

## Preface

I see a crow, perched atop a shagbark hickory tree about fifty meters in front of me. It seems oddly unperturbed on its branchlet as it surfs the tumultuous waves of a stiff wind. The winds, of course, are its own element, just as the twisting currents of a swift stream belong to the trout. The crow, I reflect, is its own sort of master of the wide domain it surveys — a domain whose whole aspect is unfamiliar to me. As I walk, I try to see myself through its unhuman eyes, a small, insignificant figure approaching far below, passing beneath, and then slowly receding into the distance.

I was once taught to see myself this way when in the presence of a bird on high — I, an intruder moving for a few moments through another's native landscape. It was a modest little exercise in becoming detached from one's own point of view. I suppose it's rather easy for us today. We are, after all, heirs of Copernicus, whose one giant leap for mankind sprang from his then-novel capacity to project himself, as an observer, onto the surface of the sun. From that viewpoint he could imagine his own, troubled earth moving serenely through space.

But Copernicus had only to project himself through what was in the process of becoming, for us, "empty space". How much more difficult to insert oneself into the "mind" of a crow! Who is it that looks down at me, and from what strange, inner world does it gaze? What would I *really* be seeing if I could see with crow-vision, so penetrating in its crow-ness, yet so alien to me? I have to admit that there is vastly more of myself projected to the top of that tree than there is of the crow. When the lives of distantly related beings are at issue, isn't getting outside one's own viewpoint all but impossible?

## Perplexities of molecular biology

My primary aim in this book is to enable the reader to see organisms — and especially animals, which are my main examples — with new eyes. In place of a systematic survey, I present what might almost be approached as a series of re-visioning exercises whose diverse focal points, so I hope, can merge for the reader into a single, coherent landscape. It will be a landscape viewed, so I also hope, from unexpected angles.

The oddity lies in the fact that I rely rather heavily on topics drawn from molecular biology, a discipline that gives us no real landscape at all — certainly not one based on the kind of direct, sensible experience the founders of the Scientific Revolution craved. The biologist's picture of atoms and particles is synthesized from theoretical constructs and outdated mental pictures that, especially in the physics of the last hundred years, have been thoroughly subverted. So how we should actually *picture* what I will refer to as the "microworld" is a genuine mystery today.

The problem is that biologists have been content to stick with nineteenth-century images of the solid little "particles" that were debunked in physics long ago. And so they imagine a cell full of little materialized "molecular machines", however tiny, and however ill-matched they may

be even to the imagined particles. Where many physicists have acknowledged wide-open questions at the foundation of their discipline, biologists have doubled down on a rather crude, mechanistic materialism.

But the biologists' problem is a problem for this book as well. How can I focus as much as I do on a field of research (molecular biology) that is more or less empty so far as an experience-based (empirical) science is concerned? Am I not just lending further support to a kind of biological fantasy world?

I am inclined to plead guilty to this charge. Of course, I do at times try to warn the reader against misconceptions — for example, in [Chapter 15](#) (“Puzzles of the Microworld”) and [Chapter 21](#) (“Inheritance, Genetics, and the Particulate View of Life”). But there are also at least three strong, positive justifications for looking carefully at how biologists appeal to molecular-level research as a bottom-up foundation for understanding organisms. These all have to do with the fact that molecular biology presents to one's imagination a kind of blank slate. Looking at what researchers have projected onto this blank slate can tell us a great deal about the character of biological thought today:

To begin with, we see a seemingly unquenchable thirst for unambiguous (and therefore unbiological) cause-and-effect explanation. These explanations tend to be of an antiquated, billiard-ball sort involving particles that, as physicists have long known, simply aren't there — certainly not in the way they are being imagined within biology. In this way we come to those ubiquitous and hopelessly misconceived “molecular machines” that are supposed to perform the fundamental living work of organisms.

In the second place, because so much of molecular biology is based on non-empirical, unsupportable, and metaphysical (materialist) assumptions, the supposed explanations issuing from molecular biology never add up. When we look at these explanations, we easily recognize the confusion at work in them. (See, for example, [Chapter 8](#), “The Mystery of an Unexpected Coherence”, and [Chapter 9](#), “A Mess of Causes”).

Recognizing the confusion can, in the third place, point us in the direction of a more adequate understanding — one that starts with the observable organism rather than a fantastic, non-observable realm littered with metaphysical “projectiles”. I gesture toward the grounding principles of such a fuller understanding in [Chapter 12](#) (“Is a Qualitative Biology Possible?”) and [Chapter 13](#) (“All Science Must Be Rooted in Experience”).

The troubles emerging from biology's deep dive into molecular biology have — rather ironically, in view of initial expectations — dramatically undermined the mechanistic understanding of life. One prominent example is provided by the prevailing image of natural selection as a “tinkerer” working on biological mechanisms over long time spans. Unfortunately, it has become crystal clear that the coordination of scores or hundreds of molecules knowledgeably performing an intricate operation such as RNA splicing or DNA damage repair in the watery medium of the cell's plasma cannot be viewed as the mere activation of a stably existing mechanism that natural selection has somehow been able to tinker with for ages. What needs explanation is not the perfection of theorized ancient mechanisms we cannot see, but rather the *present* wisdom that, as we *can* see, informs the moment-by-moment activity of those cooperating molecules. These molecules not only find their way, in the fluid milieu and with changing interaction partners, to perform (unforced) an elaborately choreographed operation,

but also manage to vary and adapt their activity to the immediate needs of the larger context — for example, by conducting the RNA splicing operation so as to produce the currently needed variant of a protein, rather than, say, the variant produced last time.

## Sobering thoughts

I have, throughout the writing of this book, been accompanied by a discomfiting awareness of the difficulty of the task I have set myself. This is presumably due mainly to my own limitations. Seeing things anew — as opposed to collecting more and more data and trying to assemble it into unambiguous demonstrations of truth — is not something I find easy, nor is it something we are generally encouraged to strive for today. The following thoughts, borrowed from others, have, for me, emphasized the great distance from assertive claims of truth to genuine profundity:

◆ The first of these thoughts is an overall conclusion drawn from a study of meaning entitled *Poetic Diction*, written in 1928 by the philologist and student of the evolution of consciousness, Owen Barfield. It expresses a truth also forced upon me directly by many less-than-satisfying efforts at communication. (The phrasing is my own:)

*If a conversation takes place primarily as a logical contest or as a battle of “proofs”, rather than as an effort to clarify, shift, and deepen meanings, it is likely to be shallow.*

In my run-up to writing this book — and throughout the writing — I have had to suppress my own deeply rooted, almost congenital instincts toward doing intellectual battle. I now know that victory in this particular struggle with myself will never be fully won.

◆ Then there is my vague remembrance of a remark I somehow associated with the late physicist, Georg Maier. It ran more or less like this:

*If you think you have reached a point where you can cleanly explain a profound truth, you do not yet understand it.*

After the first appearance of this preface, my colleague, Henrike Holdrege, gave me an actual quotation from Maier, which serves just as well: “*the knowing of a phenomenon (appearance) is not at all completed by a successful explanation*”.

◆ Finally — again from Barfield, and this time as a direct quote wrapped up with a striking metaphor — there is this:

*If you take your view of the world seriously, to air it is tiring. Moreover, in any ordinary conversation you can only do so very superficially, and your own heard superficiality wounds you. The opinions, whether firm or tentative, of a man over fifty who has thought for himself about the nature of man and the universe will have acquired a certain depth and weight that make them ill adapted for point-blank encounter. Submarines rarely engage one another in battle (Barfield 1965, p. 74).*

If you want to have a fruitful conversation with someone, the two of you must meet upon some sort of common ground. For if you see things in such fundamentally different ways that every

assertion from one side is met by a refusal to accept it on the other side, then there is not much reason to talk. If, on the other hand, the two of you are so close in thought and assumption that you mean the same thing with your words and can work with precisely the same set of facts, then the role of conversation is also limited. All you need to do is to order the facts in such a way as to prove your case to the other person. Nothing really new will arise, because your proof was already implicit in your mutually accepted understanding of things.

But there is a potentially productive middle ground where enough is shared to make conversation possible, and enough is not shared to raise the hope of genuinely new insight. In this case the challenge is to be non-defensive and to hear the other person's words and facts with receptive ears. We can most easily achieve this if we have managed somehow to get outside our own culture's "common sense", much as we today are able to challenge, or even laugh at, the unquestioned wisdom of previous historical eras. Managing to see our culture in such a foreign light, however, can be an almost impossible task. But even a small effort in that direction can be life-changing — like being let out of a prison you hadn't realized you were in.

I do not expect my efforts here to be adequate. But I do hope they may be of some use to those sympathetic readers seeking a new vantage point upon biology — one that, even if at first it presents an unfamiliar and perplexing landscape, at least does not require us to deny the living experience of all creatures, including ourselves.

## Sources

Barfield, Owen (1965). *Unancestral Voice*. Middletown CT: Wesleyan University Press.

Barfield, Owen (1973). *Poetic Diction: A Study in Meaning*. Middletown CT: Wesleyan University Press.  
Originally published in 1928.