Two Questions

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Following are the introductions to two chapters of Steve's book-in-progress called "Evolution As It Was Meant To Be — and the Living Narratives That Tell Its Story." These brief introductions are intended simply to pose the questions that the chapters then discuss. The full text of these two chapters, along with all the others currently written, will be freely available at natureinstitute.org/txt/st/bk/. Note: the full titles of the actual chapters are "All Science Must be Rooted in Experience" and "Why We Cannot Explain the Form of Organisms." This second article may have morphed into two articles by the time it is posted to the website.

Is Science Experiential?

In previous chapters we have seen how organisms, as centered agents, present us with rich, narrative contexts — mortal performances that proceed, with characteristic expressiveness and intention, through the stages of a life drama unique to their own species. And yet, as we have also seen, a powerful urge drives biologists to ignore, as far as they can, every distinctively living feature of those performances.

They ignore, for example, what it must really *mean* when they say that animals "strive" to maintain their life, or that a wound "heals" itself, or that an organism "adapts" to its environment, or that it "perceives" a threat and "responds" to it. (Stones do not strive, heal, adapt, perceive, or respond.) But it is all too easy for any scientist to side-step such meanings and analyze the organism's story into lifeless sequences of precisely lawful molecular interactions. And since there appear to be no gaps in the molecular-level picture, the resulting explanations seem complete. Only the organism is missing.

In other words, seamless as they may be in their own impoverished terms, such explanations are not in fact complete. They miss the simply observed fact that molecular-level interactions in an organism are always caught up in the higher-level pattern of one or another life story. We always find ourselves watching the meaningful *coordination of causal processes in an extended narrative* — a coordination that cannot be explained by the causal processes being coordinated. This is why explanations that never move beyond physics and chemistry stop short of biology.

Non-living explanations do, however, have one advantage: they conveniently avoid all those troublesome words I use throughout this book in discussing organic contexts and life stories — words such as *intention* and *purposiveness*, *idea* and *thought*, *agency* and *end-directedness*, *interests* and *meaning*. Most biologists prefer to have nothing to do with such terms.

One problem with those words is that they evoke features of our own inner lives — our human *experience*. It is, of course, healthy to avoid an anthropomorphic projection of human experience upon other organisms, where it does not belong. But we, too, are organisms, and we have good reason to ask: Where *does* living human awareness belong in our biological science? If we ignore the character of our own life and experience, can we fully understand a world that has been capable of producing *us*? Where can we gain our scientific ideas, if they are not *empirical* — if they are not expressions of our most rigorously considered *human experience*? And can we reasonably assume that our own experience has nothing at all in common with that of our evolutionary forebears?

Can We Explain Organic Form?

The problem of form has long been central to biology, where each creature so notably reproduces after its own kind and according to its own form. "It is hardly too much to say," wrote geneticist C. H. Waddington, "that the whole science of biology has its origin in the study of form." Through both their descriptive and theoretical activity, biologists "have been immersed in a lore of form and spatial configuration."

And yet questions of form have seemed oddly resistant to the biologist's quest for explanation. Darwin himself seemed to sense a special challenge in that famous instance where

Mallard duck showing bright blue speculum.

A speculum feather from a mallard duck.

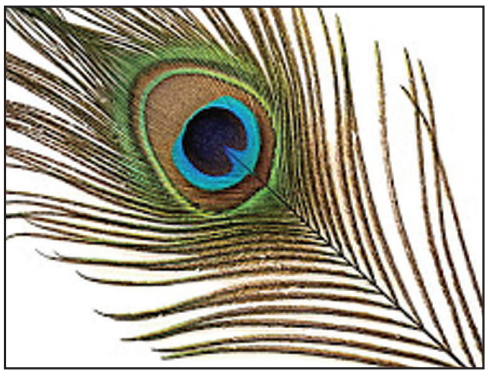
he recoiled from contemplating the subtle perfections in the form of the eye: "To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree."

Of course, as Darwin quickly added, his theory convinced him that he was merely suffering from a lack of imagination. All that was really needed were the creative powers of natural selection acting through eons upon an endless supply of small, helpful changes. But his underlying malaise was not so easily vanquished: "It is curious," he wrote to the American botanist Asa Gray in the year following publication of the *Origin*, "that I remember well [the] time when the thought of the eye made me cold all over, but I have got over this stage of the complaint, and now small trifling particulars of structure often make me very uncomfortable. The sight of a feather in a peacock's tail, whenever I gaze at it, makes me sick!"

We can assume that Darwin got over that stage of the complaint as well. But, thankfully, the biologist is still now and then allowed, if not a complaint, at least an honest expression of wonder. The great twentieth-century student of animal form, Adolf Portmann, writing not of the peacock, but of another bird with a remarkable pattern of coloration on its wings, helps us to share in his own wonder:

> If … we look at the speculum on a duck's wing, we might imagine that an artist had drawn his brush across some ten blank feathers, which overlap sideways — making white, bluey-green, and black lines — so that the stroke of the brush touched only the exposed part of each feather. The pattern is a single whole, superimposed on the individual feathers, so that the design on each, seen by itself, no longer appears symmetrical. We realize the astonishing nature of such a combined pattern only when we consider that it develops inside several or many feather sheaths completely separated from one another; and that in each individual feather it appears at an early stage while it is still tightly rolled up, the join pattern not being produced until these feathers are unfolded. What sort of unknown forces direct the construction work in the 'painting' of these feather germs?

Whatever Portmann's "unknown forces" may be, they seem to work to perfection. But how are we to understand this perfection? What sort of explanation are we looking for when we want to make *sense* of form? In the case of that patch of color on the duck's wings, surely we will eventually be able to trace exhaustively the processes and connections by which the molecules of pigment come to be present at the proper places in the various feathers. But where, amid the innumerable, widely dispersed molecular jigglings, transits, collisions, interactions, and transformations, will we glimpse the global coordinating power that guarantees the final, aesthetically satisfying outcome in the face of all the degrees of freedom possessed by the interacting molecules?



Eyespot on a peacock feather.