

HALF A CENTURY of immersion in science has immeasurably enriched my world. I can only describe what it has added with analogies—as how great music sounds when heard in live concert as opposed to the output of a miniature transistor radio. Or as the shift to HD color from fuzzy black-and-white television. Science, I find, is fun to think about, to talk about, to write about, and, most of all, to do. Few activities can measure up to the satisfaction of not just answering some nagging question about the world but at the same time doing something that has never before been done by any human who has ever lived. One even feels empowered when looking at some bit of the immediate world and seeing something that would have been imperceptible without a sense of the scientific.

This book represents an attempt to draw you into that world of science. Not the one of interminable names, arcane procedures, and even more arcane mathematical expressions, but the one that offers satisfying explanations for innumerable aspects of the world around you. Unavoidably, the particular part of that world you'll encounter happens to be my own—"own" not as ownership but as outlook. I'm a biologist who asks about ways in which the appearances and activities of the organisms around us have been determined by their encounters—individually and evolutionarily—with the physical world. That's a world that limits them, one that they can't much alter, but of which they can take all sorts of subtle advantages.

I tend to ask questions close to what might be called intuitive reality, keeping at arm's length big bangs and deep space, atoms and molecules, ultimate causation, and so forth. Thus, relative to more sophisticated science, the price of admission remains low, perhaps close to what it must have been for most of science a few hundred years ago. Really—if I look at the current issue of the oldest of our English-language journals, *Philosophical Transactions of the Royal Society of London*, I can understand only a few of the papers. If I look (online, at my university) at an issue from 250 years ago, I find every paper readable and struggle only to close the volume (or to deselect it). As a result, I find myself concerned with an unusually approachable collection of questions,

explanations, and even fodder for investigation. Perhaps you'll be led into that world; better yet, perhaps after all is said and done here, you'll look differently at your immediate world, one that might be at least a little different from mine.

My intent can be put another way. An astronomer or a microscopist might introduce us to an otherwise unseen world. The account here, by contrast, aims to reveal an otherwise unnoticed world. Thus the photographs share a general ordinariness. Almost all are my own, accumulated over quite a few years and places, some opportunistically and some specifically for the present book. They haven't resulted from the patience and artistry of the professional—I'm not long on either virtue. I should admit to a fair bit of manipulation ("Photoshopping" seems to be the current descriptor). And I admit to a fondness for such fix-ups of contrast, background clutter, and so forth—digital, full-color versions of what I once did in the darkroom but reluctantly abandoned when I shifted to color slides.

Every few pages, you'll encounter a suggestion that you might try something at home. If I were teaching a course, it would provide classroom demonstrations, taking shameless advantage of the unusual immediacy of my material. I think all the do-it-yourself suggestions here are safe enough from hazards other than the ire of those with whom one cohabits. If you're lucky, they'll instead be amused.

As to equations, most of us view these as mere formulas into which specific numbers can be put with the expectation that other specific numbers will come out. However, I suggest that the equations given in the footnotes be examined in a different way. Look at what the variables might be to see what matters. Then look at whether each particular one is in the numerator or the denominator to find whether the result will track it or go up when it goes down (and vice versa). And finally, look at the exponents to get an idea of the sensitivity of the result to shifts in the values of the variables.

After all is said, many of the issues here will be left unresolved. For some, this lack of closure can be unsettling, the kind of thing that prompts negative opinions about books and movies. For the working scientist, it generates more positive feelings, ranging from a goad for a specific project to a general sense that yes, science remains an open-ended

venture, still fraught with uncertainty and on that account rich with opportunity.

Acknowledgments

I am anything but a proper botanist, even if my degrees say "biology" rather than "zoology," and even if I was (briefly) a member of the Botanical Society of America. I'm not even much of a gardener—my contribution to the family garden consists mainly of compost. So I've drawn on friends, family, colleagues, and prepublication reviewers for information, suggestions, equipment, and extractions of feet from mouth. In particular, I'm grateful for help and tolerance to Marilyn Ball, Anne Benninghoff, Norman Budnitz, Martin Canny, John Close, Mark Denny, David Ellsworth, Ken Glander, Louisa Howard, Peter Klopfer, Andrea Leigh, Dan Livingstone, Margaret McCully, Marty Michener, Adrienne Nicotra, Howard Reisner, Margareta Schmidt-Nielsen, Sanna Sevanto, Miles Silman, Bill Smith, Kathleen Smith, Donald Stone, Jane Vogel, Roger Vogel, Karen Wallace, Dick White, Robert Wilbur, and Claire Williams. Plus our local science book club, where I learn lots about how people read these books—as well as their likes and dislikes. A portion of the book was written while I enjoyed the excellent facilities and surroundings of the Whiteley Center of the Friday Harbor Laboratory at the University of Washington.