

CHAPTER 22

A Curiously Absolute Demand for Stable Variation

There could hardly be a more frequently stated requirement for natural selection than this: *any beneficial variation occurring in an organism, if it is to be evolutionarily relevant, must be faithfully replicated, stable, heritable, and long-lasting down through the generations.* The idea is that, if a given variation is likely to pass away after a generation or two, or if it quickly suffers further change, then the normally long and slow process (by selection) of spreading the variation throughout a population will not have enough time to reach completion. Patrick Bateson was giving voice to a universal consensus when he wrote, “For the Darwinian evolutionary mechanism to work, something must be inherited with fidelity” (Bateson 2017, p. 77).

But we might want to ask: If stable, unchanging heritable elements are a *prerequisite* for evolutionary change, what about the change itself? What is our principle, not of stability or changelessness, but of transformation — the coherent transformation of an evolutionary lineage from *that* kind of a viable, living, whole organism to *this* one? And is our principle consistent with everything we know about organic processes of identity and change in general?

After all, we do have almost an over-abundance of examples of organic change. They are given to us in every complex organism’s developmental life cycle, which illustrates continuous and often intense transformation — including the kind of radical “melt-down” of old structures and subsequent “re-creation from scratch” we saw in the metamorphosis of the goliath beetle (Figure 17.1).

This near-total digestion of the old form, followed by the emergence of a dramatically different form leads us to a second, equally important question: Is it primarily certain material *products* of an organism’s activity that must be stably maintained along a path of transformation? Or is it rather the contextual (holistic) *capacity for an integrative, unifying activity* that must in the first place be preserved — an activity out of which not only are particular structures precipitated, but also the coherent life and character of a species is sustained. Whatever this sustaining activity may be, and wherever we can imagine it occurring, would this not also be the activity and the place where transformation becomes possible? After all, every organism is already a process of continual change, without which it is dead.

When the goliath beetle larva is overtaken by the seemingly chaotic “catastrophe” through which it will gloriously re-emerge in adult form, what is the organizing power, and what are the organizing ideas, through which this all-encompassing transformation of materials occurs? And how are the organizing ideas and power passed from one generation to the next?

When we talk only about the inheritance of discrete *products* of activity, we have already shown a willingness to ignore the more fundamental problem of the origin of viable new traits, which require much more than some new bits of matter. Even if we are talking only about the development of the color patch (speculum) on a duck’s wing feathers (Figure 11.2), we still need to embrace in thought a huge range of dispersed but precisely coordinated molecular interactions that are possible only as well-directed expressions of an integrated and living whole

that functions as an unfathomably wise power of activity.

The obstacle to a proper reckoning with change and inheritance lies in the focus on *things* (whether isolated or in the aggregate), which can never themselves be understood as agents of change. This remains true when the things are genes whose mathematically calculable spread through a population is naïvely thought of as equivalent to the spread of discrete traits, and when this in turn is taken to be evolution. It is the demand for this sort of sterile calculability that leads to a one-sided emphasis on stable variation (long-lived gene mutations) rather than on the potent activity of self-transformation that organisms put on such obvious display. Here, then, is the decisive point: the “thing” that remains stable (is “replicated”) across generations is not really a *thing* at all, but a process and an organizational unity whose dramatic formative potentials are shown in the wide array of stably achieved cell types in our bodies, each of which faithfully reappears “endlessly” from human generation to generation.

Unfortunately, the philosophical bias of today’s biologists prevents them from even beginning to take seriously an organism’s dynamic *capacities*, as opposed to the *things* that have already precipitated out of that dynamism. The only kind of stability they can imagine is the stability of such things, not the ever-reliable, interior, form-giving powers through which these things come about and are maintained.

It would be interesting to put this question to any evolutionist: Can you tell us how much of the difference between a chimpanzee and a human is attributable to different genes, and how much is attributable to different principles of cellular organization? And, of the part you attribute to genes, how much of that is dependent on the aspects of cellular organization affecting how those genes are used?

Meanwhile, it is well to recognize the mystery we are up against in talking about these things. The differentiating cell acts as though it somehow “knows” where it is along the larger path of transformation. It “knows” how to use its inheritance from its parent cell not only to venture upon its own variation from that parent, but also to provide a distinctive inheritance for use by its daughter cells as material for still further variation. In this way each cell participates in a coordinated movement toward an ultimate “goal” of differentiation it can neither “see” nor consciously plan for. The cell participates, that is, in the intention or directiveness of its larger context, just as its constituent molecules participate in its own directiveness.

Obviously, we are up against great mystery when we take note of all this. But we will never make progress against the mystery if we cannot allow ourselves to take note of what is in front of our eyes.

A good place to begin getting further grip on the issues may be the popularly effective case Richard Dawkins has made for the all-but-immortal, thing-like stability of the causal elements of evolution.

Richard Dawkins, genes, and the biologist's “ultimate particles”

Dawkins has been articulating his genocentric view of Darwinian evolution for some fifty years, evoking, at the extremes, both passionate support and vitriolic criticism. Despite the ebb and flow of controversy, however, one oddity remains constant: the decisive failure of his view rarely or never comes into clear focus, presumably because it is a defect found in virtually all conventional (and nearly all

unconventional) thinking about evolution.

In order for a genetic variation to be useful, Dawkins says over and over, it must be “potentially eternally heritable”. “I’m not wedded to DNA”, he assures us, but “I am wedded to this operational criterion that alterations in it go on forever potentially” (Dawkins 2009).



Figure 22.1. Richard Dawkins.¹

What he means is that, in order to be evolutionarily useful, variations must be *selected for* — perhaps not eternally, but at least for a long time. The ones that are harmful are selected *against*, and therefore tend to pass out of existence. But the truly beneficial adaptations can be selected and selected again, generation after generation, without any in-principle limitation. They are in this sense “potentially eternally heritable”, which can only be the case if they are extremely stable.

The transgenerational longevity (stability) of genes is why Dawkins favors them, rather than whole organisms, as the true reproducers, or replicators, upon which natural selection works. “Bodies don’t get passed down the generations; genes do” (Dawkins 2006b, p. 79). Just about all the details

of one’s body can change from one generation to the next. Bodies are, compared to genes, “like clouds in the sky or dust-storms in the desert. They are temporary aggregations or federations. They are not stable through evolutionary time” (Dawkins 2006a, p. 34).

For Dawkins, then, the body is a non-repeatable collection of material bits. Its identity lies in those variously aggregated bits, not in the character or the principles of organization at work bringing them to expression. But it is difficult to see how a conglomeration of material bits,

without any integrating and unifying principle, amounts to much of an identity at all. He apparently offers no principle of identity for organisms as particular sorts of living beings able to maintain their own character. And so he is quite right in saying that an organism rendered essentially invisible in this way — discounted as a kind of non-entity — can hardly be a significant evolutionary cause. “An individual organism is not [an evolutionarily relevant] replicator, because alterations in it are not passed on to subsequent generations” (Dawkins 1982). While an organism as a whole may be “the all important instrument of replicator preservation: it is *not* that which is preserved”.²

It would have been a different matter if Dawkins had asked himself about the holistic capacity of an organism to remain true to type, or to adjust itself adaptively to circumstances in accord with its given character, or — in all its processes of cell differentiation, including those of its germline — to move directly toward a complex future form that does not yet exist and is not dictated by its earlier states. It is just a fact that all these capacities *are* passed between generations; they all manifest, with stable character, in offspring as well as in parents. Who today has even bothered to look for evolutionarily significant variations in this stable power of directive movement, which is the one sort of power that could transform a species? But this is to get ahead of ourselves.

No one, incidentally — neither Dawkins nor any other biologist — is saying that the organism’s phenotype is irrelevant to evolution. Their claim is that the real relevance has to do with the fact that certain genes have contributed to this phenotype and therefore to the survival capabilities of the organism and its offspring. This in turn influences which genes will be passed down the line and survive in the larger population. It is, in this picture, the changes (mainly the beneficial variations) in genes that most directly explain and map to adaptive evolutionary change.

But beyond the question of the organism’s survival, in which they themselves have a say, genes are said by Dawkins to “live” independently of the particulars of an organism’s life. They follow their own stable arc down through the generations, remaining just what they are except for the rare beneficial mutation that is indefinitely preserved. They constitute a nearly eternal “river of information”. This river “passes through bodies and affects them, but it is not affected by them on its way through” (Dawkins 1995, p. 4).

Implied in all this — and very important for Dawkins — is the idea that genes can be conceived in something like a particulate fashion. “I insist on an atomistic view of [genes]”, he wrote in *The Extended Phenotype* (Dawkins 2008, p. 113). And elsewhere he has elaborated: “What I have done is to define a gene as a unit which, to a high degree, *approaches* the ideal of indivisible particulateness. A gene is not indivisible, but it is seldom divided. It is either definitely present or definitely absent in the body of any given individual. A gene travels intact from grandparent to grandchild, passing straight through the intermediate generation without being merged with other genes”.³

Development versus evolution

Dawkins is well aware that much of the criticism he has received comes from those studying the development of organisms. These observers find it very hard to recognize his genes in the developmental processes they investigate. It is, in many developmental contexts, impossible to assign genes long-lasting, discrete, well-identified causal roles, and also impossible to view genes as passing through these contexts unchanged in their functional significance for the developing and evolving organism.

In offering repeated responses to such criticism, Dawkins has made it clear that he considers the intricate choreography of development — in which many non-genetic factors figure prominently — to be irrelevant for evolution. But he emphatically rejects the charge that the gene-centered view denies “proper respect to the Great Nexus of complex causal factors interacting in development” (Dawkins 2008, p. 99). “I yield to no one”, he told an Oxford debate audience, “in my admiration of the complexity of feedback loops, of the details — the immensely complicated details — whereby genes actually do influence phenotypes. There’s absolutely no suggestion that it’s irrevocably deterministic, there’s absolutely no suggestion that it’s simple” (Dawkins 2009).

And yet he fears that too many people get carried away by the intricacies of development. It is true, he grants, that it is precisely through development that we see how an organism grows and adapts toward maturity through complex and holistic processes. But these all too easily distract us from the decisive role of genes in evolution — a mistake he derisively equates to the lament, “Dear oh dear, development is a terribly complicated nexus, isn’t it?” (Dawkins 2004).

He himself prefers “frankly facing up to the fundamental genetic nature” of Darwinian selection (Dawkins 2008, p. 28). Development may be a “complicated nexus”, but evolution is merely a matter of pristine bits or bytes in an informational DNA sequence.

The fact just is, he says, that we learn nothing of interest to evolutionary theorists by looking at the dynamic interrelations — the forming and dissolving, spaghetti-like causal arrows — through which DNA is fitted to its proper place among all the cellular activities. “There may be backwards arrows in all sorts of other senses but, in the sense that specifically matters for Darwinian evolution, the causal arrow of biological development from genotype to phenotype really is a one-way arrow” (Dawkins 2004).

The key to all this lies in two features of genes, as Dawkins sees them: (1) They can, through the occasional gene mutation, produce evolutionarily relevant variation in organisms. And (2) this genetic variation is characteristically stable; through the replication of DNA it can be passed down the generations potentially forever. This means that natural selection can, over as much time as necessary, change the distribution of genes in an evolving population. Very little other than genetic change, so the argument goes, yields discrete variation with such stability and lasting power and therefore little beside genetic change can contribute to evolution.

So, however vague and non-determinate genes may be for development, they are decisive for evolution. That’s why, for the evolutionist, “the complexity of development itself is an obscurantist red herring” (Dawkins 2004). Yes, he says,

development is terribly complicated, and we don't yet understand much about how phenotypes are generated. But *that* they are generated, and *that* genes contribute significantly to their variation are incontrovertible facts, and those facts are all we need in order to make neo-Darwinism coherent (Dawkins 2008, p. 22).

And again:

It doesn't matter how complicated the developmental support structure, nor how utterly dependent DNA may be upon it, the central question remains: which elements ... of development have the property that *variations* in them are replicated, with the type of fidelity that potentially carries them through an indefinitely large number of evolutionary generations? (Dawkins 2004).

So it's not just that genes qualify as drivers of evolution, but also that the other players in development do not. When we shift our attention from development to evolution, "the special status of genetic factors rather than non-genetic factors is deserved for one reason only: genetic factors replicate themselves, blemishes and all, but non-genetic factors do not" (Dawkins 2008, pp. 98-99). And, in perhaps his most succinct summary:

The quality of hi-fi variation ... is a precious, rare, onerous, difficult talent, possessed by genes and computer viruses and a few other things — but *genuinely* few ... In order for anything to evolve by natural selection, there has to be variation in something that is both potentially long lasting and causally powerful, so that there emerges a difference, on the evolutionary time-scale, between the state of the world if one variant survives compared with the state of the world if an alternative variant survives. If neither variant survives more than a couple of generations anyway, we are not talking evolution at all (Dawkins 2004).

Genes, according to Dawkins, survive this rare and onerous test.

A short critique of Dawkins' view

Dawkins is admirably forthright about his desire for a purely genocentric explanation of evolution, and therefore also about his need to put evolution and development into different boxes. But it doesn't work. One thing both he and his critics could probably agree on is that development shows genes actually carrying out their biological roles. If we want to know what genes are and what they mean for the organism, then all the

abstract talk in the world about "pristine bits and bytes" and "rivers of information" cannot supplant what we actually observe about genes in living contexts.

And this is where the problems begin. If Dawkins really is willing to concede the reality of the "Great Nexus of complex causal factors interacting in development" — if, that is, he recognizes the holism implied by the fact that the "causal arrows" of development run in all directions as guided by the larger context — then how can he assign a determinative causal role to genes independent of that larger context? How can he conclude, based on the non-evolutionary criterion of stability ("immortality") rather than any demonstrated capacity for consistent, directive change, that genes alone are the decisive basis for evolutionary transformation?

Dawkins is convinced that, “in the sense that specifically matters for Darwinian evolution, the causal arrow of biological development from genotype to phenotype really is a one-way arrow”. This is exactly wrong. Not only is the causal arrow always a work of whole organisms, but even within a single organism’s body such as that of a mammal, the causal arrow is spun around a dial whereby it is made to point to just about any and every imaginable cellular phenotype. In this way, an organism changes the meaning of its genes seemingly at will. How could this potent redirection of its genetic resources toward scores or hundreds of distinct cellular endpoints be irrelevant to the organism’s provision of an inheritance for its offspring — an inheritance that can be materially expressed only in the form of one of those masterfully managed, future-facing, whole-cell achievements, the gamete?

Dawkins’ evolutionarily significant bits of material substance not only lack any agency of their own for directing cells along a pathway of differentiation, but they are also incapable of participating in the organism’s agency. They are passive and inert, impervious to influence from the organisms (“vehicles”) that carry them along. And — contrary to his professed respect for the “Great Nexus of complex causal factors interacting in development” — they are distinguished only by their stasis and longevity, and by the fact that they have *some* causal effect on the organism’s phenotype, however vaguely conceived. Accepting this shroud of vagueness without worrying about what is going on behind the shroud is crucial to Dawkins’ thought.

The vagueness is necessary because it is impossible to imagine concretely how his bits of genetic material account for the actual powers of organic life, and therefore impossible to imagine concretely how these bits pull off any genuine evolutionary transformation of the organism. The idea seems to be: if we can only shove the problem back into the mists of geological time, maybe we can *vaguely* picture everything happening under the aegis of the all-powerful, god-like logic of natural selection acting with designing intelligence and unexplained power upon living beings possessing no powers of their own ([Chapter 16](#), “Let’s Not Begin With Natural Selection”).

Time, it seems — if only we are given large enough quantities of it — can magically paper over the explanatory void at the heart of our theorizing, just as when natural selection is said to “solve” the problem of the organism’s purposive, intentional, end-directed activity, despite such activity widely being seen as “impossible” within the accepted terms of physics. (See “Natural selection: The shortest path to confusion is circular”, in [Chapter 18](#).)

In sum: if, as Dawkins acknowledges, genes accomplish their effects only in the context of tortuous interactions with innumerable constituents of the cell, and if a different organization of these interactions can lead to a drastically different kind of cellular “creature” — red blood cell, bone cell, lung cell, liver cell — then how do we avoid the conclusion that an evolution of gene effects must require an evolution of the entire pattern of interactions?

The evasion of this conclusion leaves one aghast. Every one of the trillions of cells in our bodies, from the brain to the soles of our feet, has its own organization and character. That’s what makes us what we are. Our existence is unthinkable without this organizing power that gives every cell a distinctive life and place of its own. And Dawkins is telling us that this power is irrelevant to evolution? — that the unique *organizational powers* of the cells passing between generations have somehow been emptied of their usual sort of significance and bear no whole-

cell, creative responsibility for the potentials of the new generation? — that the only heritable factors for us to consider are the pitifully incapable and inert *things* we know as DNA molecules, which cannot even replicate themselves?⁴

Saying that development is irrelevant to evolution is a way of saying that organisms don't exist as far as evolutionary theory is concerned. Or, rather, that organisms exist only under servitude, as bearers of DNA. And, of course, Dawkins has found rhetorically effective ways to make exactly this point. He has presumably realized all along that taking development seriously would torpedo his gene's-eye view of evolution. My suspicion is that he simply never closely engages with the problems of development because he is uninterested in them and they are alien to his entire point of view.

“Immortal” genetic variation

Is genetic variation “potentially immortal” (Dawkins 2008, p. 83), stably holding to its own identity and remaining mostly unchanged by the organisms hosting it down through the generations?⁵

We have already noticed that a principle of stability or “immortality” alone does not yet give us a scientific explanation of evolutionary *change*. But it's worse than this. Dawkins doesn't even have the principle of stability he thinks he has.

We might begin with the fact that all life on earth is commonly thought to be the flourishing, down through all generations and all species, of the life of a single original cell of unknown origin. We can reasonably assume that the successors of that original cell have retained many elements of the essential character — the characteristic organization — of cellular life.

What, then, is the means by which the distinctive character of cellular life has been maintained in these “potentially immortal” cells? What keeps cells alive and as the kind of things they are, more or less forever? I mentioned above that principles of process and organization — powers of activity — are decisive. But Dawkins seems to have no interest in such principles and powers.

But while cells are potentially immortal, genes — in the causal sense that Dawkins fixates upon — certainly are not. In fact, their causal involvement in the cell's work does not even remain constant in a single cell over its lifetime. This is because local activity within the cell — the context that gives genes their meaning and makes the difference between a neuron and muscle cell — is always being coordinated and repurposed according to the changing needs and interests of the whole cell and whole organism, and the cell's genes are thus “captured” by the cell's purposes.

Dawkins gets his river of fixed, unchanging, selectable “particles” of inheritance only through an act of intellectual violence — only by mentally wrenching certain molecular parts of DNA (in particular, the nucleotide bases constituting the genetic “code”) from their meaningful, dynamic chromosomal and cellular contexts. He abstracts them from the stream of life in which alone they gain their function moment by moment. He wants dead, material things for theoretical manipulation. You might say that he abstracts the genetic “letters” from the cellular

“sentences” in which they find their life and meaning.

Only such an act of abstraction can give him what he needs: heritable particles to which he can apply the same name (even if not the same meaning) from one context to the next — particles that can be tracked within both individual organisms and breeding populations. Then, because the name of any particular genetic “letter” remains the same whether it is in fact the same letter or not, he can pretend he is always talking about precisely the same, unchanging thing.

And yet we know very well that, in the living and meaningful sense, genes never remain unaltered for long. The “same” genes can have radically different causal implications in different contexts within a single cell or organism, and also in different kinds of cell or organism. Even when we think a gene has analogous functions in different organisms, it can turn out that the functions have unrecognizably different physiological realizations. This reflects the very different ways of being from one kind of organism to another — ways of being in which genes are caught up rather than being the decisive orchestrating factors.

As one of endless evolutionary examples: the PAX6 gene is found in both fruit flies and mammals, and has been thought of as a “master control gene” for the formation of eyes. But not only is its activity now known to be interwoven and interdependent with that of countless other genes and their regulating factors and functions; the compound eyes of a fruit fly are altogether different organs compared to the eyes of a mammal. If we try to imagine a gene, *as a single, supposedly well-defined causal unit*, independent from the stream of life in which it finds itself and yet at the same time fitting itself into the completely different physiological contexts of fly and mammal, the picturing does not go well.

Throughout the first half of this book we have seen over and over how DNA is caught up in, and given its functional identity by, its context. And in [Chapter 21](#) (“Inheritance, Genetics, and the Particulate View of Life”), I illustrated some of the countless ways in which the DNA content of genes is itself twisted, untwisted, bent, distorted in various ways, chemically modified, moved around in the nucleus, converted to nonstandard double-helical forms or even non-double-helical forms, and otherwise driven by the cell into conditions that transform its genetic role and identity.

So the truth counter to Dawkins’ claims is that genes participate in, and are informed by, the whole cell and organism. Whether we’re talking about a goliath beetle (before and after metamorphosis) or a human being, genes simply are not capable of determining the form of an organism. It would be truer to say that the organism determines the meaningful form of genes and the chromosomes on which they reside.

Genes, then, are not “potentially immortal” — or even potentially “lifetime-lasting” within individual organisms — because the whole organism defines and redefines their functional nature and identity as it proceeds through the cycle of its life.

To put the matter in these terms, however, would doubtless provoke Dawkins’ skepticism. For he has very publicly worried that “a kind of ‘holistier than thou’ self-righteousness has become fashionable”, and further, “There are times when holistic preaching becomes an easy substitute for thought” (Dawkins 2008).

This may be true. But it is also true that, when it comes to understanding the life of organisms, holism is just about the most disastrous thing to lose sight of.

The embodied organism is not like a cloud

Recall Dawkins' claim that bodies are like clouds or dust storms in the desert because they do not exhibit the constancy required for natural selection and evolution. Changes in bodies (as when someone devotes much of his life to weight-lifting) are not inherited. This truth is obvious enough. But the fantasy of the whole organism's transitory existence — its lack of a stable and enduring identity — is as wildly off the mark as Dawkins' invention of the "almost eternally" durable genetic particle.

The well-directed development of a whole organism no more represents change without stable identity than does cell differentiation. If a differentiating cell "knows" very well what kind of cell it is and where it is going, all the more a developing organism follows a reliably defined path of development and self-expression leading to its own fullest realization. Crucially, this path is never *precisely* defined or *materially* determined. For example, adjustments to unpredictable environmental disturbances during development may continually occur. But the adjustments are *in the service of* the organism's fullest expression of its own nature.

The identity here is that of a *dynamic* unity. But a dynamic unity capable of maintaining itself while responding in its own way to its context is a far more profound center of identity, power, and life than a supposedly static particle impervious to its surroundings. The capacity of an organism to maintain its identity wholly escapes Dawkins' world of thought because it cannot be understood materially. Rather, it reveals principles that can be principles of true understanding only because they are also principles standing above and governing the material aspects of biological phenomena.

Never, except in the imagination of someone preferring inert particles to living beings, could the organism have been likened to a cloud or dust storm. Its unity and stability lies in its giving material expression to a specific *kind* or *species* ([Chapter 20](#), "Inheritance and the Whole Organism"). Every complex organism is an almost miraculous, stable, reigning unity governing many differentiating cell lineages. The reliability and constancy of this sort of identity is so evident that for millennia nearly everyone erroneously assumed that all species were eternally fixed in their essential nature.

In order to correct this view today, we do not need to throw out the constancy everyone can observe, but only to bring it alive by rendering it more dynamic, adaptive, and transformative in line with modern evolutionary insights. An organism's identity is crucially reflected in its ability to adapt to a changing environment in a manner consistent with its own species-character, and to transform itself according to the future (evolutionary) potentials of its kind. We see such dynamic identity and adaptability even in in our own biographies. Our immediate experience gives no support to the idea that growth, development, and change imply the lack of a coherent, guiding identity.

To observe life, then, is always to watch an interplay of change within continuity, plasticity within constancy. Both aspects of the living interplay run through all biology. Perhaps our most convenient access to them comes through the study of development, as when we watch a whole organism "coming to itself", or watch a differentiating cellular lineage progressing toward its fully realized type.

Here the principle of change is easy enough to verify — and it no more relies on the

absolute constancy of the material products of change than does the metamorphosis of the goliath beetle larva into a mature beetle ([Box 17.1](#)). I described in [Chapter 17](#) how hundreds of cell lineages in our bodies “evolve” (are differentiated), not by remaining mostly unchanged, but rather by compounding change upon change down through the cellular generations. The result is a profound, qualitative transformation of whole cells, explainable only as a power of activity, not as a determination by previous material constituents.

It is difficult to doubt that this compounding of change upon change is owing to an orchestrating power that works throughout the entire cell — a power not at all one-sidedly determined by genes, their mutations, or any other material constituent of the cell. We are watching a whole cell radically re-organize itself.

But think what this means. If many developmental changes in a cell lineage are not stable and heritable over any large number of cellular generations, it is because *they had better not be*. After all, the lineage is *on the way to somewhere*, proceeding directionally along a pathway of integral, [holistic](#) transformation. This suggests how differently we will have to look at evolutionary processes once we are willing to acknowledge that they centrally involve *coherent* change and not just random, atomistic mutations in little bits of matter.

As I have already suggested, Dawkins has no theory of evolution, no theory of change. He has only a theory of genes — a false theory of independently existing, unchanging particles being carried down the river of time and passing inertly through generation after generation of organisms. How these particles magically account for living traits — how they *could*, even in principle, account for such traits — is not part of the story Dawkins has cared to share with us. All we know is that he holds, vaguely, to the conventional view that genes must *somehow* explain organisms, their traits, and their evolution.

But there is no need to avert our eyes from the “dangerous fluidity” of a picture involving continuous change and transformation. For the other aspect of the process of cell differentiation lies in the fact that the differentiating cellular lineage is remarkably sure of its identity: it is *this* lineage, and is powerfully “insistent”, in tune with its context, about reaching *its own* mature character. And, having reached its maturity, it is capable of stably maintaining it as long as necessary, while never losing a degree of adaptability.⁶

So here in the organism’s development and cellular differentiation, we see compelling identities involving, not the stasis of inert particles, but rather a marriage of constancy and change, selfhood and transformation — a reality it would be very strange for any student of evolution to lose sight of.⁷ What is constant is not a mere physical product, but an active way of being. As I have put it a number of times (drawing on a phrasing of the Aristotle translator, Joe Sachs), an organism is “continually at work remaining itself”. We could say much the same of a cell. Physical entities — aggregations of particles, if we insist on thinking that way — are a precipitated residue of such activity, not a cause of it.

A decisive counter-picture to the gene's-eye view of evolution

The central problem that Dawkins avoids reckoning with is this: everything we have noticed about the enduring unity, purposiveness, and transformational powers of the cell and organism applies, not merely to development, but also directly to evolution. That's because *what passes hereditarily between generations is never less than a whole cell, and this whole cell is never less than a whole organism*. And, as we have seen, both the cell and the organism exhibit an enduring, purposive identity possessing not only a dynamic constancy, but also a profound transformative capacity — exactly the combination an evolutionary theorist must look for.

Anyone who wants to claim that genes, rather than whole living cells (organisms) are the basis for evolution needs to explain why we must ignore everything we know about cells — about how they proceed so effectively along evolutionary (developmental) trajectories and how they intricately, flexibly, and authoritatively enlist their genes along with all their other resources in achieving their ends.

Further, why should we assume that the totipotent zygote (capable of engendering all the cell lineages of the adult organism) brings nothing of its self-transformative, re-organizing powers *across the generational gap* — nothing, that is, of evolutionary relevance? There is, of course, really no gap at all, but only continuous life. And the activity of whole-cell transformation is fully as insistent on the parental side — in the unique differentiation of germ cells and the seemingly against-all-odds merging of distinct germ cells with distinct genomes in a single zygote — as it is on the offspring side.

We know a great deal about the powers of reliable change possessed by cells and organisms, and we also know about a gene's complete inability to represent on its own an organism's expressive traits. If it happens (as it does) that an organism's abilities as a living, developing, striving-to-survive "vehicle" for its genetic cargo require all its vast array of transformational powers, and if we see it employing those powers with almost infinite intricacy and adaptational effectiveness in all its cell lineages, why should we imagine these powers going dead or inert at those especially intense moments when one generation is actively preparing for a successor generation.

One can only assume that Dawkins has proven blind to the only agents of biological transformation we know because, as a materialist and reductionist, he simply cannot tolerate the idea of biological agency, despite what he witnesses in every organism he has ever seen. He *must* overlook active and purposive organic wholes by conceiving organisms as built, bottom-up, from collections of inert particles and mindless processes. But, as I have pointed out repeatedly in this book, such a conception is never possible to hold consistently, and all observation-based biological description immediately controverts it. (See, for example, [Chapter 2](#), "The Organism's Story".)

The organism's dynamic, transformative capacities are so clearly underwritten by everyday perception that they need not even be mentioned in order to be casually, if also silently, taken for granted by the evolutionist. But when the failure to mention them turns into an active "conspiracy of silence", so that our theories of evolution must ignore the obvious, then something has gone badly wrong.

Sterile, Immortal Particles, or Living Cells?

It would hardly be surprising to suggest that a great deal of one's evolutionary theorizing depends on whether one approaches the topic with the mindset of a materialist and reductionist or, to the contrary, ascribes to every cell and every organism a wise agency and purposiveness expressed in all its living activity. But before tackling that issue directly, one can always begin by looking at what we know of cells.

This chapter is grounded in a seemingly incontrovertible fact observed in all complex, multicellular organisms: their cells proceed through dramatic processes of differentiation reflecting stable organizing ideas in which the entire cell is caught up and through which it undergoes profound transformation. Cells can, to all appearances, become as different from each other as any two organisms with dramatically different genomes. But the differences between cell lineages in a single organism cannot, in any fundamental sense, be attributed to genetic differences, because all the lineages derive from a single, inherited genome.

I have argued that Richard Dawkins, with his stable, "almost immortal" genes has a principle of stability and continuity, but not a principle of evolutionary change. What change he does have is a mere redistribution of inherently meaningless particles within a species or population, achieved by the agonizingly slow process of random mutation and natural selection. He acknowledges that we know almost nothing about the relation between these particulate rearrangements and the development of an organism's actual traits. And he offers nothing to suggest how, even in vaguest principle, meaningless and immortally inert particles could possibly contribute to the traits expressing the meanings of a life.

But, as mentioned immediately above, we do see such a principle of meaningful change illustrated in cell differentiation within a complex, multicellular organism. Here organizational change is not preserved from cell generation to cell generation, but is repeatedly compounded (changed again) — and *must* be compounded because the cell lineage is *going somewhere*. It is proceeding toward its mature form. We have every reason to look for a similar principle of change-on-top-of-change within an evolutionary lineage that is going somewhere — proceeding toward the coherent, living form of a transformed organism.

The question this poses for evolution is straightforward — and is puzzlingly ignored on all sides: Why should this transformational capacity of whole cells be ignored as a source of evolutionary change — ignored, that is, when we shift our view toward the cell-organism that in undisputed fact bears the full inheritance passing directly between parents and offspring? It's true that the question is a difficult one because the kind of dramatic, qualitative, whole-cell transformation we encounter so often in developmental studies cannot be reduced to mathematically analyzable changes in gene sequences and gene frequencies. But why wouldn't we expect *any*

explanation for the evolutionary transformation of an organism to be challengingly complex? The complexity of holistic processes is certainly no reason to turn away from their investigation when we are seeking to understand evolution.

Notes

1. Figure 22.1 credit: Alex Folkes/Fishnik Photography ([CC BY-ND 2.0](#)).
2. [Dawkins 2008](#), p. 114. Dawkins is quoting himself from an earlier paper in *Zeitschrift für Tierpsychologie*.
3. [Dawkins 2006a](#), pp. 33-4. Along these same lines, Dawkins has written that the “digitalness [of genes] is probably a necessary precondition for Darwinism itself to work” ([Dawkins 2006b](#), p. 163). I discuss this remark along with the non-digital character of genes in [Chapter 21](#), “Inheritance, Genetics, and the Particulate View of Life”.

I would add here that my criticism of Dawkins’ “atomistic” genetic particles is in no way intended to deny the fact that genes, like much else in the organism, possess their own *specificity*. Just as an enzyme has an affinity for a particular substrate or substrates, so also a gene is associated with its own suite of protein variants. The cell flexibly employs the gene as a resource for the generation of one or another of those variants. The cell, of course, requires many other resources for this task, and the decisive, repeated modification of a protein over its lifetime is achieved *after* the gene-resource has been brought into play for the initial synthesis of the protein.

4. It is false when Dawkins says that genes “replicate themselves”. It is perfectly well known that they are utterly helpless to replicate themselves — and also to perform error correction on themselves. It is the cell that both replicates them and carries out DNA damage repair. (He surely does understand this, despite his not wanting to focus on it.) On the power of proteins to manage DNA and reassemble shattered genomes, see [Chapter 8](#).

On a different note: if genes have even a shadow of the determinative power often ascribed to them, then the best way to think of them might be as relatively dead, crystallized, anti-life structures that provide the *resistance* that the organism needs in order to assert its creative, organizing forces and bring alive its own story.

5. More specifically, it is genetic variation *in the germline* that Dawkins says is potentially immortal.
6. It would be good not to forget what we learned in [Chapter 6](#) about cells changing their “identity” in the hair follicle niche, depending on circumstances. We have to understand the cell’s identity in a broad enough way to recognize this possibility of metamorphosis. It illustrates how cells are subordinate to, and receive their identity from, the larger context and the organism as a whole.
7. Change and continuity: every organic whole embodies — lives by means of — a

harmonization of these contrasting principles. But these are exactly the principles that any theory of evolution must somehow hold together. It's obvious enough that you can't have evolution without change. But so, too, without continuity there is only the arbitrary substitution of some elements of a mere aggregate for others, with nothing that lends significance to the result. If the change is to be non-arbitrary or coherent, there must be a persistent character attributable to the whole. Without an underlying continuity no enduring, nameable entity or being exists of which we can meaningfully say, "Yes, *this* is evolving". There is instead just "one damned thing after another".

And we should add this: if, as in the physical organism, *all* the material elements are subject to change, then the underlying continuity must be immaterial (Barfield 1965, p. 96). But then, that is how we have understood the organism all throughout this book — as a bodily exterior "shone through" by an interior. Or: as an interior partly condensed into a translucent exterior.

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