The Meaning of Natural History

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Henry David Thoreau, who just barely qualified for admission, got his formal training at Harvard College. The system of education at Harvard in 1833 emphasized rote memorization and good behavior. Classroom discussion was out of the question, and even lectures by professors were discouraged. The model student was passive, dutiful, worshipped the ancients, and doubted the advisability of anything contemporary—roughly the reverse of contemporary intellectual fashion. You could be punished academically for skipping chapel, wearing a coat of a color other than black (although Thoreau, too poor to afford a new coat, was tolerated for his old green one), and making inappropriate noises in the dining hall. Of the 63 members of Thoreau's class, 44 eventually found themselves subject to disciplinary action by the faculty. Students, not surprisingly, hated the place. During Thoreau's years at Harvard, the system provoked both a petition campaign, which Thoreau supported—students said the place promoted superficial scholarship—and a riot, from which he was absent, and which was suppressed with rigor a banana republic dictator might have admired. The leaders of the revolt were prosecuted in public court, and the entire sophomore class, with three exceptions, were expelled. The curriculum, designed mainly to turn out ministers, emphasized the study of classical languages, mathematics, and philosophy. Modern languages, although not yet academically respectable in the 1830s, were offered as electives. In addition to the mandatory Greek and Latin, in which he became fluent, Thoreau studied Italian, French, German, and Spanish. The English instruction was not in literature—post-Roman writing was not respectable then either—but in rhetoric. Thoreau had only one class in modern literature—on German and Scandinavian

writing, taught by Henry Wadsworth Longfellow—and a single class in biology, a natural history term taught by the college librarian, for whom the subject was an avocation. Both were ventures beyond the required curriculum. Thoreau was, by the standards of his time, a competent student, graduating in the upper third of his class. His teachers thought him an able, if not outstanding, scholar. He might have become a good entomologist if Emerson hadn't spoiled him, his natural history teacher said. His Greek professor, Cornelius Conway Felton, later president of Harvard, remembered him as a scholar of talent, but of such pertinacious oddity in literary matters that his writing will probably never do him any justice. The most promising writer in Thoreau's class, his English professor judged, was one Horace Morison, whose sole work, *Pebbles from the Seashore*, you surely must know. Harvard did offer, despite its deficiencies as an educational institution, a splendid library of 50,000 volumes, which Thoreau patronized for the rest of his days. There he began his lifelong habit of far-flung and systematic reading. During his college years he read his way through the 21-volume Chalmers anthology, *The English Poets*. He studied the Greek poets, read Shakespeare and Homer, devoured travel books, and sampled the works of such contemporary American writers as Cooper, Irving, and Longfellow. Later, his reading would expand to include works of science and natural history, of religion and philosophy, and such accounts of native American life and culture as were then available. He read not only in English, but also in the six languages he had learned at college, and, more haltingly, in Sanskrit and Hebrew. Thoreau not only read voraciously, but he began in college to keep the extensive notebooks—a million words of which still survive—on which he drew when he settled into his life's work. He also began, in college, the practice of slipping away into the nearby woods and fields to see what was up in nature. One winter while he was at Harvard, he made daily visits to the nest of a weasel in the hollow of an old apple tree. When his neighbor and mentor, Ralph Waldo Emerson, suggested to the young graduate that he make his journal systematic—the date was October 22, 1837—the tools of Thoreau's intellectual life were complete. From then on, with remarkable steadfastness of purpose, he practiced a threefold discipline: mornings for writing, afternoons for walking, evening for reading and reflection. Over the next twenty-some years, he wrote an immortal book; started, with his brother, an elementary school that was a hundred years ahead of its time; designed the best pencil then available; made still-reliable surveys of the countryside around Concord, Massachusetts; kept a three-million-word journal that is in itself one of the monuments of American culture; and, we have only recently learned, left behind at his premature death the first serious work of ecology, although the scientific idea of ecology had not yet been invented.

John Muir, born in Scotland, was raised at hard labor on the Wisconsin frontier by a father who was tyrannical, anti-intellectual, and a religious extremist. Forbidden to read in the evenings, Muir found an outlet for his lively intelligence in invention. He experimented with waterwheels and windmills and then with a series of remarkable clocks, all of the pieces whittled from hickory, which he assembled with the aid only of a book that taught him the laws of the pendulum. He was forbidden to take apart the family clock to see firsthand how these devices were conventionally made. The first of his clocks was shaped like

a sawmill and not only kept time but registered dates, lit fires and a lamp, and could be set to upend a bed at any hour. Muir called it his early rising machine. He made a clock shaped like a scythe, in which each individual part also had the shape of a scythe or of an arrow: it kept accurate time for more than fifty years. And he made a clock meant to be hung from the barn and designed to be read from the adjacent fields: its main hand was fourteen feet long; but his father, fearing that it would attract crowds, refused to let him install it. Muir also made thermometers, pyrometers, hygrometers and a barometer as a youth. Among these was a thermometer built on the same scale as the barn clock, mounted high on the Muir house, and so sensitive that it registered the body heat of a person approaching to within four or five feet of it. An equally sensitive thermometer, fashioned from an old washboard, and two of his early rising machines became Muir's ticket to freedom. He demonstrated these devices at the Temple of Art at the Wisconsin State Fair in 1860. They caused a public sensation, won a prize, and landed him a job with another inventor who was exhibiting a steam-powered ice boat at the fair. Muir was to tend the boat in exchange for lessons in mechanical drawing, which he never got. Trial runs that winter at Prairie du Chien, Wisconsin, on the Mississippi, proved the boat a flop, and Muir soon departed for the University of Wisconsin in Madison, "desperately hungry and thirsty for knowledge," he said, "and willing to endure anything to get it." He was admitted there, despite his paucity of formal education, as a first year student, enrolled in chemistry, geology, Latin, and Greek, the science courses for himself, the language courses for his mother, who hoped he would become a preacher. He was conspicuous on campus for his homespun dress and his unshorn and unkempt hair and beard, but he was also soon marked as the best chemistry student at the university and became locally celebrated for his inventions. These included a new early rising machine, a bed triggered by sunlight to dump its occupant onto the floor; a loafer's chair rigged so that sitting in it fired off a pistol loaded with a blank cartridge; and a study desk run by a clock that dropped a book onto a shelf, gave the user a predetermined number of minutes to examine it, and then swept it aside to be replaced with another. Students showing parents and dignitaries the campus sights invariably took them around to see Muir and his inventions. But he had no money, and the Civil War, which Muir spent in Canada, intervened. In the end, he completed only two and a half years of work at the university. After he left Madison, Muir wandered and botanized along the Canadian shores of the Great Lakes, and did factory work, inventing, on speculation in the finished products, machines that doubled the standard rate of production of hardwood broom handles and rake teeth. Before the 30,000 broom handles and 6,000 rakes he had made could be sold, the factory burned, destroying not only his inventory but also his notebooks and herbaria. In 1866, with just enough money for his train fare, he returned to the United States, getting as far as Indianapolis, where he found work in a factory making carriage parts. His extraordinary abilities as a technical manager were soon noticed, and Muir was given wide latitude to make improvements. He invented machinery to make complete wheels, except for the iron tires, without hand labor. He improved the efficiency of the system of belts that operated the equipment, did time and motion studies—these were among the first such studies ever done—leading to improvements in the organization

of the plant, and recommended shorter work days for laborers. Ten-hour days were then standard, and were still regarded as an extremely liberal concession to labor, but Muir showed that the precipitous drop in efficiency after the first eight hours made longer days counterproductive. But Muir disregarded his own advice. One day in March of 1867, while working alone late at night on a new belt in the factory, he lost his grip on the file he was using and it flew up and pierced his right eye, which went blind. He recuperated for a month. Eventually the sight returned to his eye, but his factory days, which had brought him up against what he called "the gobble gobble school of economics," were over. When he had sufficiently recovered from his accident, he set out on foot, walked a thousand miles to Miami, caught a boat to Cuba (where his plan to continue on to South America was foiled by a bout with malaria), went to California instead (by way of Panama), got off his ship in San Francisco, walked straight through the town and into the Sierra Nevada Mountains, and never looked back. Muir wandered the Sierras alone for months at a stretch, eager to experience everything they had to offer, to the extent of riding out a thunderstorm in the top of a tall spruce tree, just to see what that would be like. He learned, he said, that even trees do a good bit of traveling. He figured out the role of glaciation in shaping the Sierras, his work proving more accurate than that of the leading American scientist of the day, Louis Aggasiz, who was also wrong, unlike Muir, about Darwin. He wrote several enduring volumes of natural history, campaigned for the formation of the national park system, founded the Sierra Club, and prospered as one of the first big fruit growers in California's Central Valley.

Rachel Carson grew up in the countryside near Pittsburgh, Pennsylvania. She was a sickly child who frequently missed school and perhaps on that account was something of a loner. She found companionship in the woods and fields surrounding her home. She was also precocious, sailing through her schooling, which included a degree in biology, magna cum laude, from the Pennsylvania College for Women; a postgraduate internship at the Marine Biological Laboratory at Woods Hole, where she saw the ocean for the first time; and a Master's degree in zoology, with a concentration in genetics, from Johns Hopkins University. Carson, knowing from an early age that she wanted to be a writer, enrolled, when she entered the Philadelphia College for Women, as an English major. In her junior year she took the introductory biology courses to fulfill a distribution requirement, expecting to find the experience distasteful. But she loved the classes so much that, to the dismay of her English Department mentor, for whom she was the star student, she switched her major at the last minute, and over the next several years gave little further thought to writing. One would not have been encouraged to believe in an English Department in the 1920s that science could be a suitable subject for literature. Indeed, although a strong case can be made that the two distinctive contributions of American writers to literature are the short story and the natural history essay, it is still true that Literature, when it is thought of with a capital L, means poems, novels, and plays. The essay is still treated as the literary equivalent of an etude in music, a minor form, suitable for use in instructing the young, but not in itself of any serious artistic or intellectual interest. Carson emerged from college in the first years of the Great Depression when employment of any kind was hard to find,

much less for a woman scientist. She had the good luck, however, to interview with Elmer Higgens of the U.S. Bureau of Fisheries, a distinguished biologist but no writer, who had just been assigned the task of writing a series of radio scripts about the Bureau's work. When he learned that Carson could write, Higgens took a gamble and hired her. The radio series proved so successful that Higgens edited the scripts into a government booklet, asking Carson for an introduction. He rejected the text she produced, telling her it was too good for a government pamphlet and urging her to send it instead to the *Atlantic Monthly*. Carson, who knew that the magazine had also published Thoreau and Muir, did not have as much confidence in her work as her employer. She filed the piece away in a desk drawer. In the meantime, her father and older sister died, and Carson took on the task of supporting her family, augmenting her income at the Bureau with part-time teaching at the University of Maryland. When a position opened as a junior aquatic biologist in the Bureau, she took the Civil Service test, earned the highest score, and was hired and assigned as assistant editor in the Information Section. Her radio scripts had by then attracted the attention of the Sunday editor of the *Baltimore Sun*, who signed her on as an occasional contributor. Her success there finally gave her the courage to send the introduction she had tucked away to the *Atlantic Monthly*. The magazine bought it, the piece led to a contract with Simon and Schuster, and that resulted, in November, 1941, in the publication of *Under the Sea Wind*, regarded by some critics as her best book. It got lost, however, in the national trauma of the opening days of World War II, attracted little notice, and sold poorly. The Bureau of Fisheries became the U.S. Fish and Wildlife Service. Carson rose steadily through its ranks, becoming, by 1947, editor in chief of the Information Division. Her wartime duties included writing a series of pamphlets on the cooking of various seafoods, which the government was promoting as an alternative to the increasingly scarce supply of red meats. This assignment amused her co-workers, who knew that she abhorred all housework, and especially loathed cooking. During the 1940s, as Carson worked by day at the Fish and Wildlife Service, she also moonlighted as a freelancer for several national magazines, nurturing the ambition to write another book. The idea she settled on, and got a contract for from Oxford University Press, was to write a biography of the sea. She had looked for such a book, she said, and had not been able to find it, as, of course, she couldn't: the idea was as radically original as Thoreau's *Walden*. With *The Sea Around Us*, as the book came eventually to be called, Carson was inventing an entirely new kind of nature writing. She labored at the book through the late 1940s, writing at home far into the night after she had come home from her day job. She was a slow and meticulous writer, a perfectionist not only about her style but also about her facts. The book synthesized information gathered from hundreds of dense texts and obscure scientific articles, and from correspondence with marine biologists and oceanographers around the world. It was to be an unusual book not only in its biographical form but also in that it was primarily based not on firsthand observation but on library work, although she did supplement it with as much field investigation as she could find the time for, learning, among other things in the course of her preparations, to scuba dive. Carson was to the literature of natural history what her contemporary I.F. Stone was to political journalism, a writer whose

authority derived not from being an eyewitness—a notably unreliable kind of testimony, in any case—but on having read all the fine print that everybody else skipped. Even before *The Sea Around Us* was published in 1951, it attracted significant attention, earning her a fellowship for promising young writers and a $1,000 prize, for an excerpt published in the *Yale Review*, for the best science writing of 1950. But Carson's big break came in the spring of 1951, when the *New Yorker* published three long and celebrated excerpts from the book under the title *Profiles from the Sea*. When the book was finally launched in July of 1951, it landed straight on the best-seller lists, and stayed there for the next 83 weeks. What is more, Oxford University Press reissued *Under the Sea Wind* the next year, and it, too, became a best-seller, making Carson one of those rare writers to have two simultaneous best-sellers, a feat normally reserved for the John Grishams and Danielle Steeles of the world. From then on, she was showered with invitations to speak and publish, with prizes and honorary degrees. Carson at first shied away from doing the book that altered contemporary history. With her literary success, she had been able to quit her job and to buy a house in Maine on the shore of the ocean she loved so much. After a third book on the subject, *The Edge of the Sea*, which started as a conventional guidebook and evolved into an account of three shoreline ecosystems, one of the first books of this kind, Carson felt she had done what she could with the sea as a subject. She considered writing a book about evolution and decided against it. While she was still mulling the possibilities for a new subject, one of her friends sent her a copy of a letter she had sent to the *Boston Globe* protesting the aerial spraying of Cape Cod with DDT to control mosquitoes. Carson looked into the practice, was disturbed by what she learned, and wrote a magazine piece on the dangers of overusing DDT, but editors found it unconvincing—it was scientifically unorthodox—and nobody was willing to take the piece. Then, in 1957, the government announced plans to spray Long Island with DDT to control gypsy moths. Carson, who knew that gypsy moths are forest creatures and that Long Island is not forested, found this idea absurd. A group of Long Islanders sued to prevent the spraying. Carson wrote to E. B. White, suggesting that he cover the trial. White replied that she ought to do it herself, so she made plans to write about the trial for the *New Yorker* and to collect the pieces in a small volume. She set out, as she had done with the sea, to master her subject, reading everything she could find, ferreting through journals in medicine, organic chemistry, agronomy, and other disciplines, and initiating correspondence with scientists all over the world who might shed some light on the matter. Before long, what had been meant to be a brief collection of essays blossomed into a full-scale examination of the ecological implications of pesticides. Carson was not the first person to address this issue. There had been other books, but they had been either eloquent books written by authors with a shaky grasp of science, or books of sound scientific analysis written by authors with no literary ability. Carson brought a unique combination of assets to the work: she had enough training to read and understand the science, she was scrupulous about the details, she was by nature a synthesizer rather than a reductionist, she was a gifted writer, and she commanded, on the strength of three best-selling books, a huge audience. She was also aware, by the time she was finishing *Silent Spring*, that she was dying of cancer and that the book would certainly be her last testament; the

underlying tone of urgency in the book is one factor in its great power. When it appeared in 1962, *Silent Spring* had a bigger impact than Carson could ever have imagined. Although it was vigorously, even viciously, and nearly unanimously attacked in scientific circles as the work of an hysterical amateur, with such effectiveness that even today it will occasionally be asserted by an environmentalist with the stature of a Bill McKibben that Carson was not a scientist, the book, precisely because it was scientifically sound, held and took root. It changed attitudes not only about pesticides but about the earth itself, and about science, and was the critical spark that ignited the environmental movement that has endured now for three generations.

Edward O. Wilson had the quintessential naturalist's childhood. He grew up, that is, poor, lonely, socially an outsider. His father was an itinerant government accountant, constantly on the move. Wilson's elementary and secondary education took place in fifteen or sixteen schools. During the last eight of those years, the family moved from one city to another ten times, often lodging in boarding houses. In the summers he was farmed out to family friends in Alabama, Florida, Virginia, Maryland, and the District of Columbia. He was perpetually the new kid on the block. He was, moreover, somewhat deaf, he had blinded one eye as a young boy when he collided with the sharp spine of a panfish, and he was slightly built: hardly the sort of boy to make his way in the sports-minded culture of his peers. There was no educational theory in 1938, he remarks in his autobiography, "to suggest that loneliness in a beautiful environment might be a good if risky way to create a scientist, at least a field biologist." There is no such educational theory now, either, but that formula might describe the childhood of most important naturalists in American literature. There is, I might note parenthetically, one other striking convergence in the biographies of naturalists. In nearly every instance, lurking somewhere in the background, there is an absent, or tortured, or ineffectual father. Thoreau's father was affable and inept. Muir's father prayed in his study while his boys cleared the land and ran the family farm. About Carson's father, her biographers mention only his name; there would seem to have been little else to tell. Wilson's father was alcoholic, suffered from ulcers and acute chronic bronchitis brought on by a three-pack-a-day cigarette habit, and ultimately committed suicide. I do not know what to make of this except to observe that the human consolation found in nature is among the most compelling self-interested arguments against destroying it. Wilson knew by the time he was a teenager that he wanted to spend his life as a field biologist. His monaural vision and impaired hearing ruled out birds, amphibians, and most mammals, but the sight in his good eye, it turned out, was not only undamaged but hyperacute. He was equipped to study small things. So insects it would be, he decided. Not butterflies. Too much was already known about them, and there were many excellent lepidopterists at work. Flies, he thought, would be the ideal choice: he found them beautiful, they existed everywhere in great diversity, and most of them had not yet been identified, much less studied. He sent off for the necessary supplies. But the Second World War was just beginning, Czechoslovakia's borders were already closed to international trade, and the long black mounting pins he needed were made there. He would have to settle for a subject he could collect and preserve with supplies available at the local drug store. And so it was that he became a

specialist in ants. Eventually Wilson learned more about ants than any other human being, and his curiosity about them led him far beyond his nominal subject. His interest in their evolution led him to name and essentially to found the field of evolutionary biology. His interest in their patterns of distribution ultimately inspired the theory of island biogeography, one of the seminal theoretical ideas of twentieth-century biology. His interest in the social organization of ants led him to coin the word "biophilia" and to advance a theory of sociobiology, an idea that has been bitterly opposed, but mainly on ideological rather than on evidentiary grounds. His work on ants led him to the tropical rainforests of the world, with which he fell in love, and his grief over their widespread destruction prompted him, late in life, to become a social activist and, in this role, a popularizer of the idea of biodiversity, a word that did not exist fifteen years ago and which is now part of the vocabulary of every educated citizen on the planet. Despite his lifelong sinecure in an elite institution—Harvard University—and despite his path-breaking work on several frontiers of biological science, Wilson, when he recently published his autobiography, gave it the unassuming, indeed old-fashioned, title *Naturalist*. In it, he writes that he never thought of his work in any other terms, that he always wanted to be simply a discoverer, dazzled by the variety of nature and thrilled by any new discovery of even such a modest sort as the discovery of a new species of ant.

These four writers—Henry David Thoreau, John Muir, Rachel Carson, and Edward O. Wilson—span a century and a half during which science, in the contemporary sense, emerged from its infancy and developed into the primary intellectual force of our time. In terms of our assumptions about the nature of the world, Thoreau entered his adult life closer to the Paleolithic than to the twenty-first century. The rapturous writings in his journals about the railroad and the telegraph wire—he was not simple-mindedly anti-technological—reflect the fact that each was, in his lifetime, a revolutionary invention. Thoreau lived barely long enough to have heard of Darwin, and even Wilson remembers, in his autobiography, a time an astonishingly few years ago when a proposal to hire one ecologist at Harvard University was regarded as an outrageous venture into hokum. Everybody at Harvard who counted knew, as recently as the late 1970s, that the future of science lay in molecular biology and not in the study of biological systems or in the work of taxonomists like Wilson, whom his condescending colleague James Watson referred to as stamp collectors. Although these writers represent very different stages of our recent past; were as divergent in temperament as any four human beings one might choose at random; traveled, literally and figuratively, in quite different realms; and ranged in formal training from Wilson's Ivy League Ph.D. to Muir's essentially grammar school education, they shared several key intellectual qualities that illuminate not only their work but the larger role of literary natural historians in our culture. These writers were all, for one thing, generalists rather than narrow specialists. Thoreau's famous remark, "I have traveled much, in Concord," might well stand as their intellectual credo. It was not that they didn't delve deeply into their chosen subjects. Thoreau kept elaborate phenologies of the blooming of the plants in the vicinity of Concord and spent ten years assiduously tracing the dispersal of every kind of seed he could find within a day's walk of his house. Muir planted stakes in the glaciers of the Sierra Nevadas and traced

their movements inch by inch through many years in his effort to understand how they worked and what influence they had on the surrounding landscape. Carson may have set some kind of record for the reading of arcane journal articles in dozens of highly technical specialties. Wilson, as a young scientist, literally circled the globe in search of every kind of ant he could find. These were not merely stamp collectors. Nor is it the case that these thinkers rejected the reductionist premise of science, the notion that you can learn something valid about a whole system by examining closely its parts, the idea so central to the intellectual movement known as the Enlightenment and to the Industrial Revolution that it spawned. One argument now commonly advanced is that holism—the notion that the system rather than the individual is the basic unit of reality and that this reality embodies something larger than the sum of its parts—is a viable, indeed necessary, replacement for reductionism. The problem is, of course, that the choice—reductionism or holism—is a false choice. It is entirely probable that both points of view offer versions of the truth that are, at once, useful and, taken exclusively, misleading; that a vision of life embracing its real complexity will be neither reductionist nor holistic, but something else altogether, arrived at in the synthesis of these points of view, together with as many others as we can imagine. The task of making sense of the world does not so much lie in finding the supposedly single "correct" perspective as in learning to assimilate many perspectives, reductionism and holism among them. The obvious problem with reductionism is that it fails to account for the effects of synergy, or, as a geneticist might say, of pleiotropy. The obvious problem with holism, on the other hand, is that it fails to account for the ways in which the system itself may be radically altered by the random influence of any one of its parts. If holism alone were true, we ought to be able, by now, to predict accurately next Monday's weather. If reductionism alone were true, we ought to be able to solve the nation's crime problem by building more prisons. The genius of the four writers I am discussing is that they worked reductively—which is the only practical possibility, since no human being yet born has been able to think about the whole world all at once—but did not stop there. They were all, by temperament, despite their methods of working, synthesizers. You can tell a lot about how a clock works by taking it apart and examining its pieces, but if you never put it back together again, your knowledge will not result in a more accurate sense of time. These writers were specialists who thought to try to reassemble the pieces of their work. They had a talent for generalization and the courage to indulge in it.

They were all intellectuals, moreover, with a democratic temperament. They assumed their ideas could and ought to be communicated to a general audience. Even Wilson, when he sat down to write an encyclopedic survey of all that is known about ants, a subject one would hardly think suitable for wide dissemination, took such care with his work and wrote so accessibly that the resulting volume won a Pulitzer Prize in literature. These were not writers to hide in thickets of jargon, or to be content with publishing their ideas in places where only their colleagues would be likely to see them. They did not mistake obscurity of expression for depth of vision. In a time when scientific information is increasingly offered as an exclusive substitute not only for other kinds of learning but also for any conversation that is not strictly technical, these writers made

a principled effort to include citizens at large in the discussion and provoked widespread debate about issues of science and technology. A long line of critics, especially of literary critics who have been bored with his interest in nature, have painted Thoreau as a cranky misogynist who advocated that everybody retire to a hermitage, but the central question he raised remains urgently relevant: what, he asked, is the relationship between technological (or material) advancement and human happiness, and what would be required for the former to enhance the latter? Muir was the first, and in some ways is still the loudest, critic of the U.S. Forest Service's multiple use policy. Are there, he asked, any long-term values in nature that transcend their short-term exploitation? Carson raised the central power question: can nature be overwhelmed, she asked, or must it be accommodated? What sort of victory, she asked, can we expect from a war with nature? What, Wilson asks, is the relationship between nature and culture? Both have co-evolved through at least the last ten thousand years. Would it be helpful to know how each has influenced the other? These are serious questions with profound consequences for the planet's future, and not one of them can be answered by resort to technicalities alone. Not one of these questions would yield a publishable article in a refereed scientific journal, although much that is published in such journals could shed some light on the possibilities. They are questions that overreach the limits of the demonstrable. One challenge that these writers pose is whether we can afford a system of scholarship that, at its highest levels, actively discourages asking the biggest questions. Particularly with respect to technology, we now frequently face that conundrum in which technologists disavow responsibility for the social consequences of their inquiries and inventions, claiming, quite properly, that such matters ought to be discussed by society as a whole, while at the same time communicating their own knowledge in language unintelligible, in many cases, even to other scientists outside their specialties and, at the same time, branding anybody who sees any negative implication in their work as unscientific, or Luddite, or a threat to the freedom of scientific inquiry. Rachel Carson's challenge to the indiscriminate use of certain kinds of pesticides was not generally answered in the scientific community with countervailing scientific evidence but by just such ad hominen attacks. Were it not for the intervention of scientifically literate thinkers like Carson, whose fates are independent of their curricula vitae, we might be obliged to accept all scientific and technological developments on faith, just as the medieval faithful, deprived of the Bible in the vernacular, were obliged to accept all theology as divinely inspired. The natural historians, in our culture, have been the democratizers of science and technology.

They have been, as well, the keepers of the pre-Enlightenment idea that, in the largest sense, there is only one earth history, and that is natural history. For a time we were inclined to forget that, although we are creatures of culture, and culture is an artifact of the mind, the mind itself is a biological organ, and that we cannot, therefore, escape our common heritage with the rest of life. Death is nature's way of reminding us that we are, after all, creatures and not gods. There is a wonderful Blackfeet myth that expresses this truth. In the beginning, in the Blackfeet story of the creation, as in so many accounts of the origins of life on earth, including the modern scientific one, there was water. One day Old Man decided to find out what lay beneath the water. So he sent down

diving animals on reconnaissance: a duck, an otter, a beaver, a badger; they all dived in vain. Then he sent down a muskrat, which returned with a lump of mud in its paws. When the Old Man blew upon it, the mud swelled up until it became the earth. Old Man traveled the length and breadth of the new earth, piling up stones to make mountains, digging rivers and lakes and filling them with water, creating grasses to cover the prairies, and trees to shade the forests, and birds and animals of every kind. Then he made for himself a wife, Old Woman, who was very clever. The two of them decided together how people should be made. Old Man insisted on having first say in everything, which Old Woman agreed to, so long as she could have last say. People should have eyes and mouths, arranged vertically on their faces, Old Man said. Fine, said his wife, but they should be situated crosswise. They should have ten fingers on each hand. Fingers they shall have, Old Woman said, but so many would be awkward; let people have four fingers and a thumb on each hand. Then came the big question: should they live forever or should people die? "I'll toss a buffalo chip on the water," Old Man said. "If it floats, people shall die four days and then rise again. If it sinks, people shall die."

"As you wish," Old Woman said, "but let me toss a stone into the water instead." The stone, of course, sank, and so it was decided that people should die. Old Man and Old Woman agreed that this was for the best. If they should never die, they said, then people would never feel sorry for one another.

The great contemporary oceanographer Sylvia Earle suggests another context in which our own history might be understood. If the history of the earth were to be represented, she says, on a scale equal to the depth of the deepest ocean, human civilization would occur only in the last inch, equal to the depression a floating gull makes on the surface of the sea. By insisting, through a long moment of hubris, on the reality that human history is a branch of natural history, the literary natural historians have been nurturers and preservers of the very possibility of history.

These writers also share in a refusal to acknowledge the distinction, alive since the Age of Enlightenment, between the sciences and the humanities. The extremes are best represented by Thoreau, whose apprenticeship was as a poet, and Wilson, whose earliest interests were exclusively scientific. Thoreau worried in his journal that his poetry would be overwhelmed by his science. He thought science, in itself, a barren enterprise, but he thought poetry written on instinct alone equally so. "At first blush," he said, "a man is not capable of reporting truth; he must be drenched and saturated with it first. What was enthusiasm in the young man must become temperament in the mature man. Without excitement, heat, or passion, he will survey the world which excited the youth and threw him off his balance.... A style in which matter is all in all, and the manner nothing at all." Thoreau insisted, like a good scientist, that a writer's work ought to be founded upon facts, but, more than that, upon such facts as the writer has had occasion personally to verify. He also insisted, like a good humanitarian, indeed like a good deconstructionist humanitarian, that those facts were useless until they had been established in some context that revealed their significance. "Facts," he wrote in his journal, "should be only as the frame to my pictures; ... facts to tell who I am, and where I have been or what I have thought; as now the bell rings for the evening meeting, and its volumes of sound, like smoke which rises where a cannon is fired, make the tent in which

I dwell. My facts shall be falsehood to the common sense. I should so state the facts that they shall be significant, shall be myths or mythologic." We now assume, tragically—for myths are among the highest expressions of the human imagination—that myths are by definition false, but what Thoreau was talking about, in essence, was the social construction of reality, which he believed to be of a higher order of truth than the mere facts. Here Thoreau predicts, as he foreshadowed so many ideas in our culture, Foucault. Wilson writes in his autobiography about being powerfully impressed as an undergraduate student by Erwin Schrödinger's *What is Life?*, which argued that it is nothing more than a physical process, entirely explicable by the laws of physics and chemistry; and by Ernst Mayr's *Systematics and the Origin of Species*, which offered a keystone synthesis of genetics and evolutionary theory. For Wilson, "Science became the new light and the way." Still, he remembered that he had experienced a Christian conversion only three years earlier. "Religion, I knew from personal experience," he writes, "is a perpetual fountainhead of human emotion. It cannot be dismissed as superstition. It cannot be compartmentalized as the manifestation of some separate world. From the beginning I could never accept that science and religion are separate domains, with fundamentally different questions and answers. This, Wilson says, looking back on a lifetime of science, is still the view he holds. And it has been, in general, the view of the literary natural historians, who have always walked with one foot in science and the other in the humanities, unwilling to relinquish either, valuing both for their revealing disparities of method, but refusing to see them as concerned with fundamentally different questions and answers. Current trends in literary theory, in particular, apply self-consciously scientific models to the methods of the humanities, threatening to make even the arts into subjects so arcane, rarified, and specialized as to preclude the legitimate interest of ordinary human beings. It may well happen, if this movement continues to flourish, that, just as the writers I have been discussing have kept history alive, so their successors will preserve what used to be thought of as the humanities, rather as monks copied out the classical texts in anticipation of the Renaissance, against that dark time when we will have specialized ourselves into utter incoherence.

I would, finally, mark this about the literary natural historians: they are all, to the last one, celebrants of wonder. There is not a cynic in the lot. "A child's world," Rachel Carson wrote, "is fresh and new and beautiful, full of wonder and excitement. It is our misfortune that for most of us that clear-eyed vision, that true instinct for what is beautiful and awe-inspiring, is dimmed and even lost before we reach adulthood. If I had influence with the good fairy who is supposed to preside over the christening of all children, I should ask that her gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantment of later years, the sterile preoccupation with things that are artificial, the alienation from our sources of strength." Good science in our time is anti-mystical, and good humanities scholarship is anti-romantic. We fear above all else, as scholars, that we might be caught in an unguarded moment of sentiment or nostalgia. The great sin of our age is to think fondly of the past. But in the world of the gene, in our biology, we are inextricably bound to the very beginnings of life. To despise the

past, therefore—to suppose that our highest intellectual goal is to debunk all that has gone before us—is to despise ourselves. There is no higher or miserable arrogance than that which denies our beginnings. To wonder, to be astonished, to feel awe, is the beginning of a suitable humility. "Whatever attitude to human existence you fashion for yourself, know that it is valid only if it be the shadow of an attitude to Nature," Henry Beston wrote. His words might serve to summarize this whole intellectual tradition. "A human life," he wrote, "so often likened to a spectacle upon a stage, is more justly a ritual. The ancient values of dignity, beauty, and poetry which sustain it are of Nature's inspiration; they are born of the mystery and beauty of the world. Do no dishonour to the earth lest you dishonour the spirit of man. Hold your hands out over the earth as over a flame. To all who love her, who open to her the doors of their veins, she gives of her strength, sustaining them with her own tremor of dark life. Touch the earth, love the earth, honour the earth, her plains, her valleys, her hills, and her seas; rest your spirit in her solitary places. For the gifts of life are the earth's and they are given to all, and they are the songs of birds at daybreak, Orion and the Bear, and dawn seen over ocean from the beach."