive, its self-directed response to the conditions of its environment, that does the selecting.* The squirrel forages, the rose grows new roots reaching for the nearby water, the bee flies ever new courses in search of pollen.

Of course, Darwin is right: the survival of many organisms of a certain type causes those organisms to affect the course of evolution. But organisms are not rocks—they don't just sit there and things happen to them. It is the organisms constantly *acting to survive* that *causes them to survive*; if their abilities fail it in this regard and they die before reproducing and new ones of their kind simply do not exist. As James Lennox points out (1993), Darwin himself recognized the teleological nature of his ideas with "his consistent arguments that natural selection acts for the good of each being, and that its products are present for various functions, purposes and ends (Darwin 1964, 149, 152, 224, 237, 451)" (411).

Some contemporary scientists continue to wrestle with many of the features of life that don't comport with the neo-Darwinist approach, essentialized by Daniel Dennett (1993) as "reduce or even eliminate teleology via a mechanistic model of natural selection" (389). Consequently, neo-Darwinists incorporate the view that adaptive change is entirely random and natural selection determines which species continue or die off.

For example, some biologists have admitted to the reality of function, that features of living things have a role in maintaining their lives, that is, are goal-directed. The wing's function is to allow a bird to fly away from the cat trying to capture it. However, these "neo-teleologists" take a limited approach to the issue.

For example, in the following quotes, Koutroufinis (2016) admits some specific goal-directedness but denies that it's anything but within the mechanistic framework.

> In Aristotelian biology, the final state of living processes is something aimed at. In neo-teleological approaches the concept of 'telos' is understood as final-state-directedness, but here the final state of a material process is considered to be achieved by blind, deterministic, non-mental factors alone. (415)
>
> On the basis of the evolutionary approach the functions of organisms are adaptations "packaged together into larger units" that is to say in the organisms themselves [Rosenberg 2007, 123]. Evolutionary explanations of function rest upon an implicit evaluation of functions: functions are positively selected adaptations because they are *beneficial* to organisms [McLaughlin 2005, 29]. In modern biology something is regarded as contributing in favor of an organism if it increases its so-called "fitness," i.e., its probability to stay alive and its ability to propagate. (418)

And other scientists point out the problems with seeing random mutation and natural selection as the only processes causing evolution: "Natural selection doesn't explain certain characteristics," said Ard Louis, a biophysicist at Oxford University, in an email. These characteristics include a heritable change to gene expression called methylation, increases in complexity in the absence of natural selection, and certain molecular changes Louis has recently studied (Wolchover 2014).

It seems that the proper scientific attitude should be: If it walks like a duck, talks like a duck, and looks like a duck, it's a duck. Our task then becomes to explain how this duckness, this ability to self-organize and initiate physical and mental action, works in a naturalistic manner.

With the development of a certain kind of physical order and process—living organization and living process—comes self-directed action aimed at keeping itself in existence. It needs certain conditions to do so, including food-fuel (although these conditions vary wildly, from the high pressure and temperature of the Marianas Trench to the frozen tundra of Antarctica). Its self-directed nature enables it to creatively respond to varying conditions. The ability to act toward goals to survive is the *very essence of being alive*. It's natural. It's creative. *As a scientific issue*, it's just up to us to figure out *how*. Fortunately, there have been some brilliant thinkers working on that, such as Ludwig von Bertalanffy and Arthur Koestler.

How does a hardheaded rationalist reconcile the nature of life with physics? Not by merely shoehorning life and consciousness into the physical principles we already know. We must expand our understanding of nature and discover new concepts and principles to guide our thinking. Let's see what ideas have helped and what ideas have hindered this process.

Mystical Spirits versus Aristotelian Soul—The Philosophical Quandaries

In the past five hundred years, philosophers of science and thinkers of the Scientific Revolution took the brilliant principles of physics and chemistry that Galileo, Kepler, Newton, Lavoisier, and others discovered and successfully applied them to the inanimate world. And technologists used them to build fabulous machines that continue to transform human life. This work was based on the discovery of the principles of mechanics and electromagnetism, optics, chemistry, and the analysis of many phenomena through reducing their structures and actions to their parts and subparts and demonstrating how the nature of the subparts cause the features of the inanimate.

For example, as the FAQ page on the website for the International Association for the Properties of Water and Steam explains, the reason that ice floats is water's unusual tendency to expand rather than contract when it becomes a solid, which is caused by its hydrogen bonds, that is, the nature of its constituent parts:

> There is a strong tendency to form a network of hydrogen bonds, where each hydrogen atom is in a line between two oxygen atoms. This hydrogen bonding tendency gets stronger as the temperature gets lower (because there is less thermal energy to shake the hydrogen bonds out of position). The ice structure is completely hydrogen bonded, and these bonds force the crystalline structure to be very "open." . . . It is this open

> solid structure that causes ice to be less dense than liquid water. That is why ice floats on water, for which we should all be thankful because if water behaved "normally" many bodies of water would freeze solid in the winter, killing all the life within them.

A fabulously informative analysis! But the theoreticians and philosophers of science have been like little boys with hammers: every subject has been a nail! They have insisted that *reducing* all things to their physical and chemical *elements* is the *only* scientific basis for explanation.

This reductionist confusion was fueled by the acceptance of David Hume's ([1737] 1957) skepticism and sleight of hand in equating causation with something directly perceived:

> It appears that, in single instances of the operation of bodies, we never can, by our utmost scrutiny, discover anything but one event following another, without being able to comprehend any force or power by which the cause operates, or any connexion between it and its supposed effect. The same difficulty occurs in contemplating the operations of mind on body—where *we observe* [emphasis added] the motion of the latter to follow upon the volition of the former, but are *not able to observe or conceive* [emphasis added] the tie which binds together the motion and volition, or the energy by which the mind produces this effect. The authority of the will over its own faculties and ideas is not a whit more comprehensible: So that, upon the whole, there appears not, throughout all nature, any one instance of connexion which is conceivable by us. All events seem entirely loose and separate. *One event follows another; but we never can observe any tie between them* [emphasis added]. They seemed *conjoined*, but never *connected*. And as we can have no idea of anything which never appeared to our outward sense or inward sentiment, the necessary conclusion *seems* to be that we have no idea of connexion or force at all, and that these words are absolutely without meaning, when employed either in philosophical reasonings or common life.
>
> [The idea of power, or a] necessary connexion among events arises from a number of similar instances, which occur, of the constant conjunction of these events; nor can the idea ever be suggested by any one of these instances, surveyed in all possible lights and positions. . . . [A]fter a repetition of similar instances, the mind is carried by habit, upon the appearance of one event, to expect its usual attendant. (40–41; emphases in original except where noted)

Here, Hume seems to have reduced the mind to perception. He didn't *observe* any causes, only one concrete thing touching another and the other moving.

He claims the mind forms a habit of expecting to *see* causation. He seems to refuse to acknowledge that causation is an *abstraction* from the concrete events we experience, a *conclusion and an inference* from those concretes. He does not abstract from the actions his eyes could see. The fact of the matter is, we don't *see* causation as such.[6] We see individual actions, events, forms, and materials, and we generalize from them to form the *idea* of causation. Moreover, Hume seems to equate all causes with that of an outside force, traditionally called an efficient cause. He doesn't identify any principles about the entity that might be causing change and recognize other kinds of causation. Hume's approach is a result of the problem of induction—how do we abstract from the concretes we see before us.[7] He does not abstract from his observations to the causes. *No matter that he's using inductions and abstractions in everything he says.*[8]

Unfortunately, since science is dependent on philosophy to correctly identify principles of knowledge, and philosophy has been stuck on the question of induction for the past few centuries, it succumbed to this anti-conceptual nonsense.

What's needed is a different gestalt about the animate and inanimate with regard to what's understood as scientific causation—really a return to an ancient Greek view of causation. First, to recognize that *action is caused by the nature of the entities acting.* Aristotle identified four possible causes of any change, twenty-three-hundred-odd years ago, in his *Physics* (1970a, book II, chapter 3, 194b29) and *Metaphysics* (1970b, book V, chapter 2):

1. The material, or what something is made from (such as granite or flesh);
2. The formal, its shape or configuration (such as a helix or a feedback system);
3. The efficient (sometimes called "proximate"), the agent acting on something (such as a painter painting a house);
4. The final, the end toward which it acts (either purposive or goal-oriented, such as forming a new government or reproducing, or acting in accordance with nature, as a rock falling when hit by another rock).

Aristotle uses "end" to account for the regularity of all action, inanimate as well as animate. A closed system moving toward its end-state is entropic.

Scientists were so eager to throw out teleology, which had dominated views in the Middle Ages, that they threw out teleological, that is, goal-oriented final causation for living things, as a relic of the prescientific world of spirits and the supernatural. In contrast, for example, Newton's First Law of Motion incorporates Aristotle's end-state view of the inanimate with "a body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force." In other words, the state of a body is in accordance with its nature unless acted upon by another body. And Newton and the thinkers of the Scientific Revolution kept the *metaphor* of biological teleology by calling the scientific principles they discovered "laws" on an analogy with human or God-given directives.

Modern science only recognizes the first three Aristotelian causes for nonconscious beings—except when it slides the last in the back door with terms like "struggle," as in "the struggle for existence" (or "law" of motion!). "Struggle" does not mean something being acted upon, but two or more entities acting upon each other in a goal-oriented manner. In normal, literal parlance, we never speak of lava "struggling" to transform into rock.

To reiterate: As mentioned, the term "natural selection" itself smuggles in the sense of goal-orientedness with the word "selection." Who's selecting? "The environment"? That reifies "the environment" into an agent acting upon living things. It is similar to the use of "market" to explain the myriad processes of human economic actions. The use of the term "market" seems to attribute agency to the system as a whole when, in fact, it is the individual actors causing the outcomes. As long as we're clear that "environment" and "market" are a shorthand way to refer to this combined action, conceptual confusions won't follow.

Let's be clear: *scientists have thrown out final causation because they could not see how the final cause could be naturalistic, that is, how nonconscious living beings could act toward goals or ends without invoking some consciousness, some mystical spirit or force.* Consequently, a reductionist view of causation has reigned along with the reductionist method. Their error was in assuming that if living things could not act toward goals by some mechano-reductionist means, then the only alternative explanation is an *élan vital*, a special, supernatural spirit or force that enabled the actions, a view called *vitalism*.[9] Unfortunately, as discussed, this dichotomy—mechano-reductionism versus vitalism—went back to the ancient Greeks and reappeared during the Renaissance, with Descartes as the greatest proponent of mechano-reductionism.

In the ancient world, Aristotle took a nonreductionist, naturalistic approach to living organisms. And he disposed of the mechano-reductionist arguments in his *Peri Psyche* (usually translated as *On the Soul*). But modern scientists have mostly ignored him, his philosophy, and his investigations of biology. Probably they have done so partly as a legacy of the spiritualist-dogmatic interpretations of his ideas when he was "The Philosopher" of the Catholic Church, from which science had to free itself. In fact, most modern biologists are unaware of his ideas or the fact that he founded the science of biology, and scientific investigation itself, with his work in *Parts of Animals, History of Animals, Movement of Animals, On Generation and Corruption, On the Soul, Prior Analytics*, and *Posterior Analytics.*

Often dismissed in the nineteenth century, his brilliant observations were eventually recognized as astoundingly accurate. Here are some examples from the Wikipedia entry on *History of Animals*:

> Some of Aristotle's observations were not taken seriously by science until they were independently rediscovered in the 19th century. For example, he recorded that male octopuses have a hectocotylus, a tentacle which stores sperm and which can transfer it into the female's body; sometimes it snaps off during mating [Thompson 1910, 524]. The account was dismissed as fanciful until the French naturalist George Cuvier described it in his 1817 *Le Règne Animal* [Allaby 2010, 34]. Aristotle also noted that the young of the dogfish grow inside their mother's body attached by a cord to something like a placenta (a yolk sac). This was confirmed in 1842 by the German zoologist Johannes Peter Müller [34]. Aristotle noted, too, that a river catfish which he called the *glanis* cares for its young, as the female leaves after giving birth; the male guards the eggs for forty or fifty days, chasing off small fish which threaten the eggs, and making a murmuring noise. The Swiss American zoologist Louis Agassiz found the account to be correct in 1890 [Leroi 2014, 69].

James Lennox (2021) comments:

> In the nineteenth century the great anatomist Richard Owen introduced a survey of Aristotle's zoological studies by declaring that "Zoological Science sprang from his [Aristotle's] labours, we may almost say, like Minerva from the Head of Jove, in a state of noble and splendid maturity" (Owen 1992, 91).

In his informative recounting of Aristotle's work in *The Lagoon: How Aristotle Invented Science* (2014), Armand Marie Leroi, professor of evolutionary developmental biology at Imperial College London, astonishedly admitted his total lack of tutelage in Aristotle's founding of the science.

In book II of *On the Soul*, Aristotle said life was the *psyche*, or "soul," by which he meant *the organizing principle* of a living thing. "[T]he soul is . . . the first actualization of a natural body which possesses life potentially" (1957, 411b, 20–30), and "the soul is a sort of arrangement and form, but not the matter and underlying subject" (414a, 13–14). (Translating *psyche* as "soul" unfortunately evokes that word's supernatural connotations.) In other words, Aristotle thinks the essence of life is a certain kind of arrangement of matter. He had the tiger by the tail!

When science turned away from Aristotle because of apparently mystical ideas, they threw out a valuable baby with the holy water.

Embryos and Goals

Unfortunately, these problems drove some brilliant researchers to carry a supernaturalistic view into the twentieth century, for example, notable scientist Hans Driesch. His embryological experiments, Ludwig von Bertalanffy (1952) explains, were critical to understanding development:

> [T]he machine cannot achieve the same performance [as a normal organism] . . . Driesch states, here the physico-chemical explanation of life reaches its limit, and only one interpretation is possible. In the embryo, and similarly in other vital phenomena, a factor is active which is fundamentally different from all physico-chemical forces and which directs events in anticipation of the goal. This factor, which "carries the goal within itself," . . . was called entelechy by Driesch, using an Aristotelian notion. (6)

Driesch clearly equates Aristotle's idea of *psyche* or entelechy with something supernatural; I'm not at all sure Aristotle did the same, although many contend that he did. As noted above, great progress resulted from looking at living things as mechanical, for example by William Harvey (1628) in his realization that the heart is like a pump. But Driesch was right that living things are far from the mechanical in their characteristics and abilities.

One of the most astonishing demonstrations of this was Driesch's experiments on sea urchin embryos. When split apart at an early period of development, they did not die but developed into two perfect sea urchins, twins as it were. Driesch also showed that two germ cells could unite to form a unitary larva that became one perfect sea urchin. Further, pressing an embryo between glass plates severely disarranged the cells, yet a normal larvae formed. He called this type of action "equifinal," which Bertalanffy (1952) explains as being an event in which "the same goal is reached from different starting points and in different ways" (142), *something that does not occur with the inanimate but for exceptional cases*.

Other examples of the stark difference between the animate and inanimate are:

1. Individuals can grow to different sizes even though they start at the same birth weights.
2. Despite its being damaged by a cut, the flesh of an animal can become whole again.
3. Living things go out of existence unless they continually act to stay *in* existence.

These are not actions that we see with the inanimate.

Returning to Aristotle's views, he explained in *De Anima* book II that organisms reproduce

> in order that they may share in the immortal and the divine in the only way they can; for every creature strives for this, and for the sake of this performs all its natural functions. . . . Since then, they cannot share in the immortal and divine by continuity of existence, because no perishable thing can remain numerically one and the same, they share in the only way they can. . . . What persists is not the individual itself, but something in its image, identical not numerically but specifically. (1957, 415a26–b7)

The living thing is acting toward ends, the ultimate end being the continuation of its life and its life-form. This is its entelechy.[10] Rand (1964) mirrors this view with:

> the functions of all living organisms, from the simplest to the most complex—from the nutritive function in the single cell of an amoeba to the blood circulation in the body of a man—are actions generated by the organism itself and directed to a single goal: the maintenance of the organism's *life*. (16)

Life as a Physical System

To reiterate the issues: living things strive to stay in existence. They change themselves in ways that allow them to continue existing and even flourishing: The octopus that changes its colors and skin pattern, even its shape, to avoid predators. The coffee plant that produces caffeine as a bug repellant. Bioluminescent fish illuminate the deep black sea in which they live. The most irksome elephant in the room, the quality that makes living things most difficult to explain in terms of physics and chemistry is: Living things act toward goals.

The relation between physics and biology reveals itself, for example, through the remarkable similarities in homologous structures of widely different species: Physical principles and limitations of *form* cause certain living structures to be built repeatedly in different species, which we can see in the parallel between the squirrel front leg and the bat wing, or the uncanny duplication of the skull in the marsupial Tasmanian wolf and the placental wolf. University of Edinburgh astrobiologist Charles Cockell expands on many of these factors in his generally delightful book *The Equations of Life* (2018). He beautifully demonstrates the physical principles that cause certain shapes or ways of moving to repeat over and over in nature—animate and inanimate. For example, he explains the size of an ant nest in physical principles:

> The ant nest can be predicted with nothing more than simple rules operating between individual ants. . . . Often in the natural world, in physical, chemical, and biological systems, a *power law* explains the relationship between things. Put simply, it means that one item we might be measuring, such as the volume of an ant nest, changes in proportion (as a fixed power) to something else, perhaps the number of ants. . . . Power laws come about because of some inherent link between two things that are being measured, and often that link is rooted in a physical principle. For our ant example, the more ants there are, the more grains of sand or soil they can move. . . . [T]he number of ants is related to the volume of nest they build. (Cockell 2018, 22–23)

His view is that:

> The code within life appears to give it a persistent purpose—"Life will find a way." However, this sense of purpose is an illusion. . . . This character of life, the behavior that emerges from its code, does give it a special feature, but not one that categorically separates it from physics. This feature just makes life a particular embodiment of physical process, a coded process. People are wont to imbue this chasm between life and nonlife with some sort of mystic unfathomability. Within this departure in the behavior of life from the rest of the cosmos, perhaps some see an opportunity to seize again the age-old desire from vitalism. Some people might hope to escape the nasty conclusion that life is just an interesting branch of organic chemistry. . . . Sadly, for those who dream of segregation, the difference is not that astounding. (248–49)

He's absolutely right that the ants, and all living things act within the limits set by their material and formal characteristics—physical principles. But note the ant-eye view of the issue: he doesn't explain why the ants are building a nest, or their social organization, why the code is arranged to produce self-perpetuating forms, or many other issues of *the higher-level organization* of what they are doing. He accepts the vitalism/physical reductionism dichotomy.

However, Cockell's work well integrates with that of nonreductive biologist/systems theorist Ludwig von Bertalanffy, whose naturalistic ideas of life we will examine shortly. Tufts University astrophysicist Eric Chaisson (2010) likewise presents fascinating arguments for the natural progression toward complexity in a universe apparently ruled by entropy. His exploration of how energy rate densities contribute to the development of complex systems demonstrates this:

> Energy rate density, a mass-normalized (free) energy flow denoted by Fm, is perhaps the most common currency available to do work

> thermodynamically to build structures, evolve systems, and create complexity. (28)
>
> Energy-flow diagnostics display increased complexity for a variety of steady states among plants that, following the solid curve, evade locally and temporarily the usual entropy process. (36)
>
> What seems inherently attractive is energy flow as a universal process—specifically, energy rate density as a single, unambiguous, quantitative measure of complexity—that helped to control entropy within increasingly ordered, localized systems evolving amidst increasingly disordered, wider environments, indeed that arguably governed the emergence and maturity of our galaxy, our Sun, our Earth, and ourselves. (39)

Chaisson's analysis of energy flow adds a significant dimension to analyzing the physical conditions that make life possible and functioning. Again, unfortunately, sticking to the determinist view, he says:

> [C]osmic expansion itself is the prime mover for the construction of a hierarchy of complex entities throughout the Universe. (Chaisson 2001, 126)
>
> [L]iving systems evolved in the past within environments rich in energy flux, and thus have inherited the means to acquire the needed energy flow via metabolic processes. The pathways open to biological evolution are constrained, not because few solutions exist but because energy resources are limited; natural selection exploits energy flows, determining which flows are conducive to the system, thereby apparently optimizing them. (180)

Of course, life exploits energy flows in its attempts to maintain existence. But note the use of the terms "solutions" and "conducive to the system" and "optimizing"—all implying goals and standards of achievement of some end, all slipped in without recognition. Chaisson further states: "In an expanding Universe, both the disorder and the order can increase simultaneously—a fundamental duality, strange but true" (129). He argues that free energy rate densities for things from galaxies to human culture become higher and more complex.

Quoting astrophysicist Hubert Reeves, Chaisson ultimately claims that with energy flows

> We have discerned a common basis on which to compare all material structures, from the early Universe to the present—again, from big bang to humankind inclusively . . . free energy processing rates spurred the growth of complexity in the cosmos. (191)

In other words, energy flows are critical to the development of organized systems. An important identification about how physical principles affect the development of life. Along the same lines, Natalie Wolchover (2014) discusses a theory developed by physicist Jeremy England at MIT that explains life's existence: as "entropy maximizing." England (2013) has derived a mathematical formula, Wolchover says, which shows that when a group of atoms is driven by an external source of energy (like the sun or chemical fuel) and surrounded by a heat bath (like the ocean or atmosphere), it will often gradually restructure itself in order to dissipate increasingly more energy. Notice that Wolchover uses the phrase "in order to," as if inanimate nature had a goal. Isn't that funny?

In other words, life takes in energy and uses it to create and maintain more complex forms, and then expels the leftovers. Entropy (disorder) increases in the areas around living things. Hence, it's *entropy-maximizing*, according to England, and thus fits into the law of entropy, considered the basic law of the universe. (Scientists are excited by England's theory because it seems to explain how and why life could have arisen from an inanimate universe.) Does this mean that the Earth is better at entropy-maximizing than other planets? I wonder about the principle of entropy as a fundamental law of physics; the fact that disorder appears to be increasing in the universe as a whole comes from observations going as far back as physicists can, to the "Big Bang" event at which the present configuration of the universe proceeded. According to theory, at this event, the universe started as one single point of matter and energy and then exploded and has kept dissipating in all directions since then. In this model, entropy is the basic law of thermodynamics.

But what happened before the Big Bang? The universe could not have come from nothing, it had to have existed prior to the Big Bang. What was its form? Did as yet undiscovered principles of nature cause all matter and energy to be concentrated into this single point? If so, that would mean that, somehow, all matter and energy were very ordered and then exploded. If scientists had observed it before the Big Bang, would they have concluded that order-maximizing was a basic principle of physics?

In any case, "entropy maximizing" seems to me to be *a backwards way of describing what happens with living systems*. System X exists and increases complexity in the universe in order to *decrease* complexity in the universe? You see, I say "in order" as if it has a goal, because one can't get around talking about life without talking about goals. No, System X exists and *increases* complexity *in order to stay in existence*. That's the straightforward way of describing it. Inanimate matter results in entropy; the animate acts against it.

Finding continuities between the inanimate and the animate is essential to creating a naturalistic explanation for life. Hierarchical structures are one of the keys. On these lines, Cockell discusses the deep atomic reasons carbon is the staple of life molecules. He shows the parallels between human-made hydroelectric dams and the process of osmosis. He recognizes that hierarchical structures existing in inanimate matter and systems are precursors to the much more complex hierarchical structures in living systems—from crystals to the solar system to the human brain—linking the inanimate to the animate. And this is great—but it's not enough.

Cockell offers no explanation of how the living system organizes its parts to flexibly grow, repair, and change itself, always keeping its bodily systems on the course of self-maintenance—Walter B. Cannon's homeostasis (see Cannon 1932). Nor how the abundant organic molecules on Earth organized themselves to be self-replicating. Homeostasis, says Bertalanffy (1969), "those processes through which the material and energetical situation of the organism is maintained constant," is a key feature of living things (78). Moreover, he says, living homeostasis is best described as a "steady state" or "dynamic equilibria" meaning that the number of elements entering the system by transport and chemical reaction per time unit equals the number leaving it (Chaisson 2001, 130). These are not features we see in nonliving existents and only partially in human built mechanical systems (which have maintenance processes because of the goal-oriented behavior of humans who crafted the mechanism).

The subtitle of Cockell's book, *How Physics Shapes Evolution*, seems to be arguing *against* what he sees as a "contingent" claim in biology and evolution, represented by Stephen J. Gould's argument that accidental or nonfundamental events drive the myriad life-forms and directions of evolution (Gould 1989). "The quintessential question that we might ask again is whether there is any room for chance and contingency in all this, any room for serendipitous attributes of historical quirks. Or is the architecture of this process locked into an unyielding pattern?" (Chaisson 2001, 151).

It all depends on what he means by "an unyielding pattern." Life follows all the principles of physics and *new* principles, which become evident with life's emergence. But its very nature allows it to adapt to changing circumstances so that "chance and contingent" situations—that is, ones that are not regular or whose cause is not known—can cause a living thing to change what it's doing or how it's doing it. But the *end* still remains the same, the maintenance of the living system. It is equifinal: its conditions and circumstances may change but it arrives at the same end. The principle that drives this is *self-regulation*, which applies to all forms of living things, from the smallest bacteria or archaea to a symphony composer.

Lawrence K. Frank (1948) summed up the scientific blindness this way: "The basic assumptions of our traditions compel us to approach everything we study as composed of separate, discrete parts or factors which we must try to isolate and identify as potent causes. Hence, we derive our preoccupation with the study of the relation of two variables" (50).

Systems Theory

Scientists were recognizing the many problems with the mechano-reductionist approach to biology as far back as the 1920s and were wholeheartedly developing a systems approach by the late 1940s, applied to disciplines such as cybernetics. *Systems theory studies the relationships between the structures and properties of systems, relationships that enable new properties to emerge.* As Frank (1948) stated:

> The concept of teleological mechanisms, however it may be expressed in different terms, may be viewed as an attempt to escape from these older mechanistic formulations that now appear inadequate, and to provide new and more fruitful conceptions and more effective methodologies for studying self-regulating processes, self-orienting systems and organisms, and self-directing personalities. Thus, the terms feedback, servo-mechanisms, circular systems, and circular processes may be viewed as different but equivalent expressions of much the same basic conception. (50)

Systems theories identify principles that go beyond the study of discrete parts and factors to explain new qualities that arise because of their mutual structure and interaction. Enter Ludwig von Bertalanffy, a main founder of general systems theory used in engineering, computers, physics, and so forth. His expertise was in biology, and he offered a stunning alternative scientific explanation of life. But few in the biological field took him up on it, and even fewer seem to know about it today.[11] This is despite the fact that his mathematical model of an organism's growth over time, published in 1934, is still in use.

In contrast to the mechano-reductive and vitalistic conceptions, Bertalanffy proposed the *organismic* conception because the key features of life are dependent on its special *organization*. He beautifully discussed the deep problems of trying to describe living things in mechano-reductionist terms in his book *Problems of Life*. Life seems to defy that basic law of thermodynamics because the law applies to a closed system. *Life is an open system*, one that can take in material and energy *from* the environment and release material and energy *to* the environment.

Bertalanffy (1952) does not eschew already-discovered principles of physics but builds on them.

> Analysis of the individual parts and processes in living things is *necessary*, and is the prerequisite for all deeper understanding. Taken alone, however, analysis is not *sufficient.* The phenomenon of life—metabolism, irritability, reproduction, development, and so on—are

> found exclusively in natural bodies which are circumscribed in space and time, and show a more or less complicated structure; bodies that we call "organisms." Every organism represents a *system*, by which terms we mean *a complex of elements in mutual interaction.* (11; emphasis added)

As Aristotle explained, all being is matter *in a particular form*, even if it's the form of a blob. You can't have matter without form or form without matter. These are two of the basic causes. To understand what a living thing is in the terms of physics, we need the concept of *dynamic systems*. As Bertalanffy (1952) defines it, life is a *dynamic, open system* of matter and form, consisting of a hierarchy of parts and a hierarchy of processes (42).

Its physical form is: *A complex of elements in mutual interaction which, by the system's actions, maintains its existence.* Bertalanffy (1969) offers a host of scientific principles by which living systems are able to maintain themselves against entropy and advance their existence: "An open system is defined as a system in exchange of matter with its environment, presenting import and export, building up and breaking-down of its material components" (141). As the physicists have recognized, openness enables living systems to defy the law of entropy. And living systems not only maintain their forms but create new, more complex forms and structures as they flexibly interact with their environment.

A key feature of living systems, Bertalanffy notes, is that *they are in a steady state, not in equilibrium*; in an equilibrium, a system has stopped changing in time.

> The steady state is maintained in distance from true equilibrium and therefore is capable of work. . . . The system remains constant in its composition, in spite of continuous irreversible processes. . . . The steady state shows remarkable regulatory characteristics which become evident in its equifinality. If a steady state is reached in an open system, it is independent of the initial conditions, and determined only by the system parameters, i.e., rates of reaction transport. This is called *equifinality* as found in many organismic processes, e.g., in growth. . . . In contrast to closed physico-chemical systems, the same final state can therefore be reached equifinally from different initial conditions and after disturbances of the process. (142–43)

For example, as Bertalanffy (1952) states:

> Embryonic development from the scantily differentiated ovum to a highly organized multicellular structure connotes an increase of order due to factors lying within the system itself. From the point of

> view of physics, such behaviour seems at first paradoxical. A physical system cannot increase its order by itself; on the contrary, the second law of thermodynamics demands that in every closed system a decrease of order is the natural course of events. This is exactly what happens in a decomposing corpse, but the process in a developing embryo is just the reverse . . . *the organization present in the embryo cannot be interpreted in a preformistic and structural way, but only as a dynamic order*. . . . Apart from certain exceptional cases, we do not find equifinality in physical processes. Here a change in the initial conditions usually leads to a change in the final result . . . a change in the position of the barrel of a gun, in the quantity of powder used, changes the impact of the projectile. (64; emphasis added)

Another illustration of this order is the *functional systems* of processes that supersede morphological organization:

> [T]he bulk of the tissue of the pancreas gland and the islets of Langerhans, together, constitute a higher component, in this case the organ known as the "pancreas." But with respect to other relations, one component may co-operate with another which is far removed morphologically, to form with it a functional system of a higher order. For example, the islet cells co-operate with the liver to regulate, by means of insulin, the liberation of sugar into the blood. (43)

In other words, the functional relationships among the organs and tissues are as significant to the order of the life-form as the morphological relationships—the shapes and positions within the body. How is this order and the flexibility of life possible? How is it so different from the inanimate in its abilities? *The key to the transition from physics to biology* occurs at the level of submicroscopic morphology (Bertalanffy 1952, 26, referencing Frey-Wyssling [1938] 1948).

Smaller molecular structures, Bertalanffy (1952) observes, combine into bigger, more complex, hierarchical ones that enable systematic action. "Amino-acids and protein molecules form parts of higher units, presenting themselves as microscopic fibrillae; fibrillae can again be united to microscopic fibres, and these, in turn, to macroscopic ones as shown, for example, in nerves and muscles" (26).

And these dynamic, hierarchic systems that exist in steady states have degrees of freedom of action not seen in the inanimate world. This freedom of action is key to life's nature and evolutionary developments, such as consciousness and free will.

Life as a Dynamic System

It's as Aristotle described: the soul is "the first actualization of a natural body which possesses life potentially. But whatever is organic is of this sort . . . it is the essence of a particular sort of body . . . it belongs to a particular sort of natural body that possesses a principle of movement and standing still within itself" (Aristotle 2018, 412a28–b18). "The soul is the cause and principle of the living body" (415b8). In other words, it is the *principle of form* of a living thing (its *psyche*), "the essence of a particular sort of body," that makes it alive. In all cases, this form is dynamic, whether bacterial, vegetable, animal, or human, acting constantly to maintain its functional structure. *An invariable organization defined by certain functional relationships. The invariable organization constitutes a "steady state" of an organism's open system*. For example, the way human bodies in constantly changing environments maintain their temperature of about 98.6 degrees. They do so by constant action.

To philosophically essentialize the nature of life, we must return to Rand's definition (1964, 16), that life is "a process of self-sustaining and self-generated action." This philosophical definition doesn't mention the technical features of life, such as respiration, metabolism, and growth, but it encompasses all of them. Moreover, this definition covers forms of life that we have not yet encountered. It is a *defining means of determining the existence of artificial life*: *If a being is characterized by the form of a dynamic system of self-sustaining and self-generated action, then it is alive.* Since life is a *process*, this process includes the particular living entities and their sustaining action of reproduction, as Aristotle said, "to participate in the immortal and the divine."

Contrary to the physicists who characterize this ability as anti-entropic, let's state this feature in a positive form—let's be clear about its duckness: *Life is a dynamic open system that exhibits the ability to increase complexity and energy within the system.* It is the opposite of entropic. A different way of framing the idea is: life is a *major feature of the universe*, which acts in the opposite direction of entropic, dead matter; it builds and sustains its organization over time.

When we look about us at all the generated forms and activities of living things, it's an amazing testament to the tendency in the universe for matter and energy to combine in new forms and try to maintain those forms through progeny. Locey and Lennon (2016) estimate that there are one trillion species estimated to be on Earth currently and only one-thousandth of one percent described.

The trajectory of life on Earth leads to the conclusion that these forms have the tendency to continue to increase in complexity: from bacteria to algae to carnivorous angiosperms such as Venus flytraps; from one-celled protozoa and the most primitive animals such as *Trichoplax adhaerens* and sponges to octopi and *Homo sapiens*. And *the trajectory has repeated itself multiple times.*

Bertalanffy (1952) has an extensive, technical discussion of how life works as a dynamic system. He explains that molecules are exact and predictable until they get large at which point *they are not clearly separated from one another by classical chemical forces and principles*. At that point, their exact formation and number is only *statistically* known—and this is *the point at which easy change and rearrangements, the kinds of things that enable living things to adapt to a changing world—are made possible by the indefiniteness, the changeability of the chemical structure*. These structures have the ability to go one way or the other in response to internal and external environments. The very process of molecular/cell division is a result of this feature (26). This is one of the ways living things have degrees of freedom in their actions.

The action of many genes is that of "rate-genes," that is, factors that influence the velocity of certain chains of reactions. Development is based upon a system of gene-controlled processes. Their correct timing guarantees normality; on the other hand, mutation of a gene can lead to a change in the speed of the reactions it controls, and hence to more or less far-reaching alterations of the organism. This is the "principle of harmonized reaction-velocities" (Goldschmidt 1938), which we have already encountered in embryonic development. This principle was first stated by Goldschmidt with respect to sex determination. The latter is based on the fact that in every organism, "male" and "female" reactions go on simultaneously; the quantitative ratio of the sex factors (in the typical case two X chromosomes in the female, one in the male) decides which wins the race (76).

In other words, living things interact with their environment as a *system* that enables them to stay in a steady state, despite the entropic forces of their environment. *The system has degrees of freedom in how it may act and interact, depending on its dynamic needs*. The principle of "harmonized reaction velocities" is one of the ways living things are flexible in response to circumstances and can develop new pathways of response.

You, dear reader, experience this flexible response every day. Think of sitting down to dinner: you eat some steak and bread, and then you're thirsty; you reach for a drink, but your glass is empty; so, you stop reaching and eating and get up to fill your glass. You can see these actions as those of a dynamic system that has energy needs it is attempting to fulfill. When one aspect of that fulfillment is frustrated, your system—you—pivots to another means of achieving its (your) end of fulfillment. You are able to do these things as a dynamic system, driven by what goes on inside yourself physiologically.

The hierarchic arrangement of matter is one of the key ways in which life organizes and maintains itself. Bertalanffy (1952, 37–47) points out that the vast majority of the universe is arranged in hierarchic clusters of matter, from molecules to crystals to planetary systems, which are complexity-increasing and therefore anti-entropic. Seen in this context, living systems are yet more complex hierarchic arrangements. Chaisson (2001, 11) and Cockell (2018, 200) likewise describe the universe as on a complexity trajectory in the inanimate as well as animate systems. Along these lines, Alexander Graham Cairns-Smith's book *Seven Clues to the Origin of Life* (1990) proposes a way DNA could have evolved from clay crystals and biological molecules.

Don Clark (2014) summarizes Bertalanffy's conception, telling us that Bertalanffy

> wrote that a system is a complex of interacting elements and that they are open to, and interact with their environments. In addition, they can acquire qualitatively new properties through emergence, thus they are in a continual evolution. When referring to systems, it also generally means that they are *self-regulating* (they self-correct through feedback). Fifty years ago, polymath Arthur Koestler (1967) built on Bertalanffy's work with his elaboration on hierarchical systems. His analysis links the inanimate to the animate, showing the natural contiguity of life with inanimate systems. . . . [T]here is also a significant analogy in physics to the distinction between fixed rules and flexible strategies [of biological systems]. The geometrical structure of a crystal is represented by fixed rules; but crystals growing in a saturated solution will reach the same final shape by different pathways, i.e., although their growth processes differ in detail; and even if artificially damaged in the process, the growing crystal may correct the blemish. In this and many other well-known phenomena we find the self-regulatory properties of biological holons foreshadowed on an elementary level. (63)
>
> "Holon" is a concept Koestler introduced to explain the nature of hierarchical structures. A holon is a structure that is autonomous at one level of the hierarchy and a part as another, for example, the heart can beat on its own as a function of its wholeness, yet it also functions as a part of a living body. I am trying to stress a point which they [science books] do not sufficiently emphasize, or tend to overlook altogether—namely, that the organism is not a mosaic aggregate of elementary physico-chemical processes, but a hierarchy in which each member, from the sub-cellular level upward, is a closely integrated structure, equipped with self-regulatory devices, and enjoys an advanced form of government. (64)

Life's flexibility in responding to its circumstances further illustrates its degrees of organizational freedom. Another feature of life that Bertalanffy points out (1952) is that random mutation and environmental selection alone do not account for the riot of forms and abilities that arise *under the same* *circumstances:* "In the same part of the sea, *in a thoroughly uniform environment*, hundreds of species of foraminifera or radiolaria can be found; 'natural art-forms,' the fantastic diversity of shapes of *which has obviously nothing to do with usefulness*" (87; emphasis added). If natural selection were a strict matter of the *environment* determining the forms that survive, why and *how* do all these different forms arise?

Rather, these facts demonstrate that life has the inherent ability and tendency to rearrange and re-create different kinds of living systems while pursuing self-maintenance. *Life is creative. Only by discovering new principles of action will we be able to understand living beings.*

A stunning implication of the fact that life has the freedom to be self-directed is that there is no such thing as *determinism*, that is, the belief that every state of affairs, including every human event, act, and decision, is the inevitable consequence of antecedent states of affairs.

There are three more fundamental *psychological* issues arising from the nature of life that will be explained shortly, namely, *consciousness, free will*, and *meaning. These are the evolutionarily latest permutations on life's ability to direct its action.*

Consciousness as an Extension of the Self-Regulating Abilities of Life

Evolution is the process by which different life-forms reorganize their systems to cope with changing environmental conditions, such as developing lungs to live on land. And to face their existence in new ways, hence the plethora of different kinds of radiolaria in the same environment. Or, through their own abilities, to change the environment to help maintain their systems, such as building a house of stone or a dam.

The emergence of consciousness is one of the most radical means living systems have developed to survive and evolve. Every life-form that has it, uses it to live.

But what is consciousness? This question leads to many others: How should it be defined? What gives rise to it and where does it reside? Since it doesn't seem to be material, could it be an illusion, or a universal property of all matter? Who or what might possess it? How is it related to the issues of artificial intelligence?

And while reems of interdisciplinary research in cognitive science, such as psychology, linguistics, anthropology, neuropsychology, and neuroscience, are moving apace, there are many thinkers who continue to assert that consciousness is merely an epiphenomenon of neural activity, not a causative agent. Ignacio Morgado-Bernal (2019) aptly summed up this view:

> The nature of consciousness remains one of the main unsolved questions in neurobiology. Although recent advances suggest that sooner or later we will be able to understand the neural mechanisms underlying awareness, it seems very difficult to understand how neural activity becomes a subjective experience, the so-called hard-problem of consciousness. The apparent intractable nature of this problem causes some scientists to avoid it altogether and deal only with the neural correlates of consciousness. However, for others, consciousness is an epiphenomenon, that is, something without a direct function, like the redness of blood—a characteristic which was not selected for, but was a consequence of the mechanism selected to deliver oxygen. In that view, qualia, the phenomenological experiences, correspond to internal discriminations that are reliable correlates of underlying neural mechanisms. Consciousness itself is not causal. It is the neural structures underlying conscious experience that are causal. (377)

In case you missed it, this view is a consequence of material reductionism, that is, that causes can only be material. Others deny the very existence of consciousness.[12] According to them, consciousness is nothing but an illusion that humans have talked themselves into. As previously described, thinkers such as Daniel Dennett and Sam Harris take the point of view that thoughts are not "real" and do not have causative power, nor the mind free will, because they are not material. Paradoxically, these people push this point of view by *arguments*.

What is Dennett or Harris or any reductionist doing in writing and speaking, if not *using thoughts as if they were real and had the power to change humans*? Why are they even arguing about thoughts and free will, if their words and actions have no causative power? If they truly believe they are determined, why don't they see the pointlessness of arguing and just shut up? Why? Because, apparently, they secretly agree with Frank Herbert ([1965] 2010), who said in *Dune*: "Whether a thought is spoken or not, it is a real thing and it has power" (446). And they don't want to give up that power and influence.

It's clear that the mechano-reductionist approach founders in trying to explain the nature and causative power of this seemingly nonmaterial agent, consciousness. In the end, it appears to me that their fundamental premises cause them to throw up their hands and assert that there is no such thing.

In *Mind and Cosmos*, Thomas Nagel (2012) asks many excellent questions about the relation of life, consciousness, free will, and value to conundrums of the current scientific conceptions of materialism, reductive analysis, and evolution. He proposes that contemporary evolutionary explanations of the rise of consciousness:

> [P]resent consciousness as a mysterious side effect of biological evolution—inevitable, perhaps, but inexplicable as such. To explain consciousness, a physical evolutionary history would have to show why it was likely that organisms *of the kind that have consciousness would arise*. (60)

Let's see if we can answer this challenge.

An essential aspect of the concept of consciousness is that it is impossible to define except by terms that mean the same thing, for example, awareness. As Rand ([1966–67] 1990) observed, to be conscious is to be aware of some aspect of reality. This is one of the pieces of evidence that it has a special status as a concept; it is an axiomatic concept, graspable only by direct experience, like existence or identity.

> An axiomatic concept is the identification of a primary fact of reality, which cannot be analyzed, i.e., that is, reduced to other facts or broken into component parts. It is implicit in all facts and in all knowledge. It is the fundamentally given and directly perceived or experienced, which requires no proof or explanation, but on which all proofs and explanations rest. . . . One can study what exists and how consciousness functions; but one cannot analyze (or "prove") existence as such, or consciousness as such. These are irreducible primaries. (An attempt to "prove" them is self-contradictory it is an attempt to "prove" existence by means of non-existence, and consciousness by means of unconsciousness.) (55)

Axiomatic concepts like "consciousness" or "awareness," Rand says ([1966–67] 1990, 55), are "the identification of a primary fact of reality, which cannot be analyzed, i.e., reduced to other facts or broken into component parts." This means that they can be defined only by indicating "I mean *this*." In other words, pointing to our direct knowledge of them—in this case, our own direct experience of being conscious and its consequences such as pleasure and pain. The axiomatic nature of the concept of consciousness is one of the things that causes philosophical confusion, since people tend to search for a definition/description in terms of other concepts—which is impossible. It is a fundamental concept on which all others depend.

Animals have consciousness in a large variety of forms, abilities, and complexities. We tend to use "awareness" for the less complex forms and "consciousness" for the more complex. The *basic* form of "awareness" is that of sensations, with the powers of touch and chemotaxis (the awareness of chemical gradients) of protozoa and primitive multicellular animals such as hydra, being the *most* basic forms of it. If we're using the word to mean primitive awareness of surroundings, a paramecium (one-celled animal) has awareness of its medium and environment, which allows for navigation in the fulfillment of its needs. In *Surely You're Joking, Mr. Feynman* (1985), the great physicist Richard Feynman has a delightful description of a paramecium's series of actions, reversals of its action, and "choices" as it navigates a shrinking environment of water.[13]

More complex life-forms have more senses such as sight, hearing, and electrical fields. And even *more* complex abilities include the integration of sensations into perceptions, which enables entity-recognition, the cognitive and emotional functioning in higher animals, and the self-aware, reasoning consciousness of human beings. The word "consciousness," itself, is usually reserved for organisms with central nervous systems that integrate sensations into the awareness of entities, and so forth. However, to add confusion, we often use "consciousness" *specifically* for the human power of "self-awareness," that is, a consciousness aware of its own operations. These multiple, slightly different uses cause many misunderstandings.

Apparently unrealized by Nagel and many others, Aristotle explained the *biological cause of consciousness* in his *De Anima* with this argument: "Since animals do not manufacture their own food like plants, they need to *find* food. This requires locomotion and *locomotion requires sensation to navigate*" (Aristotle 1957, 434a34–434b). This was true of the first protozoa that emerged 750 million years ago, which used touch and a sense akin to smell (chemotaxis) for navigation. Taste, sight, hearing, and other senses such as electrical field awareness in multicellular animals are thought to be specializations of the original sensory cells of touch and chemotaxis.

Aristotle's Heideggerian student, Han Jonas, added to Aristotle's description of the origins of consciousness in animal life. In *The Phenomenon of Life* (1966), Jonas says:

> Three characteristics distinguish animal from plant life: motility, perception, and emotion. . . . The emergence of perception and motility opens a major chapter in the history of freedom that began with organic being as such and was adumbrated in the primeval restlessness of metabolizing substance. Their progressive elaboration in evolution means increasing disclosure of the world and increasing individuation of self. Its elementary evidence is the mere irritability, the sensitiveness to stimuli, which the simple cell displays as an integral aspect of its aliveness. (99)
>
> In other words, all life—"metabolizing substance"—is restless, acting, moving. Awareness of the world through perception, and the elementary response to stimuli, combined with locomotion, i.e., the ability to move from place to place, gives living things abilities to act for themselves, *new degrees of freedom*. Moreover, increased awareness—"disclosure of

> the world"—results in *increased individuation of self* as a consequence of being more aware that the world is something distinguishable from self.
>
> Life, by its nature, faces forward and outward at once. Now it is the main characteristic of *animal* evolution, as distinct from plant life, that *space*, as the dimension of dependence, is progressively transformed into a dimension of freedom by the parallel evolution of these two powers: to move about, and to perceive at a distance. . . . What is less obvious is that the other dimension of "transcendence," *time*, comes in a like manner to be disclosed by the simultaneous evolution of yet another power, that of emotion . . . the interposition of *distance* between urge and attainment, i.e., the possibility of a distant goal . . . to experience the distantly perceived as a goal . . . desire is required. (101)

Jonas is saying that to maintain the impetus to move toward a distant goal requires an internal experience, which keeps the salience of that goal current in the awareness of the animal. Emotion fulfills this function; it keeps the animal motivated—moving toward the goal that is separated—distant—in space and time. As a philosopher, Jonas seems to use the word "emotion" in its original sense: to set in motion, and, as such, he includes "[t]he feelings of pleasure and pain which accompany animal experience as intrinsic rewards and punishments of conduct, to which must be added the excitement of action itself, are clear indications of the endowment of animal functions with values and ends of their own," as the basics of emotions (184).

In this usage, emotion and feeling are more complicated responses of pain and pleasure. Psychologists usually consider the word "emotion" to apply to more complex feelings such as love, hate, or envy. Nathaniel Branden's clear definition applies to both uses: "An emotion is the psychosomatic form in which man [a living thing] experiences his estimate of the beneficial or harmful relationship of some aspect of reality to himself [itself]" ([1969] 2001, 67).

Regardless of where one draws the line on the use of the word "emotion," the conclusion is: Consciousness, even in its most primitive form, is essential for the life of an animal that possesses it; the experience of pain or pleasure that draws an animal to or away from something, is essential to and for the animal's life, and in the more complex animals, this encompasses complex feelings.

To answer Nagel's questions "why it was likely that organisms *of the kind that have consciousness would arise*," we must remember that all living forms are systems, and therefore, to answer Nagel's question, we need to ask about *the function and place of consciousness in that system*: Sensation, perception, and higher consciousness are evolutionary advances in life systems, enabling them to maintain homeostasis through a new way of interacting with the environment.

In terms of *what kind of thing it is*, awareness/consciousness is *a relationship between a certain kind of body and the world*. When a pig sees a piece of corn, it is in a physical relationship with the corn in which the light reflected from the corn travels and hits the retina of the pig, initiating a perceptual process in the pig's brain that triggers a cognitive/emotive process, including a desire for the corn in the pig's consciousness. A desire is a feeling/process that keeps the salience of the corn in its consciousness until possession/ingestion of the corn is completed.

Sight, sound, smell, taste, and touch are affected when parts of the environment become part of the organism by transferring energy. While in pursuit of food, rest, care of offspring, and so forth, *the animal's awareness system literally incorporates parts of the environment—energy and chemicals—that cause sensation. This transfer changes the organism's organs and the animal's system.* This is why we call knowledge "food for the soul." Its analogy to food is strong: like food, it's an incorporation of elements of the environment to be used for the goals of the organism.

The fact that human consciousness usually malfunctions when put in a long-term sensory-deprivation environment (Zubek 1969) affirms that *awareness or consciousness is a relationship between the animal and the environment, a process going on between the world and the life system. This activity gives the animal the ability to change the actions of the animal to serve its life needs.* A powerful implication, clear from the evidence, is that consciousness is *not* merely an epiphenomenon of matter. But the issue of whether consciousness has causal power needs to be reframed in terms of a more exact (nonreductionist) view of causation, namely: Causation is a function of the identity of the entities that act such that living beings with consciousness have powers of action beyond those without it. The evidence demonstrates that animals with consciousness are able to take actions and cause change that beings without it cannot do.

In the more advanced animals, the interaction with the environment results in mental structures, such as representations of the environment as memory, that enable the animal to further interact with the environment. These structures and interactions affect the animal's further actions. When we, as humans, are just thinking and not interacting with our environment, we use these mental structures to think, at which point our conscious awareness is made up of mental entities resulting from the activity of our mind/brain in relation to the world.

As per Aristotle and John Locke, our minds are *tabula rasa* for the *content* from the world. As Aristotle puts it:

> Alternatively, the point that a thing is affected in virtue of something common has been previously described: namely, thought is in a potential way identical with thinkable objects, though in an actualized way with none of them until it thinks. It must be present in it the same way as

on a tablet on which there is nothing written in an actualized way. This is just what happens in the case of thought. (Aristotle 2018, 429b30–430a3)

In *An Essay Concerning Human Understanding*, Locke says, "If we will attentively consider new-born children, we shall have little reason to think, that they bring many ideas into the world with them" (Locke 2017, essay 1, iv, 2). We have to discover the content.

Subsequent to our initial perceptual encounters with the world, as we interact with it, we develop ideas by abstracting and integrating the material of the senses. In this process, we create the very structure of the mind (Montessori [1949] 1967), namely, the concepts we hold, their relationships to each other, images that represent our ideas, and specific perceptual memories.

However, there is much confusion about *tabula rasa* that proceeds from the fact that humans are born with many mental as well as physical needs, and these shape the way in which we develop our minds. They *dispose us to more readily form certain concepts and pursue certain shapes, smells, feelings, or tastes*. For example, we have the tendency to pursue sweet foods, warm places when it is cold, and savory smells—and many other dispositions and tendencies toward complex values such as those involved in the pursuit of love or social position. Consequently, we form ideas and values about these especially salient aspects of the environment more easily and they affect our systems more easily.

The energy from the environment via the cognitive organs affects the maintenance of the life system. Environmental inputs via consciousness can be part of what changes the system. The system can incorporate the elements from the environment and then rearrange itself to respond in a new way to the environment, for example, cold air on the temperature receptors can cause an animal to shiver by activating its muscle fibers to produce heat. Subsequently, awareness of the cold conditions can initiate movement to a warmer place. A living system's degrees of freedom increase with the introduction of consciousness by *enabling it to change what it's doing in response to the environment much more quickly.* It can move toward or away from the perceived, it can store the awareness of the perceived in memory, which may allow it to change its course in the future, it can help the organism realize it must look for new perceptions (awareness of the environment)—it allows for many possibilities. This dynamic relationship is our experience of consciousness.

Grasping that awareness is the relationship between the body of the organism and the world through the processes of the cognitive organs (sensory and neurological) answers the question: what type of naturalistic thing is consciousness?

Even further, we can apply this principle to the question: what is "meaning"? In dictionaries, meaning is defined as: "the end, purpose, or significance of something" (WordReference.com n.d.). From a bio-psychological approach, *the awareness of the relationship of some aspect of reality to an organism's goals is* *the meaning of that aspect to the organism.* As such, *only humans* can *understand* meaning, that is, can form concepts to be aware of the relation of some aspect of reality to their goals and those of other organisms. Metaphysically, meaning is a function of human consciousness, and it exists as equally as an electron.

We can use this understanding to answer the question: what is the meaning of life? Life as "a process of self-sustaining and self-generated action . . . is the only phenomenon that is an end in itself: a value gained and kept by a constant process of action" (Rand 1964, 16–17). *This is a unique metaphysical status*. The implications of this unique status are easy to overlook but most apparent with the lower organisms, like bacteria and amoebae. The organisms of those kinds that exist today are the outcome of previous organisms splitting over billions of years, *as one continuous process*. Bacteria today is a continuation of the bacterial process, hardly separate from the process itself, that is, not anything close to an individuated organism.

In fact, all life processes attempt to be continuous, that is, to stay alive. Each living thing's actions are aimed at keeping its action going through the maintenance of the body, or the body of its offspring. In some forms, such as those that use sexual reproduction, the organisms are more completely separate individual bodies from their generators than organisms such as bacteria. In other words, they have parents. But in all cases, the living being is the life process of a certain type of body, the end of which is to keep that process going. The life process is the goal, the goal is to implement the life process, whatever form that living being takes. It's a process that aims to an end and *is* the end. Its uniquely recursive; the end *is* the living.

Getting back to meaning then, the *meaning of life is to live and to experience one's power to live, to be aware of how one's actions are serving one's life goals, and how one's life goals are to live well as a human (for example, maintain the human living process). Living as the being and the doing is an end in itself, the ultimate end in the universe.*

Aristotle's concept of purpose is built on the conviction that the final state of a particular natural process is something *good* for that very process. As Koutroufinis (2016) notes, Aristotle recognized this:

> In his seminal work *De Anima* (On the Soul) Aristotle says both that all processes occurring in a living being are determined by its *soul* (psyche) and that the soul is the 'eidos' or the formal cause of a "natural body having in it the capacity of life" (II, 1, 412 a 1λ-21έ). . . . "[T]he Good is that at which all things aim (τἀγαθόν, οὗ πάντ᾽ ἐφίεται)" [*Nicomachean Ethics* I.1094a1], "the Supreme Good seems to be something final (τὸ δ' ἄριστον τέλειόν τι φαίνεται)" [I.1097a25–30]. Accordingly, final states at which the soul of an organism aims are good for that very organism. Each organism is something good in itself because thanks to its soul and

> essence it has *intrinsic value*. From Aristotle's perspective the purpose of being able to learn to read is not about producing numerous offspring but to contribute to a person's happiness (εὐδαιμονία) which is a value in itself rooted in the *noetic soul* of the human. (423)

I read "intrinsic value" as a value that is an end in itself.

The documentary film *My Octopus Teacher* by the South African naturalist-documentarian Craig Foster shows the jolting intelligence of *octopus vulgaris* in its curiosity about Foster and its ability to play with a school of fish. In the documentary, Foster explains that its intelligence is distributed in the eight arms as well as the head of the octopus. The activities of this disconcertingly different intelligence demonstrate Aristotle's original observation that living things enjoy exercising their abilities.

The more complex and multifunctioning the organism, the more enjoyment it experiences. As illustrated in Masson and McCarthy (1995), it plays, enjoying doing what it *can* do as well as what it *must* do to stay alive, that's all a part of the meaning of being alive, like the wild animals that slide down a snowy slope over and over for fun or the dog that plays fetch.

Contra neo-Darwinian views, life is *not* just reproduction, it is *living*. It is a mistake to focus on the importance of reproductive fitness *alone* when trying to understand living action. Aristotle recognized that living *itself* is the goodness *and the action toward goodness*.

Understanding consciousness as being part of the living system has further psychological implications. Psychologically, when the needs of consciousness are not met, the psychological steady state, one is motivated to restore one's steady state. The more unmet the complex needs of the human psyche, the more extreme the actions, such as in schizophrenia. Actions that push the mind/organism toward disorganization are unsuccessful actions; those that push it toward organization are successful. *The principle of "steady state" is a key to objectively identifying those needs and actions necessary to maintain the mind.*

In Plato's *Republic*, Cephalus is anxious to continue his offerings to the gods, so that in his old age, he will know peace of mind—a steady state of consciousness (Plato 1961, 331a–331d). For a fully integrated biopsychological-conceptual understanding of human life, ethics and psychology should endeavor to define what actions and pursuits help to maintain the steady state.

The System of Consciousness

As to how consciousness is organized: Koestler, in his book *The Ghost in the Machine* (1967), carried Bertalanffy's banner and ideas into the mental realm and applied them to furthering the theory of evolution and to explaining biological organization and action. Among his many powerful explanations, he expanded on the nature of the hierarchical organization of living systems and consciousness and added the concept of the "holon" to explain living organization:

> Needham (1936) wrote: "Whatever the nature of organizing relations may be, they form the central problem of biology and biology will be fruitful in the future only if this is recognized. The hierarchy of relations, from the molecular structure of carbon compounds to the equilibrium of species and ecological wholes, will perhaps be the leading idea of the future. Yet the word 'hierarchy' does not even appear in the index of most modern textbooks of psychology or biology" (45).
>
> The first universal characteristic of hierarchies is the relativity of and indeed ambiguity, of the terms "part" and "whole" when applied to any of the sub-assemblies. A "part," as we generally use the word, means something fragmentary and incomplete, which by itself would have no legitimate existence. On the other hand, a "whole" is considered as something complete in itself which needs no further explanation. But "wholes" and "parts" in this absolute sense just do not exist anywhere, wither in the domain of living organisms or of social organisations. What we find are intermediary structures on the series of levels in an ascending order of complexity: sub-wholes which display, according to the way you look at them, some of the characteristics commonly attributed to parts. . . . Phonemes, words, phrases are wholes in their own right, but parts of a larger unit; so are cells, tissues, organs; families, clans, tribes. The members of a hierarchy, like the Roman god Janus, all have two faces looking in opposite directions: the face turned toward the subordinate levels is that of a self-contained whole; the face turned upward toward the apex, that of a dependent part.
>
> But there is no satisfactory word in our vocabulary to refer to these Janus-faced entities: to talk of sub-wholes (or sub-assemblies, sub-structures, sub-skills, sub-systems) is awkward and tedious. It seems preferable to coin a new term to designate these nodes on the hierarchic tree which behave partly as wholes or wholly as parts, according to the way you look at them. The term I would propose is "holon," from the Greek holos = whole, with the suffix on which, as in proton or neutron, suggests a particle.
>
> Biological holons are self-regulating open systems which display both the autonomous properties of whole and the dependent properties of parts. This dichotomy is present on every level of every type of hierarchic organization, and is referred to as the Janus Effect or Janus Principle.[14] (47–48)

In describing the automatization of actions that formerly required much conscious attention, like learning to ride a bike, Koestler (1967) says:

> The transformation of learning into routine is accompanied by a dimming of the lights of awareness. We expect, therefore, that the opposite process will take place when routine is disturbed: that it will cause a change from "mechanical" to "mindful" behavior. Everyday-experience confirms this; but what are the implications?
>
> Habits and skills are functional holons, each with a fixed canon of rules and flexible strategies. Flexible strategies imply choices between several alternatives. The question is how these choices are made. Automatised routines are self-regulating in the sense that their strategy is automatically guided by feedbacks from their environments, without the necessity of referring decisions to higher levels. . . . I have mentioned . . . the tightrope-walker keeping his balance [as] "kinetic homeostasis." (99)
>
> Only when something unexpected happens, such as dropping his balancing stick, a strategic choice has to be made which is beyond the competence of automatized routine, and must be referred to "higher quarters." *This shift of control* from one level to a higher level of hierarchy—from "mechanical" to "mindful" behavior—seems to be of the essence of conscious decision-making and of the subjective experience of free will. (207–8)

In other words, the possession of consciousness allows an organism to flexibly deal with reality in a much more complex and creative way than through routine action. In his books, Koestler's organizational description of consciousness reaches far beyond simple automatizations into the realms of humor, science, and art—but we shall have to leave that for another day and go on to address some last perspectives on the relationship of consciousness and life.

Human Immortality

Human survival is critically dependent on the human ability to form abstractions and reason about reality (Rand 1964, 20). Reason allows us to be aware of the future and the past. And death. Consequently, as a fundamental part of being alive, individuals have a strong tendency to find ways to continue. Children are a primary means by which most people extend their life process.

But human reasoning and the awareness of past and future lead to other means of participating "in the immortal and divine." Specifically, the desire to be remembered, to take actions to achieve a legacy. Hence, the importance we place on remembering the dead and celebrating their impact on the world. Life stories, pictures, movies, the family busts of the Romans, monuments, songs, the glory of Achilles, the fame of Alcibiades. Performing ceremonies or even just saying a few words about a person at burial or a memorial service is considered important by most people. To do otherwise seems like we are acting as if that person had no existence or importance. These are all the things that keep previous humans "alive" in the giant, ongoing experience of mankind.

Many thinkers have written on the desire for transcendence, which usually is taken to mean taking oneself out of concern for oneself and into concern for something "greater." Does this desire derive from the desire to stay alive *psychologically*—by doing something that affects and continues the life and growth process of others? Then we're more likely to be remembered thus stay alive in others. Moreover, when we improve the lives of others, we feel more efficacious, actualizing our ability to use all our functions. This is the essence of being alive and flourishing.

The Fourth Dimension?

Another significant factor in the development of reasoning consciousness is that it has resulted in a new dimension in the universe: the shared mental world of humans. British physician-philosopher Raymond Tallis reflects on this in his thoughtful, contra-reductionist tome, *Aping Mankind: Neuromania, Darwinitis, and the Misrepresentation of Humanity* (2014). Humans have a wealth of ideas, history, knowledge, and experience that they share through communications and hold in memory. A small part of it, but a substantial representation, is all the entries on Wikipedia. This shared mental world exists in different respects in different people, but collectively has an enormous influence on human action, history, and the world. It exists in our minds—the process and relationship that is human consciousness. It is a new evolutionary development.

Free Will

To reiterate an earlier point: there is no inevitable sequence of events, no determinism, because life has freedom to change its course. Rather than determinism, there is *causation* to lawfully explain why entities act as they do. "Life is a process of self-sustaining and self-generated action" (Rand 1964, 16). In other words, part of the very *essence* of being alive is the *ability to generate action*. This ability gives living things a freedom of action, made possible by their systems, that emerges in the universe with the first living creature.

Free will is the latest version of this capacity and a naturalistic development. Free will is the ability to direct conscious attention or *focus*, as Rand calls it in "The Objectivist Ethics": "The act of focusing one's consciousness is volitional" (1961, 20). This is a clear extension of an animal's ability to direct its action. With the development of human consciousness, the human animal can *direct* *the actions of its consciousness*, via focal awareness. In other words, it can direct what it is paying attention to, instead of being at the mercy of what is happening in its environment. For example, the lion sits in its pride until it hears the eerie sound of a hyena, which causes it to get up and turn its ears in the sound's direction. But there is no evidence the lion has control of what it is thinking about or can say to itself, "I don't want to respond to hearing that hyena, I'm going to read a book." The lion can't say anything to itself because it can't think in concepts. It seems to have *some* freedom as to how it will respond to the hyena call, as evidenced by the fact that lions don't always respond in the same way in similar circumstances. Its life system, *through* its consciousness, responds differently in different situations, balancing its needs and resources against what it perceives of the environment around it.

Humans, however, have surprising powers of self-direction, which make an enormous difference in our range of actions and the freedom to choose actions. Most of us acknowledge this because of our own experience in changing the course of what we do.

In the famous "marshmallow experiments" on young children, aged three to five years old, as documented by Mischel and Ebbesen (1970), some, when left alone, were found capable of figuring out ways to distract themselves from eating marshmallows put in front of them for *fifteen minutes*, to get more treats when the experimenter returned. Mischel, Ebbesen, and Zeiss (1972) noted:

> They made up quiet songs . . . hid their heads in their arms, pounded the floor with their feet, fiddled playfully and teasingly with the signal bell, verbalized the contingency . . . prayed to the ceiling, and so on. In one dramatically effective self-distraction technique, after obviously experiencing much agitation, a little girl rested her head, sat limply, relaxed herself, and proceeded to fall sound asleep.

As Raymond Raad (2013) observes, this experiment demonstrates that *preschool-aged children* are capable of self-control. They can decide how to direct their attention. This directive ability of our mental capacities and actions enables humans to notice different aspects of entities such as color, length, hardness, form abstractions of these aspects, and integrate them into concepts. It is the magnificent source of our power of reason, organizing our concepts into propositions and syllogisms. *Our thoughts organize our actions toward ends.* To ignore that is to ignore an obvious connection between cognitive psychology and motivational psychology.

Most of us are familiar with stories such as that of Alexander the Great, who set his mind to conquering the world and nearly did by the time he was thirty. Or to Alexander Hamilton, born on the insignificant island of Nevis, abandoned by his father and orphaned at eleven when his mother died, who became a prominent lawyer in New York City, one of the U.S. Founders, and chief architect of its industrial and financial future, all through diligent work, perseverance, and incessant thinking. Or the rock climber Aron Lee Ralston, who became stuck in a crevasse and cut his own arm off to save his life. Or any of a huge line of entrepreneurs who put their minds to creating new companies and rose to riches.

Currently, there is a large body of research—such as Mihaly Csikszentmihalyi's on flow (2008), Anders Ericsson's on deliberate practice (Ericsson and Pool 2017), and Andrew Huberman's on focused attention as a chief means of changing behavior (Huberman Labs Podcast 2021)—that demonstrates the power of free will via the ability to direct focused attention. The evidence includes people who go from being homeless to being successful scientists; factory workers who maintain interest and creativity in their work by directing their attention; amateur golfers who decide to become professionals in their thirties; and special forces candidates who overcome freezing water, enormous sleep deprivation, and monstrous physical challenges to succeed.

But these and other facts do not deter materialists from insisting that humans do not have free will. Instead, on top of their materialist philosophical arguments, they cite various experiments. One set of experiments measuring nonconscious brain activity has been taken as proof that there is no free will, that human action is the result of physiological processes that seem to be directing what the person does—I suppose they would say "determining." The controversy began with an experiment in 1983, commented on by Patrick Haggard (2011):

> To date, the field has been dominated by the "Libet experiment" (Libet et al. 1983). In this experiment, participants are asked to make a simple voluntary action, such as a key press, whenever they feel like it. Brain activity is measured throughout, originally using EEG and more recently using fMRI (Lau et al. 2004). At the same time, they observe a rotating clock hand and are asked to note the position of the clock when they first experience the conscious intention, or "feel the urge," to press the key. This hotly debated marker of volition is referred to as W (judgment of will, following Libet's terminology). EEG activity over frontal motor areas began 1 s or more before movement (the so-called "readiness potential" [Kornhuber and Deecke 1965]), while W occurred much later, a few hundred ms before movement itself. These findings raise important questions about the brain events that initiate voluntary actions and their relation to consciousness. (404)

In 2008, while imaging subjects' brains, Soon et al. predicted whether subjects would press a button with their left or right hand *up to ten seconds before* the time the subject said they chose to do it (60 percent accuracy with twelve subjects). Some people argue that these results show that the conscious mind is thus an epiphenomenon, rationalizing actions that the body or the unconscious has initiated. One of the researchers, Patrick Haggard (2011), says, “the current work is in broad agreement with a general trend in neuroscience of volition: although we may experience that our conscious decisions and thoughts cause our actions, these experiences are in fact based on readouts of brain activity in a network of brain areas that control voluntary action” (404).

In other words, voluntary action is controlled by “brain activity”—presumably meaning “mechanistic” processes of the brain, not subconscious mental activity. He goes on to say, “It is clearly wrong to think of [the feeling of willing something] as a prior intention, located at the very earliest moment of decision in an extended action chain. Rather, W seems to mark an intention-in-action, quite closely linked to action execution” (404). In other words, there is a complex of activities that lead to an action and conscious awareness of the decision. The experimental evidence seems to indicate that the conscious awareness of the decision is quite late in that chain.

Many thinkers have interpreted this experiment to mean that our free will is an illusion because the conscious mind is aware of the decision after the action is put into effect. But Haggard puts his finger on the issue: it’s wrong to think of willing as *merely* the result of the conscious decision to do something. That’s because the *person* is *not merely his conscious mind*. Instead, we can take an organismic approach to the results of these experiments by seeing that *the decision is a function of the entire organism*. The conscious mind is an essential aspect of that system since in the experimental situation, the subjects have to be consciously aware of what they’re supposed to pay attention to and how they should respond in order to perform the requested decision and action. The fact is, the organism, through its needs and its dynamic equilibrium, initiates an action to fulfill the needs. The conscious mind is a *part* of that process. And perhaps that’s what Haggard means.

The *importance* of using one’s whole organism to make a judgment is demonstrated by Antonio Damasio’s patient, Elliot, described in *Descartes’ Error: Emotion, Reason, and the Human Brain* (2005, 34–51). Elliot was a victim of a frontal lobe brain tumor. From life as a financially and socially successful person, Elliot had descended into a disastrous set of choices after his operation to remove the tumor, which led to him ending up in the neurological institution in which Damasio worked. Elliot’s reasoning was perfectly intact, but he could not make decisions about what actions to take in his life because, Damasio discovered, Elliot’s conscious mind was cut off from his feelings.

In my view (see Enright 2002), Elliot was cut off from crucial parts of his subconscious and his integrated organismic valuing process, his life *system*. Reasoning and judgment require access to the data, ideas, conclusions, needs, and values in the nonconscious parts of one’s being. It is why we cannot rely on conscious deductive reasoning *alone* to form good judgments and conclusions; it must be combined with a careful awareness and examination of all our thoughts and feelings.

A good judgment about any course of action incorporates material from memory and experience integrated by the subconscious as well as awareness of bodily feelings and needs that are relevant. When one does not incorporate one's subconscious material in a judgment, but merely decides via deduction from premises, one makes a *rationalistic* judgment.

For example, Oliver and Simon have both read Rand's novels and essays and believe that her philosophy is true. But Simon also thinks that living in anarchy is a good way to live because thereby one is free to live entirely by one's own judgments. However, Rand argues that the right way to live is in a society structured by laws protecting individual rights; anarchy would descend into the chaos of warring factions. Oliver deduces that Simon is evading the truth to believe in anarchy because Rand made her argument so clear that any rational person *has* to agree, especially one who knows the rest of her philosophy.

Oliver is making a rationalistic judgment because its structure is: X is true, therefore the only way to believe in non-X is to evade the truth of X. His reasoning does not take into account that ideas of politics result from a large system of long complex chains of reasoning, knowledge, and experience of human behavior, so there are many ways by which people can reasonably disagree.

Again, life is a system that is constantly striving to keep itself in a steady state to live. Consciousness is a part of that and we can only correctly understand life's elements in that context.

Free Will and the Inanimate Universe

A rather startling implication of free will is that *nothing in the universe is determined*. Free will is the human ability to control attentional processes, thereby enabling control of much else in mind and body. And because of *this* ability humans can affect the course of the inanimate, thereby enabling the inanimate to have an open-ended course of action, not a determined one.

For example: The way in which the green billiard ball hits the red one causes the red to fall into the table pocket, apparently determined by the laws of force and motion. And it's true that the actions of the two balls can be understood as a result of those laws, *given a set context*. But if I choose to reach out and touch the green billiard ball, I can change its course. Therefore, the motion of the balls is *not determined*; they are *caused*, that is, acting in accordance with the natures of the entities acting. My point is that our free-will choices can change the direction of the universe by rearranging inanimate matter. In fact, *we do this all the time*. An essential, life-maintaining human characteristic is the ability to rearrange matter to fulfill our needs by producing materials for our needs.

Another startling implication of these facts, as my inimitable husband, John Enright, said, “if free will exists, its potential has existed since time immemorial.” The potential for *free will has always existed*.

Summing It All Up

1. With the arrival of living things on Earth came a new form of existence, one that follows the laws of physics and chemistry but demonstrates further properties of matter and energy not revealed in inanimate objects (what are often called “emergent properties”).
2. Life’s physical form is a system: A complex of elements in mutual interaction, specifically a complex of hierarchically arranged elements in mutual interaction forming a dynamic, open system which, by the system’s actions, maintains the existence of the system.
3. Life is always organized hierarchically and acts to counter the entropic forces of the inanimate; evolutionarily, it has developed in increasingly complex hierarchies.
4. Living beings have properties and processes beyond those of the inanimate, *as a result of* their organizational structure or form.
5. Life is action, a process that perpetuates itself.
6. The living systems’ internal order—their *organization*—enables them to take actions to maintain their existence (survival and reproduction); to be alive is to self-maintain and self-generate, that is, to internally originate and direct action.
7. Living systems are the opposite of entropic; they are open systems that import material from their environment to maintain and further their own structures and systems.
8. Life has degrees of freedom in how it may act and interact, depending on its dynamic needs; the amount of freedom depends on the particular living system.
9. Their freedom enables living systems to be dynamic, perpetuating themselves by maintaining a steady state, meaning, the organization is maintained despite numerous, ongoing, irreversible processes by constantly changing their actions and composition to keep themselves in the steady state. This applies to all levels of life, from the most automatic function of the organelle to the highest human mental states.
10. Their degrees of freedom allow living things to be not only adaptive but creative in their response in pursuit of their needs and goals, changing

their structures and actions in the direction of increased complexity of forms, contra entropy.

11. The very essence of life is creativeness: the ability to take elements of the universe and rearrange them to grow and maintain the particular life system of the particular organism.
12. Evolution, consciousness, free will, and human mental creativity are more complex expressions of life's basic ability to creatively direct its action to maintain itself.
13. Consciousness arises as a result of animal existence and its need to use locomotion to obtain food.
14. Awareness in all its forms (leading to what we usually call "consciousness") is an evolved, complex relationship between an animal and its environment.
15. Awareness/consciousness is the relationship between the body of a certain organism and the world through the processes of the cognitive organs (sensory and neurological), and answers the question: what type of naturalistic thing is consciousness?
16. The principle of "steady state" is a key to objectively identifying those needs and actions necessary to maintain the mind.
17. Meaning is the awareness of the relationship of some aspect of reality to the organism's goals.
18. Life as a process of self-sustaining and self-generated action is an end in itself; therefore, the meaning of life is to live and to experience one's power to live. Life as the being and the doing, the ultimate end in the universe.
19. Free will is a further evolution of life's ability to direct its action; it is the human ability to direct their awareness.
20. *These properties and processes, this ability to self-maintain and self-generate, is the naturalistic source of value and meaning in the universe.*

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NOTES

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1. Spirit in the naturalistic, not supernatural, sense of awareness combined with a valuing capacity that creates desire and the vitality of action.

2. Thanks for this point to John Enright.

3. Whether the universe is a closed system seems to be an unanswered question to me in the sense that the universe is timeless and we don't definitely know of its extent—how does "closed system" apply?

4. Reductionism sometimes takes the view that only matter and energy exist. However, it's clear that relationships and processes between matter and energy exist; in fact, we know of no matter that exists without being in a relationship (spatial being one of the most fundamental). That implies that relationships are as fundamental as matter and energy because, while you can't have relationships without matter and energy, likewise matter and energy are always in relationships.

And this fact is critical because the arrangements and relationships between material objects give rise to other arrangements, processes, and relationships, all of which exist likewise. They "emerge" from the different arrangements of matter and energy, as new phenomena. Life is one honking major emergent phenomenon, that is, the ability for certain arrangements of matter and energy to sustain and generate their continued existence in a certain form by their own self-initiated action (there are more technical aspects to life, but I think this is the essence). And, in this view, life has causal power: living things can change the world around them and change themselves. They act toward ends, although we don't exactly understand how, but that is fundamental to being alive, for example, acting to keep themselves in existence.

5. An interesting fact about this tendency is that humans feel the necessity to imagine supernatural consciousness to explain and give grounding to order, values, purpose, and meaning rather than recognize the inherent order, values, purpose, and meaning as a naturalistic part of the universe. They're wedded to their imagination rather than their direct observations and conclusions partly *because they're so confused by material reductionism.*

6. Although some causation is so easily abstracted that older infants and toddlers recognize it, for example, the fact that objects fall from a height (think of the infant throwing things off her high chair tray—over and over and over—demonstrating the principle by induction).

7. Rand solved this problem with her explanation that abstractions are the integrated awareness that a characteristic, aspect, relation, etc. exists in many things but in different amounts. As she says, our awareness recognizes them with their *measurements omitted*. The Chihuahua and the Great Dane both possess the characteristics of dogness, but in different amounts. We mentally separate these characteristics from the individual dog and ignore their amounts and integrate them into the idea of dog.

8. I'd like to ask anyone who makes a philosophical argument against the validity of induction: if induction is impossible, why are you talking? Wouldn't it be more honest to say that you don't know how it works, but clearly it does? Otherwise, how could you be communicating at all?

9. Henri Bergson expressed the idea of a universal vital force in his 1907 *L'Evolution Creatrice*.

10. What Aristotle here means by "the divine" is much debated (see, for example, Gabbe 2020), but could be interpreted as the highest, most important ends—most "sacred" in a non-supernatural sense.

11. As Davidson (1983) said, "He [Bertalanffy] may be the least well-known intellectual titan of the 20th century." There's some question, however, as to whether Bertalanffy was dropped from view and reference because he cooperated with the Nazis during World War II after U.S. authorities required him to return to Germany.

12. Such a denial is ridiculously ironic to me because if there is no consciousness, who/what is doing the denying? By what means? This entire philosophical position boggles the mind.

13. Feynman's description in full reads:

> As the drop of water evaporated, over a time of fifteen or twenty minutes, the paramecium got into a tighter and tighter situation: there was more and more of this back-and-forth until it could hardly move. It was stuck between these "sticks," almost jammed. Then I saw something I had never seen or heard of: the paramecium lost its shape. It could flex itself, like an amoeba. It began to push itself against one of the sticks, and began dividing into two prongs until the division was about halfway up the paramecium, at which time it decided that wasn't a very good idea, and backed away. So my impression of these animals is that their behavior is much too simplified in the books. It is not so utterly mechanical or one-dimensional as they say. They should describe the behavior of these simple animals correctly. Until we see how many dimensions of behavior even a one-celled animal has, we won't be able to fully understand the behavior of more complicated animals. (1985, 75–76)

14 . I suspect Cockell (2018) may have read Arthur Koestler, even though he does not cite him in this book, because he says, "The protons sitting outside the membrane have a Janus-faced quality: not only are they at a higher concentration of charge on the outside of the membrane . . . and the higher concentration of actual protons themselves . . . creates this powerful gradient . . . called *proton motive force*" (148). Koestler used the Janus-faced image of the god of the New Year, looking to both the past and the

future (Koestler 1967, 47–48), as a key image to illustrate his "holon" concept of functioning biological hierarchies (45–48). It's unfortunate that his conceptual work in this area has been largely ignored as he brings us a step closer to understanding how biological systems work. According to Koestler, holons are self-reliant units that possess a degree of independence and can handle contingencies without asking higher authorities for instructions—that is, they have a degree of autonomy. These holons are also simultaneously subject to control from one or more of these higher authorities. The first property ensures that holons are stable forms that are able to withstand disturbances, while the latter property signifies that they are intermediate forms, providing a context for the proper functionality for the larger whole.

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