CHAPTER 1

The Keys to This Book

We begin with a vignette drawn from a single activity of just one from among the millions of species with whom we share the earth. This description is taken from the biologist, novelist, and science philosopher, E. L. Grant Watson, who in turn is compactly summarizing observations by one of the world's great entomologists, who lived during the late nineteenth and early twentieth centuries:

Box 1.1

The Enigmatic Wisdom of the Potter Wasp

"Among the fascinating stories of animal life told by the French naturalist Henri Fabre is that of the [potter wasp] *Eumenes*. The fertilized female builds a little domed house of sand spicules on some stone or rock foundation. The foundation ring is traced in minute pebbles. On this she builds a series of concentric rings, each diminishing in circumference, so as to enclose a domed space. At the top she leaves a hole. She then begins collecting certain species of small caterpillars. She stings these into a partial paralysis, but does not kill them, for they will be needed as fresh meat for the young she will never see.

Figure 1.1. An unidentified species of *Eumenes*.[1]

"When the wasp has collected either five or ten caterpillars, she prepares to close the dome, reducing the size of the hole. She now goes through a complicated process which would seem to indicate foresight on her part. Yet she has no foresight, only a highly developed instinct. From her ovipositor she excretes a juicy substance, working it with her legs into a narrow, inverted cone. With a thread of the same substance, she stitches the cone to the top of her domed building. Into the inverted cone, she lays an egg. She then seals up the hole, leaving the egg safe within the cone, suspended on a thread. This done, she goes off and builds another dome to repeat the same cycle of events.

"In a short time the egg hatches into a tiny, white grub, so helpless and delicate that if placed among the still-living caterpillars on the floor of the dome, it would inevitably be injured. In its cradle it is safe. When hungry it spins a thin thread of its own, on which it descends and takes a bite of caterpillar. If the wriggling caterpillars appear threatening, it can retreat up the thread, and

wait. In this way the grub spends its infancy; but, as it grows stronger, it risks a final descent, and devours, at its leisure, the still living food that mother has so satisfactorily provided.

Figure 1.2. Nest of a potter wasp on top of a concrete wall.[2]

"From the domes that contain five caterpillars male wasps emerge; from where there are ten caterpillars, the larger female wasps. This raises an interesting question: Does the amount of food determine the sex? The mother wasp, who appears throughout her lifetime as a highly nervous and brilliantly alive creature, has built just the right sort of houses for the offspring she will never see; and has provided just the right amount of food. She is singularly well-adapted for her life; she stings the caterpillars just enough to keep them quiet, but not enough to kill them; she packs each dome with the right amount of food for male or female grub. The suspended cradle protects the tender infant from the rough reactions of the caterpillars while being eaten. Everything is in order, and as the emerging wasp dries her wings in the summer sunshine, she must surely feel that God is in his heaven, and all is well with the world. The caterpillars might harbour different sentiments …" (Watson 1964, pp. 85-86).

And so (focusing on the wasp's offspring) we picture in our imaginations a minuscule creature, with the nascent intelligence of an insect newly hatched from its egg, immediately setting out upon a journey by descending an almost invisible, yet reliably strong thread, spun (surely it knows not how or why) by itself — all *because* it needs a bite of food. And it then quickly retreats back up the thread (itself a remarkable feat) *because* its existence is threatened by larvae far more massive than itself.

That word "because" — *due to the cause of* — is central to a science always concerned with the causes of things. But the usage here, referring to a creature's *need* and its *effort to preserve its own existence*, is as far removed from the word's preferred scientific employment as the little drama of the potter wasp's performance is from the events of the nonliving world. Inanimate phenomena are not characterized by need, effort, or a drive toward self-preservation.

The seemingly unbridgeable difference between living beings and inanimate phenomena is not something many scientific students of life are fond of. That is why they have invested heavily in an abstract evolutionary drama of nearly miraculous character in order to explain the difference away. As Lila Gatlin, a prominent biochemist, mathematician, and shaper of evolutionary theory in the twentieth century, once acknowledged, "The words 'natural selection' play a role in the vocabulary of the evolutionary biologist similar to the word 'god' in ordinary language" (quoted in Oyama 2000, p. 31). In effect (as we will see in later chapters), the organism's living wisdom has been transferred to an omnipotent "force" of evolution, where it can be kept safely out of sight, obscured behind an elaborate technical and mechanistic terminology.

The story of the potter wasp will strike most people as truly amazing. What is not so often

realized is that we can discover more or less the same improbable story in all biological activity once it is investigated deeply enough. Whether we are talking about DNA damage repair, or cell division, or the cell's timely and spatially patterned production of subtle protein variants distinct from anything for which there are unambiguous "instructions" in genes, or the development of any complex organism from a single cell toward maturity, or the annual round trip that migrating arctic terns make from pole to pole, or the endlessly variable and often bizarre reproductive strategies of plants — in all such cases we encounter an intricately organized wisdom that doesn't align well with the restricted explanatory resources available to the contemporary biologist. We do, however, find in the literature many celebrations of the logic of natural selection and how it is supposed to explain everything about life without any problem.

An aim of this book is to recapture the drama of life in the place where it actually occurs — not in the "mechanism" of natural selection, but in organisms themselves — and then to lay bare as clearly as possible the failure of the reigning evolutionary theory to explain the special qualities of that drama. This will be a matter of showing that, in a primary sense, the life of organisms explains evolution, rather than being explained by it.

Meanwhile, all may agree that our wonder at the potter wasp's behavior is perfectly natural. And we can rightly be confident of the further marvels we would encounter if we looked into the wasp's mating and reproductive processes, or inquired how it *perceives* a world and effectively navigates the features of that world. Or how it searches out prey for its young. Or how its body gains and sustains its staggeringly intricate and complex physical form, all the way down to the pattern of its molecular interactions.

We find ourselves woven into a fabric of earthly life that is diverse and luxuriant beyond words, and and is nearly incomprehensible in its wondrous displays. But then, too, there is this: the wasp's capacities, like those of countless other creatures, seem in some regards wholly routine, familiar, and even human-like to us. In fact, they so powerfully remind us of our own skills and intelligence that we are continually tempted to commit the sin of projecting our own sort of experience onto other organisms.

On one hand, no scientist would — or should — say, with anything like the human meaning and feeling of the words, "The potter wasp takes great care to make thoughtful provision for its young". On the other hand, we can hardly avoid our scientific responsibility to ask, "How is it that the performance of the potter wasp so forcibly reminds us of what, in our own evolutionary development, has become 'taking great care to make thoughtful provision for our young'? Could the two kinds of behavior arise from wholly disparate roots in the history of life on earth, despite appearances and despite our common evolutionary origin?"

Perhaps the best place to start answering that question is with a resolve not to compromise any side of the truth merely because we are philosophically uncomfortable with its apparent implications. In particular, we ought not to twist our understanding out of shape due to a historically conditioned revulsion against anything like a purposive dimension to life processes. Nor should we be unwilling to acknowledge the ways in which all organisms behave as more or less centered agents in the world. Nor again ought we to respect any presumed rule in biology that says, with blatant self-contradiction, "Some human traits appearing in our evolutionary history are unnatural and cannot be referred to in a properly 'naturalized' science".

Oddly, those who most eagerly remind us that "humans belong to the animal kingdom"

often seem the ones most reluctant to embrace the flip side of this truth: all animals have arisen within the same drama of evolving life that, we now know, also happened to be in the business of producing humans. If we want to say that humans share in the nature of all animals, how can we then turn around and ignore the obvious implication that all animals share something of the nature of humans?

Here I would like to summarize, ever so briefly, certain themes suggesting what sort of book you are reading:

THEME #1: NARRATIVE

Meaningful life stories are the primary subject matter of biology.

Every organism (In this book I speak primarily of animals) is weaving a life story — or, perhaps better, is actively *participating*, or *caught up*, in a life story, a meaningful narrative. The description of the potter wasp above is one episode in one such story. These stories are future-oriented in a manner roughly analogous to a biographical or historical narrative. That's why so much of biology concerns the *development* of organisms — a word no one would use in the same sense for geological strata or clouds. Biological narratives depict the meaningful activity through which organisms progressively express and realize the potential of their own natures.

These narratives feature births and deaths, both at the cellular and the whole-organism levels. Life is partly founded upon continual death. And yet the course of a life has its own, unbroken unity and wholeness, whereby the imprint and meaning of the past is borne into the future, as anyone who has inherited an abused pet dog or cat well knows. This imprint of the past may or may not be further worked on and transformed.

An animal's life story is composed of innumerable smaller stories (episodes) woven into the overall narrative. And the episodes may in turn be composed of innumerable gestures (micro-episodes?). Life stories and the meanings constituting them seem to have this pure character: the elements of stories are stories-in-small, just as the elements of meaning are never anything but meanings.

A life story is an end-directed, intentional movement from a beginning to an end. This movement is there for us to observe regardless of whether an organism is self-aware and highly individuated — regardless of whether it subjectively conceives intentions for itself in a human-like fashion. The bare fact of *something like intention* is written all over the potter wasp's behavior.

If our scientific understanding rightly teaches us to avoid the all too natural but wrongheaded idea of a "goal" being "aimed at", this should not scare us away from recognizing the full sense of the wasp's performance in its own evident terms, or prevent us from acknowledging the playing out before our eyes of a set of meanings that we can follow with something like the interest we commonly give to a story. The events hold together and flow from a beginning to an end much like a story. We find ourselves marveling at a remarkably apt wisdom — a wisdom we can hardly understand as anything other than a present, moment-by-moment activity of some form of reasoned, more or less conscious, and generally non-self-aware intention.[3]

We need to distinguish between *possessing* one's intentions in the rather free and

conscious way we humans do (when we are fully awake), and being *possessed by* them, which seems to be the potter wasp's case. These are very different conditions, but even the unfree state of *being possessed by* is not a reduction to mere inanimate physical lawfulness. We're still talking about a life story with intentional behaviors, even if the intentions are not fully the organism's own — even, that is, if the organism is not sufficiently individuated to be seen as a potential bearer of its own intentions.

It's worth remembering here how we ourselves can sometimes become aware of meanings and intentions that once lay far below (or above?) our conscious willing and planning, and that therefore possessed us more than the other way around. Whose can we say are those intentions before we become aware of them? It's no easy question, and it presumably has rather different answers depending on whether we are talking about humans or wasps.

Much of what I have just said requires us to acknowledge the organism — and particularly every animal — as a focal *agent*, a being capable of spinning out and inhabiting its own story, and whose causal activity is locally centered and distinct from the more general regularities we observe in the inanimate world. At the same time, every organism is interwoven with that inanimate surround, whose substance and reliable lawfulness it makes into a means for its own existence and self-expression.

THEME #2: INTERIORITY

Every animal's life narrative is an outward expression of interior meaning.

It may be that when humans communicate, there is nothing (apart from certain instances of spoken and written language) more richly and specifically informative than the expressions of the human face. Much of our life is shaped and guided by the facial expressions all around us. What these expressions tell us, however, cannot be reduced to the physical-causal terms of facial musculature, skeleton, and flesh. That which bears the expression is indeed outward, material, and physically lawful. But what is expressed is, we can reasonably say, *interior*. Sadness, pensiveness, elation, doubt, anger, vexation, impatience, uncertainty, satisfaction — these are not physical entities. Or again: while the material embodiment of what is expressed is both real and spatial, what is expressed *through* the outward manifestation is real and meaningful, but not spatial. So the word "interior" is problematic; it suggests a spatial relation, whereas I am using it to suggest something like "not *out there* in a sense-perceptible or spatially locatable sense".

Of course we do, in a sense, "perceive" the interior. We look through and by means of faces as material manifestations in order to see the interior meanings they are expressing. It is much the same with spoken words, whose interior meanings are not revealed so long as we are noticing the words only as sense-perceptible sounds. We are "hearing through" the sounds when we grasp their immaterial and interior meaning.

It is not altogether different when, gazing through a microscope and conducting molecular assays, we "watch" a cell carrying out its *intention* to divide. But the quote marks here are meant to indicate that we're not really directly perceiving intentions or any other interior phenomena with our physical senses. We have to add an interpretive activity — the "seeing" through or "hearing" through — to the immediate physical reports of our eyes and ears. Anyone

who thinks this interpretive activity carries us dangerously away from scientifically verifiable reality should cease attending to human language, including the language of scientific description.

As I have already indicated by mentioning the cell, it is not just humans who possess interiors. All living performance expresses one or another form of interiority. In our own case: if I walk through a campground looking for a source of drinkable water, what I am doing can never be captured by what we think of as a purely physical description of the movement of my legs and arms, vocal apparatus, and so on. So, too, with an animal engaged in anything we would call "behavior". The meaning of the behavior — whether a courtship ritual, or burial of food, or tracking of a scent, or flight of a hawk, or the digging of a burrow — can never be described in strictly physical terms. We are always watching an unfolding interior narrative expressed through the outward, physical "face" of events.

Further, as I will try to suggest throughout this book, even our descriptions of cellular and molecular "behavior" refuse to be altogether cleansed of interiority. When we look at cellular goings-on, we can always recognize a *meaning* or an *end*, a *task* or a *function* — what a biological activity is *about* (for example, synthesis of needed proteins, or extraction of usable energy from a substance) — and our biological inquiries are guided by our curiosity about this meaning. We may want to learn, for example, how a particular kind of cell pulls off cell division, or how the mammalian circulatory system meaningfully adjusts to cold weather or high altitude.

A dramatic fact about contemporary biology is that biologists seem to have a horror of interiority, or the non-spatial and non-sense-perceptible. Given that the *life* of animals is through and through an interior business, this horror is not only perplexing, but also devastating for the prospects of a truly biological science.

If there is one central theme of this book, it is that we need to leaven every biological topic, from gene regulation to respiration, blood circulation, and animal behavior, with an understanding of interior meanings. This will lead us to talk about intentions, purposiveness, wisdom, intelligence, agency, needs, and interests, all of which are implicit in nearly all biological description. Yet that description is badly distorted by the undisguised horror of interiority and the attempt to substitute purely physical terms for the interior dimension of life.

Making this point is my primary aim in this book. I am not looking for dramatic new discoveries in biology. I am saying, "Look how all biology is transformed if only we overcome our antipathy toward interiority and acknowledge what is right in front of us". And, in fact, the acknowledgment is already implicit whenever we are doing biology as opposed to physics and chemistry. It is simply not possible to talk about the extraordinarily complex process of DNA repair without taking into account, however subconsciously, the fact that the cell is *attempting as best it can to perform the difficult task of DNA repair* — and must somehow, in some terms, possess the necessary knowledge of health, the practical skill, and the persistent intention required for the task.

Rocks don't have intentions of this sort. How do organisms come to differ from rocks in this matter? And why are we not in a state of wonder about the whole business? This tells us a good deal about how blasé we've become about fundamental issues in biology — and also how we are so intimately aware of the nature of living things that we can't help taking their true nature for granted even when we have been intellectually swallowing absurdities about the non-

living character of life. And it may also remind us how many biologists are convinced that natural selection has solved all mysteries such as this difference between rocks and organisms. (See "The shortest path to confusion is circular" in Chapter 18, "Teleology and Evolution".)

The idea of interiority not only overlaps that of narrative (a story is an interior reality), but also that of holism, as we will now see.

THEME #3: HOLISTIC PORTRAYAL

The meaningful, narrative character of life demands its own, holistic style of understanding and explanation.

If the organism's life, its biological existence, takes *narrative* form, then our characterization of its life — contrary to conventional notions of explanation — must also take a narrative form. And it could hardly be clearer that the elements of a story, like the elements of an organism's life, can never be considered adequately in isolation from each other. Nothing is absolutely distinct from everything else. The end of a really great novel will be illuminated by its beginning, and the beginning by the end. This interwovenness of interior narratives amounts to a kind of holism, and in this respect a narrative might far more appropriately be compared to a portrait that captures a subject's essential being than to the analysis of a machine into discrete parts and causal relations.

How, in fact, do we come to understand any context of meaning — a dance, a painting, a novel, a human life, the choreography of a developing embryo? Johann Wolfgang von Goethe noted the impossibility of capturing an "inner nature" — say, a person's character — in any kind of direct causal or explanatory way. "But when we draw together his actions, his deeds, a picture of his character will emerge" (Goethe 1995, p. 158). That is certainly how we try to understand each other — and we, too, are organisms.

Our knowledge of the character of wholes is not impotent. If I familiarize myself with the distinctive way of being of a bluejay, I may not be able to predict exactly what it will do or project its flight as a Newtonian trajectory. But my knowledge is nevertheless real. I will, in appropriate circumstances, be able to say, "Yes, that is just like a bluejay" or "No, that is not at all what one would expect of a bluejay in this situation. There is something wrong, or something missing from the picture". With such knowledge I can learn to interact meaningfully with the bird even though I cannot mechanistically predict its behavior. In developing a qualitative portrait, we aim less at exact prediction and control than at understanding and the potentials for working with nature.

The main question about a portrait is how full, how detailed, how multi-faceted a picture we gain. The supposed causes, of course — when properly contextualized and shorn of their strict causal aura — help us to build this picture. There is neither any end to our picture-building, nor an inherent limit to how far we can carry it. And biologists surely *are* carrying it further, even when they think they are fingering clear-cut, explanatory causes.

Moreover, it is clear that we cannot have holism without also applying the remarkable analytical skills that we humans have so fruitfully gained. It is hard even to conceive how one might sketch an organic whole without having a lucid and detailed awareness of its parts. The need is to hold together the complementary movements of thought — the synthetic (holistic)

and the analytical.

And, in fact, the meaningful counter-movement to analysis is inescapable — although generally not noticed for what it is. After all, in order to analyze a whole into parts, we must start with an already recognized whole, and then we must recognize each part as possessing a significance of its own — as being a meaningful whole in its own right. This recognition of wholes, however unconscious it tends to be, is fully qualitative, contrary to our usual ideas of science, and it requires a movement of understanding that runs contrary to analysis. I say "fully qualitative" because only qualities can blend or interpenetrate so as to erase the rigid boundaries and mutual "otherness" of things.

The synthetic, or holistic, counter-movement to analysis is implicit in the biologist's frequent citing of the "context-dependence" of biological processes (Chapter 6, "Context: Dare We Call It Holism?"). The problem is that the implication here — the implication that there is a kind of influence or causation running from a collective, complex whole toward its parts — has drawn little reflection and has had little effect on the underlying assumptions of biologists. "Context" is a word commonly used by geneticists and molecular biologists. But it seems there is little interest in explaining what one actually means by the term.

"Holism", by contrast — and despite its being hardly distinguishable from "contextuality" — has become a kind of "devil word" in biology, a fact ironically coexisting with a refusal to consider the issues implicit in current, context-centered biological language.

In this book "holism" will simply be taken for granted from the beginning. But, unlike "context-dependence" in the existing literature, the meaning of "holism" will be consciously and explicitly drawn out and illustrated as we go along.

THEME #4: BLINDSIGHT

A kind of blindsight is evident in much of biology.

Living narratives, as observed, for example, in all animals, are in fact recognized within biology. For example they provide the structure for research projects. These typically have to do (as I mentioned above) with how an organism accomplishes this or that function, or *task*, such as obtaining food, or maintaining bodily temperature at an acceptable level, or, in the case of many cells, achieving cell division. (Rocks and streams do not have tasks.) But something rather like a taboo seems to require biologists to ignore all this in their scientific explanations. They are allowed to discuss only physical "mechanisms" that make *no inherent reference* to — and therefore do not explain — the task-nature of the problems that prompted biological inquiry in the first place.

This might bring to mind the curious and well-known phenomenon called "blindsight". It works like this. Suppose there is a certain life-sized statue on the floor of a museum I am exploring. If, for some reason, I suffer from blindsight about the statue and am asked about it, I might truthfully reply, "What statue? I don't see one." But then, in wandering about the room, I am observed always to walk carefully *around* the statue rather than bump into it. Clearly, in some sense I do see it, even while remaining consciously unaware of (and even denying) what I see.

My suggestion, then, is that something analogous to this phenomenon works powerfully

within biology today. Biologists carefully walk *around* the fact of the animal's narrative agency, even while pretending in their explicit theorizing that nothing is there. Yet every biological question they ask ("How does an organism accomplish this or that?") affirms their *knowledge* of this agency. One result is that much about the true character of animals (and organisms generally) comes through in the biological sciences despite the biologist's explicit denials. Bringing attention to the great mass of obscured truth already "seen", if only blindsightedly, is a lot of what this book is about.

Nevertheless, because of biologists' blindsighted theoretical and philosophical commitments, their science suffers from the deepest possible distortions. They end up with living processes *theoretically* stripped of their life — this despite the fact that they know this life more directly and intimately than they know anything about the non-living world.

What is needed, according to the late Harvard geneticist, Richard Lewontin, is for biologists "to take seriously what we already know to be true" (Lewontin 2000, p. 113).

Some definitional hints about key biological terms

A number of the terms central to this book, while common in normal human discourse, are foreign to conventional biological usage. The strangeness in this, I dare say, is on the part of biology rather than this book. In general, I try to employ the following words in agreement with their routine, non-technical use, and not to tie them down with overly artful precision. I hope that the meanings will become more specific — or more flexible — based on their various contexts of use.

Agency. Humans are agents. We possess agency because we possess an awareness of our world and can *act* in it instead of merely *being shuffled around* along with the furniture of our surroundings. We help to create the situations in which we live, instead of being wholly determined by them. The cells of our bodies clearly can participate in our agency by giving expression to it, as when we move our limbs intentionally. But we would never say of those cells as such that they possess awareness or agency in their own right, as opposed to moving with an agency not fully their own. This is suggestive of the kinds of distinction we must make between ourselves and other organisms, all the way down to single-celled organisms.

I know of no reason *not* to believe that, just as the intention of a human individual can play through trillions of cells, so also, though perhaps in a somewhat different manner, an intention can play through a collection of bacteria in a bacterial film (evident, for example, in "quorum sensing"), as well as through the members of a termite colony, or any species at all so far as its members share a common way of being — and indeed in human society in ways of which we are scarcely conscious.

Agency does not arise from physical interactions among the parts of an organism. Rather, the purposive coordination or organization of such interactions is an expession of agency. The distinction between these two ways of looking at the matter is not often enough

appreciated. Nothing about physical laws connects with or supports our understanding of the biological *striving* we so readily observe. This is why the biological literature is awash in references to "emergence", a rather magical term referring to features of life that are thought to "just show up somehow", without specific reference to lawful process.

See also **Intention/intentional** below.

Archetype. The archetypal idea of an organism is its dynamic, adaptive, evolving way of inhabiting, and remaining true to, the character and potentials of its kind. It is simply and obviously not true that the fact of evolution makes a lie of the observable *way of being* (archetype) of any given type of organism.

Atoms/Molecules. You will find comments here and there in this book suggesting something about the unreality of atoms and molecules. The effort is to emphasize that in the submicroscopic realm we are dealing with theoretical constructs that do not have the reality required by a science of the material world — the reality of sense-perceptible experience. The problems arise, as physicists well know, when we endow certain constructs such as *wave* or *particle* with imagery derived from our experience of the material world. Then we are dealing with invented unrealities, and these tend to mock us when we try to make sense of our experiments.

I attempt to show in Chapter 24 that we have little choice but to assume that the reality the world possesses is, according to its own nature, a reality appearing in all the possible forms of *experience*. To make any other assumption is, on its face, to speak ignorantly about *what we do not know from experience*.

Blindsight. See Theme #4 above.

Consciousness. We might say that consciousness is the experience of meaning in an organism's life. Human consciousness can be an experience of meaning of which we are aware. In many other organisms (and in some aspects of ourselves), so far as there is not awareness of the play of meaning, we might speak paradoxically of "subconscious consciousness", or "consciousness of which one is not aware". Or we could switch to *intelligence*, which we can readily imagine as operating without awareness. That is, intelligence can work in us (or an animal), without being *possessed* by us as "our own". Think, for example, of animal instinct or, in humans, the implacable logic of disruptive complexes derived from childhood abusers.

Directive. E. S. Russell, a marine biologist and proponent of "organismal biology" during the first half of the twentieth century, adopted the word "directive", as in the title of his wonderful book, *The Directiveness of Organic Activities* (Russell 1945). He chose this less familiar word in order to encourage in his readers an awareness of the distinctions between human end-directed, or planned, activity and the future-oriented activity of animals such as the nest-building of birds. I will, in part, follow suit, although I will also freely use "directed" or "end-directed" in the conviction that we need to cultivate, not only an awareness of the *differences* between humans and animals, but also of the *connections*.

Biological activity *is* directed in the immediate sense of the word — interiorly and insistently guided in the way the development of a squid or fox or ape is guided from the zygote

toward the adult form. This remains true even though the process is not at all consciously directed in the manner of our own willed activity. For that matter, neither is our own human movement from zygote to adult form consciously directed by ourselves. See also ***telos*-realizing** below.

Holism. See Theme #3 above.

Integral unity of the organism. When I use something more or less like this phrase, I intend it as an active concept in Aristotle's sense of "being at work staying itself" (in Joe Sachs' translation of Aristotle's *entelecheia* — Sachs 1998, p. 245). Through this activity, the parts of an organism arise within an integral and differentiating whole; they are not assembled together as pre-existing building blocks in order to make a whole. The integral unity is actively there from the start, and is not at any point imposed from outside. It is a unity because each part reflects — or participates in and remains consistent with — the nature of the whole from which it arises and gains its identity.

Intelligence. See "**Consciousness"** above.

Intention/intentional. I try to use these words as far as possible in their routine, day-to-day meaning. We recognize intentions by observing the guiding principles and meanings at work in an activity. It needs noting, however, that we humans can intentionally do something not only through careful planning, but also subconsciously ("unconsciously"), as when we notice a traffic irregularity while driving a car and engaging in conversation, despite the fact that we were paying no conscious attention to the road. It is much the same when we ride a bicycle while quite unconscious of any intention to remain upright and balanced on the bike.

We should never ascribe our own, most wide-awake sort of consciousness to other organisms, who seem to function quite well by means of intentions that do not originate reflectively. Also, a great part of human subconscious activity (think of the bicycle-riding example) derives from prior intensely conscious practice. But we can't say the same of, say, a monarch butterfly's participation in a multi-generational migration from Canada to Mexico. So, just as we shouldn't project our self-aware consciousness upon other organisms, neither should we assume that their subconsciousness is the same as ours.

Nevertheless, in all cases of intentional behavior, I'm not aware of any grounds for taking the intentions to be anything other than a function of mind. The difficult question regarding organisms then becomes "Whose mind?" Whose mind accounts for the archetypal or shared way of being among the members of a species? And I did say *difficult* question. Not all questions currently facing us in biology have obvious answers. But it seems to me important for biologists to notice that, in all organic performance, we *are*, in one way or another, looking at the activity of mind as well as body. This remains true even if the organism is not aware of its intentions as its own. Even in some of our human activity we can sometimes recognize a kind of unconscious, collective "supra-mind", not fully our own, taking hold of us in a crowd, as in a football stadium, or in a highly charged interpersonal confrontation.

Interiority. See Theme #2 above.

Material. Accessible through our physical senses.

Material/physical/materialist/materialistic. I speak broadly of "the material world" as the world we routinely experience, the world we live and move in, the world accessible to our senses. "Material" and "physical" might be taken as rough synonyms, but I preferentially use "material" when speaking about the sensible world as we directly experience it and can know it, and I use "physical" when emphasizing the habits of thought that come to the fore when, as *materialists*, we are thinking falsely and *materialistically* about the nature of the world and trying to conceive it purely in terms of inanimate entities and processes conceived as mindless and having nothing to do with our own interiority. So I might say, on one hand, that an organism adapts to its *material* environment, but, on the other hand, that we are commonly thought to live in a world subject only to *physical* laws. But there is no strict line between these terms, and doubtless no full consistency in my usage.

Problems arise because the idea of the "strictly physical" is incoherent: physical laws are ideal and conceptual, not mindless in the sense of "physical" usually taken for granted. My use of the "physical" is a bit schizoid, since I may use it in the materialistic sense ("inanimate, mind-independent"), especially when trying to represent a materialistic point of view; or I may use it in a more neutral fashion as a synonym for "material" ("sense-perceptible").

Please note that whatever is sense-perceptible — whatever is available as a content of science — has an irreducibly interior character. We possess it only as a content of consciousness. Whatever we perceive and whatever we think, we perceive and think upon the stage of consciousness. (Where else might we become aware of these contents?). And we have good reason for thinking that this appearing as a content of consciousness reflects the material world's inherent and objective nature. For more on this, see Chapter 24, "Is the Inanimate World an Interior Reality?".

Meaning. All coherent descriptive content is meaningful, a fact already implicit in the word "coherent". ("Coherent" in common usage just *means* "hanging together in a meaningful way".) Meaning seems to us problematic only because we have materialist mindsets as a cultural inheritance, and because meaning is so thoroughly inescapable, like a fish's watery environment, that we have a hard time stepping back and seeing it for what it is. The sea of meaning is that from which we are born and in terms of which we continue to live and finally die. We cannot do anything or say anything or pursue any science without the doing, saying, or pursuing being an expression of meaning.

Some people have a very difficult time with any use of the word "meaning" in a scientific context. It's worth setting this difficulty alongside the fact that the things we *know* about the world are generally things we try to communicate in words — which is to say, things we try to express in terms of meanings. Meaninglessness (nonsense) would not yield itself to knowledgeable, scientific articulation.

And so meaning can hardly be questioned. The effort to question or define it — or just point to it — assumes that the person being addressed already possesses a working understanding of meaning, such as the meaning of a pointing finger. Acting out or expressing meanings is pretty much the only thing we do with our lives. The same thing is true of organisms generally, all the way down to one-celled creatures — except that they lack the capacity for conscious reflection upon the meanings at work in their lives. The interesting

questions have to do with the different sorts of meaning at work in different kinds of organism.

The fact that we are dealing with the fundamental basis of life when we use the word "meaning" is hardly a reason to avoid it in biology. The (always unsuccessful) effort of avoidance is perhaps the central pathology of contemporary biological thought and practice. In a thousand ways the taboo against any suggestion of meaningfulness makes a fool of scientists and nonsense of their use of scientific language, which is nothing but a highly sophisticated way of expressing the meanings they have discovered in the world (Chapter 23, "The Evolution of Consciousness").

Narrative. See Theme #1 above.

Purpose/purposeful/purposive. We know the routine human meanings of these terms, where "purposeful" and "purposive" are synonymous. As is common in the biological literature, I often use "purposive" to distinguish directive activity in many other organisms from the conscious, self-aware, planned, goal-aimed activity of humans. But I sometimes use "purposeful" when referring to non-human animals, if only to avoid making the human-animal distinction seem absolute or unnatural.

All biological activity is purposeful in a way we have no great difficulty understanding. And we do not require all that subtle an understanding in order to realize that animals in general are not reflecting upon or planning their activity in the self-aware way we sometimes do. Perhaps we can be aided in understanding an animal's purposes by considering the "purposes" of our own cells in carrying out the intentional movements of our bodies. We would not want to say that the cells have purposes of their own in anything like the whole-human sense. But so far as they are capable of being caught up in our purposes and giving perfect expression to them, they themselves clearly have (or have been lent) a kind of purposive character.

***Telos*-realizing.** *Telos* ("end") is often taken to refer to final causation — to the *end* we humans are aiming at when we consciously formulate plans. But, consistent with the Greek term, it may be more useful to take the "end" as a matter of *self-realization*, which is the "being at work remaining oneself" referred to under **Integral unity of the organism** above. Or, we might say, "being oneself ever differently". It's a matter of bringing oneself to ever fuller and ever different expression — taking always a further step in expressing one's own nature. Only in the human case does this involve a creative awareness whereby an action can become intimately *our own*.

Regarding the ideas conveyed by "end", "self-realization", and "holism", we have this incisive comment by the philosopher Ronald Brady: An organism's biological development "does not proceed towards [a] whole, but rather *expresses* it" (Brady 1987). From the very beginning of its life, it is already a whole. It is, however, hard to find words that capture the meaningful coordination of processes in the achievement of a certain result without seeming to imply an external goal. The alert reader will need to make an inner adjustment whenever encountering language that sounds external-goal-directed (unless the language refers to humanly planned activity).

See also under **Directive** above.

Where is the evidence? Two concluding notes

The preceding discussion, especially that of Themes #1 and #2, underscores a truth that is alien to contemporary biology: *We meet in the living world something akin to our own inner being.* However, everything I have hinted at here desperately needs expansion, which is why this book was written.

But while the themes and underlying convictions shaping the character of the book lie far outside mainstream thinking, I offer no new or revolutionary findings in biology or evolutionary theory — and would lack the qualifications for doing so even if that were my inclination. Instead, I merely ask: What would biology and evolutionary theory look like if we overcame our blindsight and reckoned with the stories we actually observe in the life of organisms? Can we allow ourselves to see with restored vision?

And so there will be no occasion for readers to ask, “Where is all the new evidence?” The evidence supporting my contentions here — as I try to show chapter by chapter — amounts to just about *everything* biologists have already recognized as truth, however much they might prefer not to acknowledge the gifts of their own insight. This is why you will not find me straining toward the fringes of biology, but rather citing, with very few exceptions, one fully accredited researcher and theorist after another. The case for a thoroughly disruptive re-thinking of organisms and their evolution has long been staring us in the face.

A second note is not unrelated to the first. Throughout this book I have, to a degree, tuned my vocabulary to the more complex animals with which we are most familiar, although the language could readily be adjusted to reflect the intelligent life processes in bacteria, plants, and other groups. Many will say that this is to ignore what are by far the most abundant creatures on earth. Perhaps so. But I am convinced that, contrary to the usual intuitions, the “higher” organisms are key to understanding the “lower”, not the reverse.

This is true in the indisputable sense that the kind of understanding we are looking for emerges only in humans, so that we are the *only* organisms capable of understanding other beings in a scientific manner. But I believe it is also true in the sense that those organisms more fully manifesting the potentials of life do in fact *more fully manifest the potentials of life*.

At the same time, we have no reason to think that the intelligence working through the material limitations of, say, a bacterium is a “lower” or less capable intelligence than that which is at work in ourselves — or that the intelligence at work in the cells of our own bodies is lower than what works in our conscious minds. Actually, our cellular intelligence quite evidently far transcends our conscious capacities. We can say this without doubting that the arrival of a self-aware sort of consciousness is a pivotal development in the evolution of life. It’s just that we have no grounds for arrogance regarding our current conscious achievements. These achievements are, in the overall context of life on earth, humble indeed!

Notes

1. Figure 1.1 credit: Rama Warrier (CC BY-SA 4.0).

2. Figure 1.2 credit: Pollinator (CC BY-SA 3.0)

3. It is so easy to forget that the implanted “wisdom” — a wisdom from the past — that we so easily ascribe to an unconscious machine always has its origin in a prior, conscious, designing activity of a person. And the manifestation of that wisdom in the machine is radically different from its immediate presence in whatever sort of consciousness acts *now* in a living being. Organisms are not designed machines. This truth is underscored time and again in the following chapters. Our construal of organisms on the model of machines — a construal that so much current biological thinking shares with so much intelligent design theory — needs to be overcome.

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