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HISTORY

Darwin's Garden of Earthly Delights

Robert J. Richards

THE DARWIN ARCHIPELAGO: The Naturalist's Career beyond *Origin of Species.* Steve Jones. xviii + 228 pp. Yale University Press, 2011. $27.50.

Open up the Tuesday science section of the *New York Times*, and you'll be treated to articles on new scientific discoveries in physics, anthropology and medicine; observations about the starry skies above and moral law below; and a great deal about the evolutionary processes that unite these disparate areas. The articles are usually written with verve and authority. Now ratchet that up a couple of notches, and you'll have the style of the connected essays that constitute *The Darwin Archipelago*. Your guide is Steve Jones, whose authority comes from his position as professor of genetics at University College London, and whose verve comes naturally—its hallmarks are a mordant irony and sly, knowing nods. A public intellectual and educator, he is skilled at making the science go down easily.

In each of the book's chapters, Jones selects a few theoretical judgments or experimental observations that appear in one of Darwin's less frequently read books and then jumps to a discussion of comparable concerns in contemporary research. We tend to think of Darwin as having had two great tricks up his sleeve: descent of species with modification (evolution), and the means by which this occurs, natural selection. But Darwin was a scientific conjurer of amazing versatility. In addition to the *Voyage of the Beagle* and the *Origin of Species,* he composed some 17 other monographs: two volumes on geology, four on barnacles and six on plants, as well as books on such varied subjects as human racial differences, emotional expression in humans and animals, variability of domestic organisms, and, at the end of his life, earthworms. Like his famous works, these less well-known ones contain minute observations, ingenious experiments and prescient conjectures.

Jones follows a meandering path through Darwin's volumes, pausing to pick out some nugget and then bringing up many related facts of a curious and often wondrous character, which have been mined using the instruments of modern science. He starts with the "shaved monkey," ourselves. Darwin conceived of human beings as descended from animal ancestors and thus subject to the same biological considerations as other animals, except that humans have reached a stage beyond: We are moral animals. Jones doesn't really do anything with that distinction, although Darwin made much of it in the *Descent of Man,* constructing a complex theory of the evolution of moral behavior, the basic structure of which is yet preserved in a multitude of descendant theories scattered through contemporary journals in anthropology, psychology and philosophy. In this chapter Jones makes a number of desultory references to recent discoveries about human biology (the fact that we have only about 20,000 genes in our genome, for example, about the same number as a simple worm), but his heart is not in it.

Jones takes much greater pleasure in Darwin's botanical work, in which that ever-curious naturalist described the kinds of experiments that mark him virtually our contemporary. Just after publishing the *Origin of Species* in 1859, Darwin began observations on insectivorous plants, from the sundews, which trap insects on the sticky surface of their leaves, to the Venus flytrap, which snaps its bivalve leaves on an unwary victim within a tenth of a second of sensing its presence. Darwin discovered that the constant pressure of a couple of grains of flour will not spring the trap, nor even a sliver of meat; but the tap dance of an insect—or the play of a fine human hair—will cause the prison doors to slam shut and the dissolving juices to begin their job. To Darwin's account, Jones adds our current understanding of the evolutionary pressures that led to such marvelous contrivances: Most carnivorous plants have a meager root system and live in nitrogen-poor soil; their adaptations have allowed them to draw life-preserving sustenance from living flesh, like beautiful, multicolored vampires.

Like Darwin, Jones delights in the intricate webs of coevolved life. Darwin described in the *Origin of Species,* for example, how cats in an area controlled the growth of clover: They fed on the field mice that destroyed the nests of "humble-bees" that pollinated the clover. Likewise Jones details how some ant species control the survival of acacia trees in the Amazon jungle: The trees exude a sweet, oily substance lapped up by the ants; in return the ants attack herbivores trying to lunch on the tree's tasty leaves; and as the ants die in the crevices of their abode, enzymes from the tree dissolve their bodies, releasing nitrogen; up to 90 percent of the nitrogen absorbed by the acacia is derived from insect visitors in this fashion.

Natural selection requires spontaneous variability in organisms in order to ensure morphological variability for exploiting different resources in the economy of nature. As selection continues to fit organisms into new pockets in the environment, morphological divergence, even within a family, can become quite large. In the plant kingdom, orchid varieties stretch morphologies to the extreme, from species whose flower might serve as the corsage for a ladybug to those whose girth exceeds that of a sumo wrestler.

But barnacles may win the prize for the most bizarre extremes of morphology. Darwin began the study of one type of barnacle he collected while in South America, a tiny, naked, insect-like animal that drills into the shell of a mollusk or another barnacle to live as a parasite. As he worked to come up with a description of this barnacle, which he called Mr. Arthrobalanus, the persistent naturalist stumbled through the shambles of barnacle systematics then available to him. He tinkered and obsessed, spending almost eight years (from 1846 to 1854) dissecting barnacles and trying to put order into their classifications; in the end, he wound up describing all of the known living and extinct barnacles in four large volumes, which are still the standard in the study of these creatures. Although Carl Linnaeus and Georges Cuvier had placed barnacles in the phylum of mollusks, because as adults they often had a clamlike shell, Darwin showed that their larval state was morphologically almost identical to that of crabs, lobsters and shrimp—they were really in the subclass Articulata. This discovery

supported his early conviction that embryological development retraces the stages of the evolutionary history of the phylum—or in his German disciple Ernst Haeckel's formulation, ontogeny recapitulates phylogeny. Jones, however, elides features of Darwin's study of barnacles to concentrate on tales of the weirdness of some species that have only recently become known.

And some are decidedly weird. A female of the genus *Sacculina,* in its larval state, will insert a slim needle-like apparatus through the joints in the armor of a crab, injecting a blob of its cells. These cells mature into the adult barnacle, which takes the form of a funguslike network, wrapping the internal organs and muscles of the crab in energy-sucking tendrils and depositing its eggs in the host's external pouch—the place where the host would normally keep its own young. The male barnacle, also equipped with a syringe, shoots its sperm into the pouch, and the crab must now eat constantly to ensure that it gets enough food, not for its own growing brood, but for alien babies. Crabs may live this way for years, like zombies.

Jones must have hundreds of index cards (or their computer equivalent) filled with such tales of the delights, wonders and oddities of evolution. After a while, the whirl of cards flipping by must have wearied even him, since his attention occasionally flags—when, for instance, he tells his reader that orchids form one of the largest families of flowering plants, with some 25,000 species; three pages later he gives the number as 20,000. Jones's stories, nonetheless, are the kind to rouse to consciousness a drifting student in a first-year biology class.

Despite the fact that portraits of Darwin in his later years show him looking like an Old Testament prophet, he retained an optimistic and cheerful attitude, whether in cultivating hopes for the future progress of human society or in enjoying a novel read to him by his wife—especially, as he declared, if the characters of the novel included a pretty girl. Jones's demeanor is different. He ends his book with lines that recall Philip Larkin's poetic lament for an England receding into the past. Vanishing from Darwin's Island are the abundant varieties of plants and animals; nine-tenths of the heaths that the Victorian naturalist knew, the sundews, orchids and gentians—all are being replaced by tract housing and golf courses. And beyond the British Isles, rain forests, coral reefs, mackerel and much else besides are also imperiled by humans. The optimism of Charles Darwin has found its modern corrective in Steve Jones's melancholy threnody.

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PUBLIC HEALTH

A Climate of Ill Health

Noel Castree

CHANGING PLANET, CHANGING HEALTH: How the Climate Crisis Threatens Our Health and What We Can Do about It. Paul R. Epstein and Dan Ferber. xii + 355 pp. University of California Press, 2011. $29.95.

Will anthropogenic climate change alter the global geography of illness, disease and death? If even the most conservative scientific predictions of the Intergovernmental Panel on Climate Change (IPCC) are accurate, the answer is a resounding yes. Securing the health of the populace in some 200 nation-states—including many with exceedingly poor and patchy health-care provision—is likely to be one of the signature challenges attendant upon unchecked atmospheric warming. Yet, as Harvard University's Paul Epstein and science journalist Dan Ferber explain in *Changing Planet, Changing Health,* it has taken 20 years for researchers, and more recently policy makers, to recognize the connection between climate change and public health. Thus far, the focus in behind-doors discussions and public debates seems to have been on admittedly important things such as food security, alternative energy sources and emissions reductions, with the health issues to which all three are obviously related relegated to the background. As Epstein explains in the introduction,

> This book is about how climate change harms health now, how it could devastate public health by midcentury, and how we must transform the way we power society and organize our economy to preserve a livable planet. But it is also about the incredible opportunities that will arise once we do.

Changing Planet, Changing Health offers diagnosis and cure—appropriately so, given that its principal author is a medical doctor now engaged full-time in research, teaching and advocacy. Epstein is Associate Director of the Center for Health and Global Environment at Harvard Medical School, the first organization of its kind to be created in a U.S. medical school (back in 1996). Alone and with others, he has been an indefatigable analyst of the health–climate-change nexus. In the book's foreword, Jeffrey Sachs characterizes Epstein as "a great scientific problem solver" and notes that "a breath-taking love of humanity and nature" is on display in the book. Epstein's considerable efforts as a researcher, knowledge synthesizer, pedagogue and network builder have all been geared to one aim: to ensure that public-health professionals and politicians understand the need for systems of illness detection, prevention and cure that can cope with the challenges of global climate change.

Epstein describes and explains the links between climate change and spreading health risks, employing a narrative form that is semiautobiographical rather than conventionally scientific. Readers are taken on a journey of discovery that retraces Epstein's winding career path as he moves from working overseas as a physician to serving as a leading expert in the study and management of epidemics.

After encountering a cholera outbreak in Beira, Mozambique, some 33 years ago (as he relates in chapter 1), Epstein went on to reeducate himself in the disciplines of epidemiology and public health (as we learn in chapter 2)—driven, in large part, by curiosity about why new infectious diseases were emerging and why known diseases thought to be under control were

