

riffs between the genetic haves and the have-nots reminiscent of the Eloi and the Morlocks as our divergent descendants in H. G. Wells's *The Time Machine* (2). Yet while Mehlman is certainly cautious—recognizing the importance of unanticipated genetic consequences, the risk of genetic engineering—not once do I get the feeling that I'm reading the words of a Luddite.

Mehlman has published extensively on the challenges and excitement of genomics and genetic enhancement. Accessible while having enough scientific substance to be taken seriously, *Transhumanist Dreams* provides a thought-provoking read for genetics professionals, ethicists, interested scientists, and concerned citizens. However, this dystopian nightmare isn't going to keep me up tonight.

References

1. M. S. Frankel, A. R. Chapman, *Human Inheritable Genetic Modifications: Assessing Scientific, Ethical, Religious, and Policy Issues* (AAAS Publications Services, Washington, DC, 2000); www.aaas.org/spp/sfrll/projects/germline/report.pdf.
2. H. G. Wells, *The Time Machine* (Heinemann, London, 1895).

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HISTORY OF SCIENCE

Roots of *Origin*

Stuart Firestein

Arguments over attribution are among the most contentious in science. From authorship on papers, to correct citations of the preceding literature, to the choice of only three winners of a Nobel Prize, there is always disagreement about priority, contribution, and significance. Of course, attribution encompasses more than often seemingly petty arguments over order in the author list; it speaks to deeper issues in the history and philosophy of science—where do “new” ideas come from, and what constitutes a “new” idea.

Darwin's new idea (also Wallace's, of course) was arguably the most seminal, world-altering, paradigm-shifting conceptual leap in modern science, certainly in the life sciences. But did it spring de novo from Darwin's mind?

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Were there precedents? Was it “in the air”? How much of it was his and his alone? What, if anything, did he owe to predecessors?

It is on this worry, one that plagued Darwin through continuously revised editions of the *Origin*, that Rebecca Stott masterfully hangs *Darwin's Ghosts*—a beautiful tapestry of the scientific and philosophical search for the answer to how life came to be the way it is on this planet. The book begins with Darwin constructing a list of possible sources that he had unwittingly failed to acknowledge (the ghosts of the title), at first wide ranging and then, as he crosses names off and adds new ones, more focused. Tracking them down, Stott weaves a story that proceeds through ancient Greece, the Middle East, medieval Europe, radical Enlightenment France, 19th-century Edinburgh, Malaysia (where Wallace caught a fever in the throes of which evolution by natural selection came to him), and of course Down House, Kent. Her account provides a view of Darwin and evolution quite different from the hero narratives we have become accustomed to and all the more fascinating for its sniffing out the bits and pieces of an idea so long on the verge of discovery.

The book offers a gripping narrative tension. One after another, great thinkers grapple with the notion that species cannot possibly be immutable, as the dominating biblical story says, but can't quite see through to the crucial idea of natural selection working its undirected way through multitudes of mutations. So many were so close for so long, you find yourself wanting to scream to Lamarck or Diderot or a host of others, “No, no, just look a little bit over here and all will be crystal clear.” But of course hindsight is always easy, and the importance of appreciating the state of knowledge (or rather of ignorance) that prevailed prior to the moment of discovery is too often forgotten. All great leaps one day become common knowledge.

I was especially taken with a short digression on the young Darwin in the years he spent in Edinburgh, apparently failing at his medical studies. Have you ever wondered what motivated Darwin to go off on the



“The sponge philosopher.”
Robert Edmond Grant.

Beagle voyage? I've always supposed it was for more or less superficial reasons: getting out of England and away from his father, travel is what other young men of means were doing at the time, the romance of voyaging, and other such simple youthful motives. And then, being a careful book-

keeper, the evidence just kind of piled up until, lo and behold, the idea of evolution by natural selection came to him. That is a story with more miraculous overtones than I think Darwin would have preferred.

Stott's discussion of Darwin's friendship with Edinburgh physician Robert Grant suggests alternatives. She tells us of Darwin's adventitious meeting with the radical Lamarckian, a seashore naturalist who, aided by a small club of boys, collected sponges and logged vast amounts of information about the marine animals that either washed up or were brought in by fishermen. This was after Grant had spent his inheritance on studies at the Museum of Natural History in Paris and travels in Europe to collect specimens and visit marine invertebrate specialists, libraries, and collections (another possible motive for Darwin's desire to travel). It was from Grant that Darwin picked up the habit of talking to locals, fishermen or their wives selling the creatures in the market, and extracting remarkable bits of intuitive knowledge from them. That investigative strategy appears in the *Origin* as his discussions with pigeon fanciers and domestic breeders of all sorts. It may have been Grant, through his amazingly detailed experiments and observations of sponges in search of an understanding of species mutability, who introduced Darwin to the method of using a detailed problem to ask and answer a big question (think barnacles, worms, and carnivorous plants)—to this day, the way much of biology progresses. Grant and Darwin fell out after a couple of years, and Grant died in obscurity. Stott brings deserved attention to this remarkable character and his influence on a young Darwin.

Grant's engaging story is one of many recounted in *Darwin's Ghosts*. Every chapter seems a travelogue in scientific history and culture, full of interesting material you didn't know or only thought you knew. Stott gives us a fascinating view of the evolution of one of the biggest ideas ever—evolution.

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