CHAPTER 16

Let's Not Begin With Natural Selection

Evolutionary theorists tend to become frustrated when many of the rest of us fail to "get" the revolutionary and convincing simplicity of natural selection, the supposedly primary engine of adaptive evolution also known informally as "the survival of the fittest". For example, Niles Eldredge, a paleontologist and, for several decades, a curator at New York's Museum of Natural History, has wondered, "Why do physicists, who have the reputation of being among the best and the brightest, have such a hard time with the simple notion of natural selection? For simple it is". He then quotes the familiar passage from Charles Darwin:

> As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring Struggle for Existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*.

"The concept", Eldredge writes, "is definitely simple enough. This description of natural selection may be a bit longer than the elegantly brief F=MA [force equals mass times acceleration — Newton's second law of motion]. Conceptually, however, it is hardly more complicated" (Eldredge 2000, pp. 89-90).

The simplicity of what is being promulgated as "natural selection" can hardly be doubted. In his landmark book on *The Nature of Selection*, the philosopher of evolutionary theory, Elliott Sober, considered it "remarkable that a hypothesis of such explanatory power could be so utterly simple conceptually: If the organisms in a population differ in their ability to survive and reproduce, and if the characteristics that affect these abilities are transmitted from parents to offspring, then the population will evolve" (Sober 1984, pp. 21-22).

The idea of natural selection seems to many so straightforward and conclusive that it forces its way into the receptive mind without much need for evidence. August Weismann, whose importance for nineteenth-century evolutionary theory has been considered second only to Darwin's, rather famously wrote in 1893 that we must accept natural selection as the explanation for the wondrous adaptation of organisms to their environments "because it is the only possible explanation we can conceive".

Further, according to Weismann, "it does not matter" whether we can demonstrate the role of natural selection in particular cases. "Once it is established that natural selection is the only principle which has to be considered, it necessarily follows that the facts can be correctly explained by natural selection" (quoted in Gould 2002, p. 202).

The compelling simplicity of natural selection, according to Ernst Mayr, is so pronounced as to have proven a stumbling block for many. Mayr, whose influential career spanned the entire twentieth-century history of the modern evolutionary synthesis, proposed that "startling simplicity was the most formidable obstacle that the selection theory had to overcome. Students of the phenomena of life found it undignified to explain progress, adaptation, and design in nature in so mechanistic a manner" (Mayr 1964, p. xviii).

Brief summary statements of the simple logic of natural selection abound. In philosopher Daniel Dennett's succinct formulation, "evolution will occur whenever and wherever three conditions are met: replication, variation (mutation), and differential fitness (competition)" (quoted in Lenski et al.). Or, expanding the idea just a little, we might say that evolution is guaranteed to occur under three conditions:

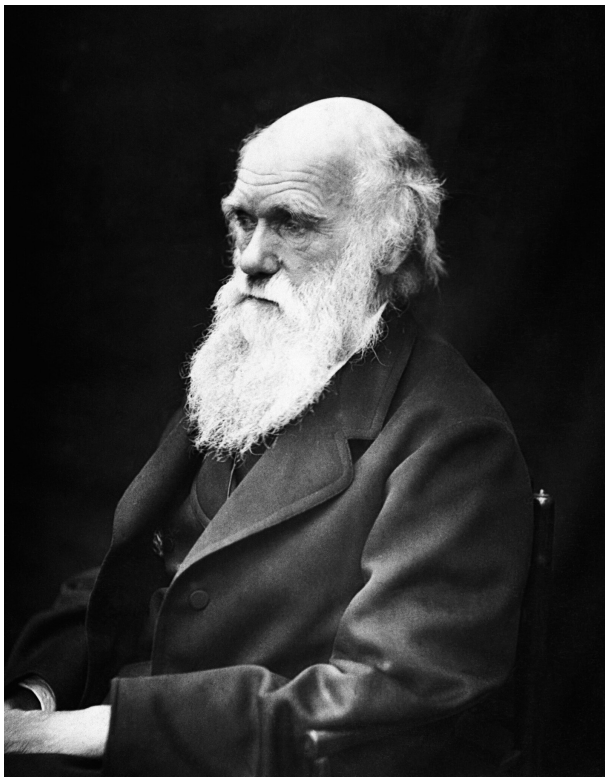

Figure 16.1. Charles Darwin.[1]

- There must be trait *variation* among individuals in a breeding population. Without variation, nothing new could ever come about.
- This variation must to some degree be *heritable*, so that offspring generally resemble their parents more than they resemble others. (This is Dennett's principle of *replication*.) If offspring didn't tend to resemble their parents, then it's not clear how variants, even if they occurred in specific members of a population, could spread through the population as a whole.
- Individuals possessing different variants of a trait must, at least in some cases, exhibit *differential fitness* (or differential survival) — that is, they must produce, on average, different numbers of offspring, whether immediate offspring or later descendents. This is often referred to as the principle of *competition* or *survival of the fittest*. The advantageous adaptation of the fittest organisms is what gives them a better chance of surviving and contributing their fit genes to the descendent population. Similarly, less fit organisms will have a reduced chance of surviving and passing on their genes.

With various terminological variations, that is the textbook presentation of natural selection. According to the influential popularizer (and noted theorist) of evolutionary theory, Stephen Jay Gould, the basic idea has the simplicity of a syllogism. He referred to it as the "syllogistic core" of natural selection (Gould 2002, pp. 125-26n). For Dennett, this core is a "mindless" recipe, or *algorithm*, — one so obvious and universal that it could be derived even without reference to organisms, while nevertheless offering "guaranteed results" in biology. The algorithm is "Darwin's dangerous idea", and it is the key to making sense of everything from the simplest irritable cell to human meaning, cognition, culture, and morality (Dennett 1995, pp. 51, 163-81).

Variation, inheritance, and survival of the fittest: for a certain mindset (well-established in our day), something does indeed seem irresistible and self-evident about the way these

conditions testify to the idea of change. And — Eldredge's obtuse physicists apart — more than enough students of evolution do seem smart enough to "get" the extraordinary power and simplicity of natural selection. The widely read British psychologist and science writer, Susan Blackmore, speaks for many when she says that "evolution is inevitable — if you have information that is copied with variation and selection then you *must* get [quoting Dennett] 'Design out of chaos without the aid of mind'". Blackmore goes on almost rapturously: "It is this inevitability that I find so delightful — the evolutionary algorithm just *must* produce design, and once you understand that[,] you have no need to *believe* or not believe in evolution. You see how it works" (Blackmore 2014).

This cocksureness about the simplicity, universality, and persuasive force of the evolutionary algorithm as an explanation for the complex forms of life we observe seems to know no bounds. It extends, for example, even (or especially) to computationally oriented researchers. In 2003 Christoph Adami, who was then head of the Digital Life Laboratory at the California Institute of Technology, defended the value of trivially simple and non-living "digital organisms" — bits of computer code standing in for genes and living processes — as teachers instructing us about evolution. What we learn, he said, is that the principles of evolutionary theory are "very, very general, and very simple", so that our predictions "don't depend on these little details of molecular biology" (quoted in O'Neill 2003).

It is, we may sense with a certain unease, almost as if actual phenomena become irrelevant to the researcher, who needs only to work out a simple logic.

And our sense of unease only grows when we hear Richard Dawkins discussing how some animals cleverly coerce the behavior of others. For anyone skeptical of his explanation, Dawkins had this word of encouragement: "With natural selection working on the problem, who would be so presumptious as to guess what feats of mind control might not be achieved?" (Dawkins 2008, p. 71). One almost hears an echo of the parent trying to soothe a child's perplexity about some puzzle of creation: "Surely, with God working on the problem …".

And, indeed, over-estimation of the explanatory power of natural selection may be why Darwin's contemporary, the geologist Charles Lyell, accused him of "deifying" the theory.[2] A century later, in 1971, Lila Gatlin, a biochemist and mathematical biologist who figured centrally in developing the conception of life as an "information processing system", could summarize contemporary usage by saying, "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 2000a, p. 31). Such is the power of logical constructions over the contemporary human mind.

No doubt the "evolutionary algorithm" truly is simple, and its logic, as far as it goes, is self-evident. But we might want to keep in mind how thin and unstable is the strip of intellectual real estate between "self-evident" and "vacuous" — especially when we find ourselves preferring abstract logical necessity and simplicity to superfluous "little details" (Christoph Adami), such as the difference between a computer program and the life of a tiger or octopus.

When we allow ourselves to ignore material particulars, we depart from science. We allow ourselves to be moved by the force of a discarnate logic whose "bodily substance" derives from vague and abstract mental constructs rather than careful observation of the world. These constructs reflect the presuppositions and biases of our own untethered minds much more than any truths of the organisms whose lives have disappeared from our thinking.

What are the "guaranteed results" of natural selection?

It may take a while, and it may be rather uncomfortable, to digest the anti-scientific attitudes we have just heard from leaders of science and its philosophy. But recall the substance of it. Apparently dismissing as unnecessary the role of painstaking observation in science, August Weismann declared in "medieval" fashion that what his mind had been able to conceive was "the only possible explanation" for the still largely unknown facts of evolution. Daniel Dennett was sure that it didn't require any knowledge of organisms in order to see the unquestionable truth of organisms under natural selection, an attitude seconded by Christoph Adami, with his blithe disregard of the facts ("little details") of molecular biology.

The decisive truth of the theory of natural selection, it seems, could be spun as pure thought-stuff out of the minds of its devoted theorists, and what their minds conceived in this way was, as Susan Blackmore put it following Dennett, a process that just *must* produce "Design out of chaos without the aid of mind". The hypothesis of natural selection, according to Elliott Sober, married great explanatory power to utterly simple conceptuality. Putting all this together, we might conclude that, with "startling simplicity" and independence from all the complexities of biological fact, natural selection somehow explains just about all the great issues of biology — "progress, adaptation, and design in nature" (Ernst Mayr).

It's as if we were celebrating a recipe by marveling at the extraordinarily simple procedure by which one can proceed through Steps 1 to 5 and, suddenly, behold! — automatically, simply, mindlessly, and guaranteed — a mouth-watering *chicken cacciatore*! And why not? Why not ignore the bothersome details about how all the ingredients came about — how the herbs and spices were grown, where the mushrooms and onions came from, the skills of the chef, how fresh or rotted the ingredients were, and, above all, the life, growth, health, and care (or lack of care) of the chicken. The five steps are all we need to focus on, because we just *know* they must already be the adequate explanation of a delicious chicken dish.

And, of course, they are, depending on how we contextualize them. But, considered independently from their context — for example, from the availability and quality of all the ingredients — we also recognize that they tell us very little about what, if anything, awaits our discriminating palettes.

In order to assess the foregoing claims about natural selection, I would begin by inserting two question marks in the testimonials we have heard. First, there is Darwin's statement: "Any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected".

I would insert my first question mark after the word "vary". Notice how easily the word is slipped into the flow of thought, as if it were wholly unproblematic. *Of course, organisms do vary. We know that.* How easy to forget (like forgetting the provenance of a recipe's ingredients)

that the variation referred to is never the result of anything other than the unsurveyable complexity of organic processes — processes that just happen to be *intensely organized* toward certain ends. Crucially (and despite their complexity), they always manage to be consistently expressive of a particular, qualitative way of life, while differing from the expressive character of other kinds of organism. (A sloth is not like a monkey.) “Gee”, we might bring ourselves to wonder. “How do they do that?”

The main thing we should notice, especially in an evolutionary context, is that all this organic activity is characteristically *future-oriented and directive* in nature (Chapter 2, “The Organism’s Story)”. For example, a single-celled zygote, compensating as best it can for all disturbances along the way, determinedly pursues its unique path toward the intricate, billion-celled, not-yet-realized form of a mature trout or mountain goat.

Until we understand how an organism manages to exhibit these *intensely organized, future-oriented, and directive processes*, inexplicable as they are solely in terms of their undoubted physical lawfulness, it seems irresponsible to formulate an evolutionary logic that ignores the distinctive character of these processes. After all, it is through them that viable traits and their variations come about. Do the evident creative forces in the life of organisms have nothing to do with evolution?

Nothing in Darwin’s statement leads one to dwell even for a few seconds on the infinitely complex, living realities underlying the word “vary”. It is as if variation were something that “just happens” to organisms for no particular reason. Merely assuming this happening in an unreflective way (“*Of course* organisms vary!”) is a prerequisite for our interpreting Darwin’s words as an explanation of evolution. We don’t need to ask ourselves, “Out of what sort of a life is an organism enabled to manifest those extraordinary and directive powers of development, physiology, and behavior, through which variation comes about?” Nevertheless, we *can* ask the ignored question, and we can go on to wonder, “What might these powers tell us about evolution?”

My second question mark applies to Elliott Sober’s comment when he is marveling at the “explanatory power” of a simple proposition: “if the organisms in a population differ in their ability to survive and reproduce, and if the characteristics that affect these abilities are transmitted from parents to offspring, then the population will evolve.”

Sober’s claim is strange, given that it is flatly false — false in the sense that nothing in the bare logic of the theory tells us that populations *must* evolve in a manner that yields the new species or fundamental changes of “type” that the theory is intended to explain. It’s true that healthy populations exhibit plasticity, variation, and adaptability — a spruce tree growing in the lowlands will differ greatly from one growing near the alpine treeline, and in any given location one tree will differ from its neighbor. But none of this explains the evolutionary origin of the diverse forms of life on earth.

In fact, despite such in-species variation, for millennia *all* species were widely assumed to remain constant according to their “essential” nature. Yes, untypical variation, including “monstrosities”, could occur, but this only reminded our ancestors that defective organisms tended to be removed — part of the means by which the character or type of the species was preserved. So how did we learn that the situation was quite otherwise, and that species *did* evolve?

Surely a major factor was the discovery and systematic investigation of fossils. Seeing was believing. It was the apparent historical record, not the logic of natural selection, that most persuasively settled the question for us. Look at it this way: the logic can hardly be decisive because it leaves out what organisms actually *do* — and, as has long been recognized, one of the most remarkable things they are capable of doing amid all sorts of variation is to give consistent, generation-by-generation expression to the character of their own kind. Whether that kind needed to be understood as a static or dynamic reality could only be resolved through empirical investigation — and the bones continually being unearthed by paleontologists proved eloquent in this regard.

As for the character of the dynamism at issue, even today there are debates about whether evolutionary change tends to occur during relatively brief and scattered periods of intense transformation, or is instead a more or less constant phenomenon. It seems that questions about what organisms actually do can't be avoided by a mere appeal to logic. And this is true even before we take into account the evidence produced in the first half of this book for the directive nature of all biological activity.

Wholeness, unity, type: how not to over-estimate genes

My strong surmise is that a simple conviction lay behind Sober's conclusion that heritable variation bearing on fitness necessarily implies Darwinian evolution. This was the conviction that genes explain organisms, and that changes in the genome just *are* evolution. So we have no need to look at whole organisms in order to understand their evolution. Genetic variation was already enough to convince Sober that a profoundly transformative sort of evolution must be under way.

But this was to overlook the lesson we have already approached from many sides in earlier chapters: the organism as a whole exhibits a unity prior to all its parts, including its genes. This unity, though manifested in the material, is not itself a physical principle. No physical laws demand or account for an organism's holding together as the kind of whole that it is — the whole that comes to such well-directed expression throughout its development. Genes are *caught up* in the organism's unity (which we might want to call its *type* or its *kind*), so that we have to understand the causal basis[3] of the immaterial principle of unity before we can say anything about the relation between genes and evolution.

The principle of unity and wholeness applies to every level at which we analyze the organism. It was, for example, the principle that Paul Weiss was getting at when, with particular reference to the cell, he spoke of the whole being more than the sum of its parts: "certain definite rules of order apply to the dynamics of the whole system … reflected [for example] in the orderliness of the overall architectural design, which cannot be explained in terms of any underlying orderliness of the [molecular] constituents" (Chapter 6, "Context: Dare We Call It Holism?)."

The mystery of the unity of the whole may be related to a deeply problematic aspect of all contemporary thought about evolution. How can evolution via natural selection explain any feature of an organism at all if we insist on the usual, physical, bottom-up style of explanation

rather than approaching the matter from the vantage point of an immaterial principle of unity (or the type)? We have observed in the first half of this book that cellular activities in general are impossible to explain mechanistically on a genetic basis. As in our consideration of the mRNA splicing activity (Chapter 8, "The Mystery of an Unexpected Coherence"), we are always looking at fluid, complex interactions among numerous molecules in a watery medium, where the physically expected degrees of freedom of those molecules are disciplined, not by genes, but "from above" by the meaning and unity of the larger context.

More particularly, we find ourselves looking at so-called plastically "disordered" proteins with highly flexible functional structure that is not fixed by the genetic sequence; continual, on-the-fly but essential modifications of proteins by other molecules — modifications required for the ever-changing tasks to be accomplished; phase changes involving the formation and dissolution of functionally distinct droplets (collections of specialized, cooperating molecules) within the watery medium; gene-regulatory processes through which genes are maintained and variously expressed by many of the very molecules whose activity the genes supposedly account for; healing of wounds never exactly like any previous injuries in the history of the species; electrical fields that signal major changes of form before genes are summoned to their roles in those changes; and, in general, interaction networks of virtually infinite complexity whereby causal sequences circle around so as to make causes into causes of themselves.

As I have pointed out previously, we see no levers, gears, wires, or conductive channels like those in silicon by which, in any conceivable way, genes could meaningfully oversee and direct all this activity. If we only think of topoisomerases untangling knots in chromosomes, we quickly realize that no genetic mutations *in the past* can underwrite their uncoerced, contextual, never precisely repeated, moment-by-moment, purposeful activity in service of the *ever-changing, present needs* of cell and organism — and, indeed, no past genetic mutations can underwrite the *recognition* of those needs.

In sum, organisms are not the machines demanded by the logic of natural selection. So, then: in the absence of gears, levers, or logic circuits of a machine enduring from generation to generation, what exactly is the renowned evolutionary Tinkerer[4] supposed to be tinkering with? There is, in fact, nothing we can describe as "tinkering" going on, and there is no way for the past history of a species to determine physically the exceedingly intricate, unpredictable, and fluid physiological activity through which particular traits are realized at the cellular and molecular levels, which are supposedly the most fundamental levels for biological explanation (Chapter 8, "The Mystery of an Unexpected Coherence").

Unanswered questions

It is therefore hardly surprising that natural selection tells us little or nothing about how species have evolved:

- What sorts of directionality, if any, will we discover in evolutionary change? For example, might change be directed toward more complex or less complex forms of life? Toward

greater individuality or more collective interdependence? Toward increase or decrease in size? Toward the realization of human potentials? Toward competitive superiority or superior cooperation? Toward some sort of diversity, balance, and qualitative completeness upon the earth as a whole?

- What pathways of change are open to any given species at a particular time, and what pathways are closed off by the dynamic character (type) of the species itself or by the surrounding world?
- In what ways will genes or molecular and physiological processes be conserved in different organisms during evolution, and in what ways will they diverge?
- How much convergent evolution should we expect? ("Convergent evolution" refers to the independent development of similar features in distinct branches of the "tree of life" — something now known to be strikingly common, as when the "camera-eyes" of the octopus and of humans developed independently of each other.)
- How much diversity of life should we expect, and how radically disparate are the possible forms of life?
- Is evolutionary change more or less possible today than at various times in the past?
- Do populations evolve sporadically or continuously, and why?
- What accounts for the uncanny *qualitative* unity of an organism — a unity leading one observer to say of the sloth, for example, that "every detail speaks 'sloth'" (Chapter 12, "Is a Qualitative Biology Possible?").

I can think of no fundamental question about evolution whose answer *is* suggested by the advertised formula for natural selection. Everything depends on what the amazingly diverse sorts of organism actually do as they respond to and shape their environments. Contrary to Susan Blackmore's exultant insight, nothing in the "algorithmic logic" of natural selection tells us that evolution *must* have happened — and, given that it certainly has happened, the logic by itself tells us little about what we should expect to find in the fossil record. We may ask then, "What, in truth, is being celebrated as the revolutionary principle of natural selection?"

None of this is to deny the trivial validity of the idea of natural selection. *Of course* organisms that are "fitter" will generally do better in life than "unfit" organisms. That's just what "fitter" means. And *of course* a record of the winners and losers in the "struggle for survival" will tell us something about evolutionary processes. Or *could* tell us if we understood all that happened in order to establish this particular record. It is hardly unreasonable to point out that we will gain a profound understanding of evolution only when we know a fair amount about *how* it has happened among actual organisms and along its broad course down through the ages.

Every organism's life and death encompasses and, so to speak, "sums up" a vast range of purposive activities, not only on its own part, but also on the part of many other organisms — including, to begin with, its mating partners and would-be predators. One might feel, therefore, that the "theory" of the survival of the fittest can explain just about everything. Certainly the overall pattern of births and deaths must yield the observed evolutionary outcome! Actually, it

just *is* that outcome, which may be why the theory strikes so many as powerfully explanatory. But an outcome — the pattern we need to explain — isn't yet the explanation.[5]

What, for example, if "fit" meant "able to thrive as such-and-such a kind of organism", where "kind" was understood statically rather than dynamically? Some species certainly do show something like this sort of constancy during lengthy periods of relative stasis. Do we understand this ability to maintain stasis well enough to say that the organism's directive powers *must* result in an evolution of kinds in the modern sense, as opposed to an active maintenance of an already existing kind?

Surely we *can* arrive, and arrive rightly, at the modern notion of dynamically evolving kinds. But the Darwinian theory of natural selection is not how we get there, because it offers no understanding of the highly directive processes through which variation arises. Nor does it offer understanding of the meaningful wholeness that is faithfully preserved from generation to generation. It doesn't tell us whether the organism's directive processes are directed at the maintenance of type, or also (at least at times) directed at the transformation of type.

Actually, the theorists of natural selection have not been interested enough in the idea of a *type* (or *archetype*, or *kind*, or *unity*, or *whole*) even to address these questions. And so the qualitative and expressive unity of every kind of organism — scientifically baffling as it is — has been given little attention. This is an egregious oversight I have tried to go some distance toward remedying in Chapter 12 ("Is a Qualitative Biology Possible?").

The "algorithm" of natural selection is widely treated as if it were an agent

The miracle of it all is that, if current evolutionary rhetoric is to be believed, the empty formula of natural selection explains just about everything you could imagine — all based on some form of "blind" agency. Despite this celebrated blindness, natural selection, we're told, is always managing to do great things, as if it were an active, well-directed power. And so we hear about the *mechanism* of selection, as well as the *forces* or *pressures* that operate in it. We learn that natural selection *shapes* the bodies and behaviors of organisms, *builds* specific features, *targets* or *acts on* particular genomic regions, *favors* or *disfavors* (or even *punishes*) various traits or behavioral strategies, *operates* in this way or that, *maintains* DNA sequences, *promotes* adaptation of populations to local environments, *polices* mutations, and, in general, *causes* an endless variety of effects. Darwin himself spoke about how

> natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life (Darwin 1859, p. 84).

This sort of language is now all but universal. I think it is safe to say that relatively few

references to natural selection by biologists fail to assert or imply that we are looking at something like a humanly contrived *mechanism* with an effective power to do the things it was designed for, beginning with the activity of *selecting*. If what biologists say has any significant bearing on what they mean, then they are telling us, emphatically, that they believe natural selection to be an efficacious, mechanistic *agent* — an agent of evolutionary change.

And perhaps we would be forced to agree with them if in fact it was all just a matter of the living and dying of organisms whose lives meant nothing in particular — organisms in the hands of an endlessly subtle mechanism capable of performing an evolutionary work closely akin to the work organisms do in their individual development. And this seems to be the picture that is being forced upon us. All we need to do in order to accept it is to forget *how* organisms live and die — forget, for example, that we know little about what their life actually means, or what the Darwinian striving for life is a striving *toward* for each particular kind.

Developmental systems theorist Susan Oyama was fingering this forgetfulness when she reminded us that

> Nature is not a deciding agent, standing outside organisms and waving them to the right or the left. However much we may speak of selection "operating" on populations, "molding" bodies and minds, when the metaphorical dust has settled, what we are referring to is still the cumulative result of particular life courses negotiated in particular circumstances (Oyama 2000b, p. 81).

Some evolutionists are uncomfortably aware that their use of a phrase intentionally evoking the breeder's "artificial selection" invites mystical belief in a breeder-like agent supervising adaptive evolution. And so they assure us that "natural selection", despite its explicit suggestion of a selecting agent, is "just a metaphor".

The prolifically blogging defender of evolutionary orthodoxy, University of Chicago geneticist Jerry Coyne, spells it out this way: natural selection "is neither a 'law' nor a 'mechanism'". If we explain the evolution of coat color in polar bears as "'natural selection acting on coat color', that's only our shorthand … There is no external force of nature that 'acts' on individuals. There is only differential replication of genes" (Coyne 2010).

In other words, as Coyne goes on to say, the language of agency really refers to a mundane process — "a process that is inevitable", he adds — and here, as expected, he launches into the familiar logic of natural selection.

But it is hard to see this as anything but subterfuge. There is a reason why no effective verbal alternative to the painfully tendentious "metaphor" of selection has taken hold. After all, there really is a transforming agency at work, and no evolutionary theory of the transformation of species can prove persuasive without acknowledging it, if only in a roundabout and deceptive way. We can't have a theory of transformation without the idea of transformative power appearing *somewhere* in it.

The idea of a selecting power is deeply rooted and seemingly ineradicable from the modern biologist's thinking about evolution. Yes, we can redefine the metaphorical selecting agent as a process. But if it's the kind of process that inevitably yields exactly the results we could previously ascribe only to an intelligent agent — yields what can be viewed as the *policing*, *targeting*, *sculpting*, and *creating* of organisms and their features — we are not getting rid of the agent. We are merely giving it a different name and comforting ourselves by calling it a

metaphor. The hope that we will eventually be able to substitute a blind, mindless process for the metaphor is a hope for which we have been given no encouragement.

As far as Coyne is concerned — and this is the conventional view — natural selection gives us only a substitution of some genetic particles for others. Unfortunately, however, he offers no explanation for how the mere substitution of particles actually explains the formation of viable traits harmoniously integrated into an organism's holistic way of being and its present and future life potentials. That is the part of the "recipe" of natural selection — the living part — where he is perfectly content to let ignorance reign. So here, in this space of ignorance, is where the real fact of transformation is, for now, hidden away.

Instead of saying, "There is only differential replication of genes", Coyne should have said, "There is only the development of specific form and the creation of viable traits harmoniously integrated into the unity that is the organism as a whole (but we have no idea how this happens — and our understanding of evolution thoroughly depends on the answer we ultimately find)".

Do not underestimate the difficulty biologists have in seeing this matter clearly. Regarding the "syllogistic core" of natural selection, Gould wrote that "nearly all textbooks and college courses present the 'bare bones' of natural selection in this fashion (I have done so in more than 30 years of teaching)." After suggesting that this presentation "does not permit a teacher to go beyond the simplest elucidation of selection as a *genuine force* that can produce adaptive change in a population", he goes on to say: "In other words, the syllogistic core only guarantees that selection can work … [it] can only rebut charges of hokum or incoherence at the foundation" (Gould 2002, p. 126n; emphasis added).

It would be truer to say that the famously simple and compelling logic of natural selection, misconceived as a "force" and as the "foundation" of a powerful theory, has itself become a primary source of hokum in evolutionary thinking. It is a kind of blank template upon which overly credulous biologists and lay people can project their faith. As for the "genuine force" and causal power of the syllogistic core that Gould refers to, it is a magical invention born of the refusal to recognize agency in the only place where we ever observe it, which is in the lives of organisms.

This is not to deny that we have learned a great deal — for example, from paleontology and molecular studies — under the banner of "natural selection". After all, despite the fact that the generality and emptiness of the logical template allow the biologist to use it as a frame for just about any investigative work, the work itself often has value. Whatever it is that actually happens (which is the valuable part), we can always say (without adding anything to our understanding) that the surviving organisms were somehow or other "selected".

Certainly all extant organisms have in some sense been selected as expressions of whatever future is now being realized. The question is "What has been done, concretely, to get them here?" and the algorithm of natural selection — the idea that organisms have in fact lived and died precisely in the pattern that has landed them and us where we are now — adds little if anything beyond a certain illusion of explanation.

The inadequacy of the theory of natural selection has long been noticed

It happens that the explanatory vacuity of the logic of natural selection has been recognized by some of the most prominent and reputable evolutionary biologists for more than 150 years. They have been concerned about how complex adaptive innovations are achieved, and how, in general, we can make sense of the evident creativity in evolution. The question that nagged at them can be put this way: What does natural selection *select* — where does selectable variation come from — and why should we think that the mere preservation of variants that have already been achieved, rather than the creative production of those variants in the first place, accounts for the "accomplishments" of evolution?

The influential Dutch botanist and geneticist, Hugo de Vries, framed the matter this way during the first decade of the twentieth century:

> Natural selection is a sieve. It creates nothing, as is so often assumed; it only sifts. It retains only what variability puts into the sieve. Whence the material comes that is put into it, should be kept separate from the theory of its selection. How the struggle for existence sifts is one question; how that which is sifted arose is another (quoted in Gould 2002, p. 428).

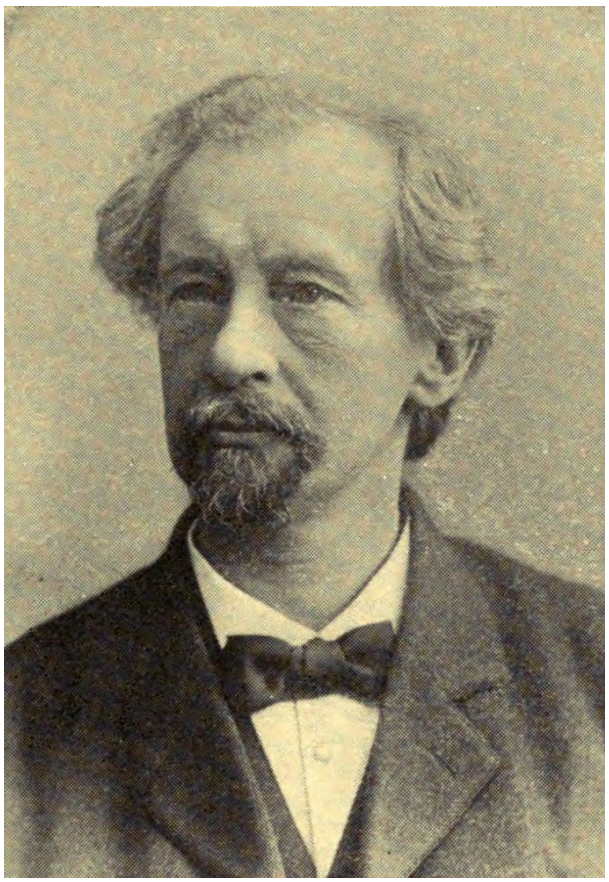

Figure 16.2. Hugo de Vries.[6]

It was de Vries who gave currency to the catchy phrasing that has since been repeated many times: "Natural selection may explain the survival of the fittest, but it cannot explain the arrival of the fittest" (de Vries 1906, p. 826). The concern is not easily dismissed. Other biologists have added their own accents, and it is worth pausing a few moments to trace a theme that some might see as a kind of subterranean and ignored history of evolutionary thought — a history beginning no later than the year after the original publication of

The Origin of Species in 1859:

> "If we take the three attributes of the deity of the Hindoo Triad, the Creator, Brahma, the preserver or sustainer, Vishnu, and the destroyer, Siva, Natural Selection will be a combination of the two last but without the first, or the creative power, we cannot conceive the others having any function" (Sir Charles Lyell [1860], Scottish geologist who laid the crucial uniformitarian foundation for Darwin's theory).

> "It is exceedingly improbable that the nicely adapted machinery of animals should have come into existence without the operation of causes leading directly to that end. The doctrines of 'selection' and 'survival' plainly do not reach the kernel of evolution, which is, as I have long since pointed out, the question of 'the origin of the fittest' … The law by which structures originate is one thing; those by which they are restricted, directed, or destroyed, is another thing" (Edward Drinker Cope [1887, p. 225], noted American paleontologist and formulator of "Cope's Rule", which proposed that the organisms of an evolutionary lineage tend to increase in size over time).

> "Selection permits the viable to continue and decides that the non-viable shall perish … Selection determines along which branch Evolution shall proceed, but it does not decide what novelties that branch shall bring forth" (William Bateson [1909, p. 96], a founder of the discipline of genetics).

> "The function of natural selection is selection and not creation. It has nothing to do with the formation of new variation" (Reginald Punnett [1911], British geneticist who cofounded the *Journal of Genetics*; quoted in Stoltzfus 2006).

> "The actual steps by which individuals come to differ from their parents are due to causes other than selection, and in consequence evolution [by natural selection] can only follow certain paths. These paths are determined by factors which we can only very dimly conjecture. Only a thorough-going study of variation will lighten our darkness" (J. B. S. Haldane [1932, pp. 142-43], a major contributor to the twentieth-century consensus theory of evolution).

> Regarding specific traits, natural selection "might afford a reason for their preservation, but never provide the cause for their origin" (Adolf Portmann [1967, p. 123], preeminent zoologist of the middle of the twentieth century).

> "Natural selection is the editor, rather than the composer, of the genetic message" (Jack King and Thomas Jukes [1969], key developers of the idea of "neutral evolution").

> "In evolution, selection may decide the winner of a given game but development non-randomly defines the players" (Pere Alberch [1980], Spanish naturalist and embryologist, sometimes spoken of as the founder of Evo-Devo — evolutionary developmental biology).

> "Natural selection eliminates and maybe maintains, but it doesn't create" (Lynn Margulis [2011], microbiologist and botanist, pioneer in exploring the role of symbiosis in evolution, and co-developer of the Gaia hypothesis).

Misplaced agency

We began this chapter by listening to Darwin saying that “any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*”. And we heard much the same from contemporary philosopher, Elliott Sober: “If the organisms in a population differ in their ability to survive and reproduce, and if the characteristics that affect these abilities are transmitted from parents to offspring, then the population will evolve”.

I am not sure why the void at the heart of these statements was so long invisible to nearly all biologists, or why, even where it has in one way or another been recognized, it has not fundamentally changed the dominant thinking about the theory of evolution by natural selection.

In any case, what these statements by Darwin and Sober (and just about every other evolutionary thinker) necessarily and unthinkingly assume is the existence of beings capable of sustaining their own lives and development, and also capable of producing variation. This production of variation, like development, inheritance, and organic activity generally, is always a reckoning with the present even as it is in some way oriented toward the future.

But the living beings to whom this truth applies, in the very process of being assumed as the starting point for a compelling bit of evolutionary logic, have fallen out of the picture. They play no role in the elaboration of the logic (which is why that logic can be so vacuously compelling, rather than complex and difficult to understand). Rather, organisms become “black boxes” out of which variation fortuitously appears without need for explanation.

In this way, life vanishes from the theory taken as foundational for all the life sciences, and therefore the theory’s explanatory power shrinks toward nothingness. The very real knowledge of evolution we have gained so far is not owing to the theory of natural selection, even if we have learned a great deal about a subordinate topic — how gene distributions change within populations. Genetics is not evolution. Only whole organisms evolve, and genetics contributes to the picture only as one part of the whole.

Some readers will have been wondering whether I haven’t fatally overlooked the latter-day turn of some biologists toward “evo-devo” — evolutionary developmental biology. And it does need saying that this turn has often included a renewed focus on organisms. Unfortunately, however, the still-uncompromised and strictly enforced materialism of the biological community has meant that the actual *life* of organisms cannot be fully acknowledged.

And so the decisive limitation of all biology remains: organisms are conceived as if they could be understood in purely physical terms — as if they were mind-independent machines existing in a mind-independent world thanks (ironically) to a God-like Designer, the mechanism of natural selection. This means that the increasing references to “purpose”, “consciousness”, and “agency” in certain circles around the fringes of biology do not point to genuinely interior activity, but are only circumlocutions for various patterns of machine-like interaction. And this in turn means that the unity of the organism — an immaterial, purposive, and wisdom-infused reality that must be considered *before* we can make sense of genes and all the rest — cannot

be taken seriously.

It seems to have been the task of biology over the past couple of centuries to reconceive living things without their life — to see the world of organisms, not through their own eyes, but through ours, which are as if hypnotized by the well-designed automatisms that now shape every dimension of our existence. It is not often that the spell is momentarily broken, as when the philosopher of biology, Denis Walsh — after noting the indisputable yet ignored truth that "organisms are fundamentally purposive entities" — expressed his perplexity by asking, "Why should the phenomenon [of agency] that demarcates the domain of biology be off-limits to biology?"[7]

It is now my intention in further chapters to discuss evolution by articulating a different point of view, taking life in its own terms. And I see no reason to exclude what we know most directly — and in a higher key, so to speak — through our own existence as organisms. This higher key of consciousness or awareness offers us many possibilities for an immediate, inner understanding of our experience, which is hardly grounds for excluding ourselves, or our understanding of the meanings of life, from a science of organisms.

WHERE ARE WE NOW?

Sweeping Out the Cobwebs Is Good To Do

We can hardly hope to engage profitably the many puzzles and perplexities of evolutionary theory without first "cleaning out the attic of our minds", where we find stored the heritage of the past century's theoretical refusal of the life of organisms. I suppose just about everything in this book requires — and is intended to encourage — such a cleaning out in one way or another.

I have, in the above discussion, attempted to show how conventional evolutionary theory has eliminated the organism as the one available source of, or channel for, the kind of adaptive, transformational agency required by evolutionary theory. This ignoring of the organism, together with the prevailing reluctance among evolutionists *explicitly* to acknowledge that they have effectively reassigned the organism's agency to the "mechanism" of selection, has resulted in a bland formulation of natural selection as if it were the "obvious" operation of an abstract and empty logic — a dematerialized logic that somehow pretends to be causally effective despite its being abstracted entirely away from organisms. One tries not to speak *openly* of agency at all.

The logic is empty because (1) it refuses to account for the variation that is one of its core presuppositions — refuses to particularize this variation as an expression of the creative life and activity of incarnate living beings. But if we do not understand how organisms creatively produce the material of evolutionary change, then we do not understand evolution.

As we will see in later chapters, (2) the advertised logic of natural selection also fails to reckon with the organism's reliable capacity to produce an inheritance after its

own kind. And, as we saw in many of the earlier chapters, (3) today's biology has also failed in understanding the relation between genes and the organism's fitness for survival — a relation whereby the organism governs its genes much more than its genes can be said to govern the organism.

So the banishing of the organism from evolution occurs in the conceptualization of all three stated requirements for natural selection to occur — (1) variation; (2) inheritance; and (3) differential fitness.

We also noted how the idea of natural selection, as it is used today, takes the organism to be a durable machine that evolution can tinker with at the cellular and molecular levels. The tinkerings are supposed to be preserved stably as fixed mechanisms that can be further tinkered with down through the geological ages so as to shape the capacities of future organisms. But as soon as we drop the fallacious machine idea and acknowledge the fluid, watery, moment-by-moment context of the internal workings of the cell, everything changes. In particular, one belief loses all credibility — namely, the belief that the evolutionary past, mediated by genes, somehow physically determines the trillions of molecular interactions every second of the cell's life so as to support the ever-changing life fuctions of the organism. I develop this point at somewhat greater length in Chapter 18 ("Teleology and Evolution").

In the next chapter we will look more particularly at the evolutionarily relevant, adaptive, and transformative powers of individual organisms, revealed especially in their development. After that, it will be necessary to look more directly at the evolutionary process itself.

Notes

1. Figure 16.1 credit: Rakesh.infosys (CC BY-SA 4.0)

2. This according to philosopher of biology John Beatty (2010, p. 23), citing correspondence between Darwin and Lyell.

3. The kind of causation we're talking about — *formal causation* — was introduced in our discussion of Ronald Brady's analysis of leaf sequences in Chapter 12 ("Is a Qualitative Biology Possible?)."

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

5. The American philosopher, Susanne Langer, said of natural selection that

> this constant interplay of forces, which makes shifting obstacles and openings for each individual so that variously equipped organisms are differentially brought to grief, is not a mechanism; the frequent references, in the literature, to the "mechanism of selection" bear witness to the beguiling influence of the term "natural selection", which seems to refer to an

act, or at least a function, of some specific power. “Natural selection” is a historical pattern, not a mechanism; it is the pattern of the natural history of life (Langer 1967, p. 394).

6. Figure 16.2 credit: Store norske leksikon (Public Domain via Wikimedia Commons).

7. Walsh 2015, p. ix. And yet, even Walsh, wonderfully insightful as he is, proceeds to characterize the organism’s agency in a strictly materialistic manner, as if it could be understood without accepting at face value the inner dimensions of life. These dimensions include the organism’s living (not camera-like or instrument-like) — perception of its surroundings (Chapter 24), the evident wisdom at work in its instincts and behaviors, and the intention and volition evidenced in its persistent and well-directed efforts to satisfy its own needs and interests. We are instead given agency without agency, life without life. Such is our way today. Biologists and philosophers call it “naturalizing” agency and purposiveness, as if even our human agency, taken at face value, were decidedly “unnatural”. (This point of view is happily contradicted by the decision of those many worthy individuals who are inspired to exercise their “unnatural” capacities by dedicating themselves to the tasks of science and philosophy.)

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