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How to Raise a Naturalist

The ascent to nature begins in childhood, and the science of biology is therefore ideally introduced in the earliest years. Every child is a beginning explorer naturalist. Hunter, gatherer, scout, treasure seeker, geographer, discoverer of new worlds, all these are present at the child's inner core, rudimentary perhaps but straining for expression. Through time immemorial children were reared in intimate contact with natural environments. The survival of their tribe depended on a close, tactile knowledge of wild plants and animals.

Then, after millions of years of such existence, the agricultural revolution abruptly removed most people from the habitats in which their ancestors had evolved. It allowed them to multiply to higher population densities, but at the price of chaining them to much simpler surroundings. They came to depend on a drastically reduced number of plant and animal species, which could be cultivated only in a biologically pauperized environment by repetitive labor. As the still larger populations supported by agricultural surpluses emigrated into villages and cities, people drifted still farther from the ancestral environment. Today, most of humanity dwells in an artifactual

world. The cradle and original home of our species has been largely forgotten.

The ancestral instincts nevertheless still live within us. They are expressed in art, myth, and religion, in gardens and parks, in the strange (when you think about it) sports of hunting and fishing. Americans spend more time in zoos than at professional sports events, and more time yet again in the increasingly crowded wildlands of national parks. Recreation in national forests and nature reserves—the parts that remain uncut, that is—generate substantial wealth, over $20 billion annually, for example, to the American gross domestic product. Wild nature saturates television and movies in the industrialized world. A touchstone of personal wealth is the second home, typically in pastoral or natural environments. It serves as a retreat for peace of mind and a return to something otherwise lost but not forgotten. Bird-watching, or birding, as the cognoscenti prefer to call it, has become a major hobby and a robust industry.

To be a naturalist is not just an activity but an honorable state of mind. Those who have expressed its value and protected living Nature are among America's heroes: John James Audubon, Henry David Thoreau, John Muir, Theodore Roosevelt, William Beebe, Aldo Leopold, Rachel Carson, Roger Tory Peterson. Cultures around the world still living close to Nature value talent in natural history. Those dependent on artisanal hunting and fishing, and on sustenance agriculture, stake their lives on knowing it well. The cognitive psychologist Howard Gardner has defined such ability as one of the eight major categories of intelligence:

> A naturalist demonstrates expertise in the recognition and classification of the numerous species—the flora and fauna—of his or her environment. Every culture prizes people who not only can recognize members of a species that are especially valuable or notably dangerous but also can appropriately categorize new or unfamiliar organisms. In cultures without formal science, the naturalist is the person most skilled in applying the accepted "folk taxonomies"; in culture with scientific orientation, the naturalist is a biologist who recognizes and categorizes specimens in forms of accepted formal taxonomies.

The cognitive skills of the talented naturalist play out in many other ways, including the practical activities of industrialized societies. "The young child who can readily discriminate among plants or birds or dinosaurs," Gardner observes, "is drawing on the same skills (or intelligence) when she classifies sneakers, cars, sound systems, or marbles"; and "it is possible that the pattern-recognizing talents of artists, poets, social scientists, and natural scientists are all built on the fundamental perceptual skills of naturalist intelligence."

I argued earlier that biophilia, the inborn attraction to the natural world, has provided individuals and tribes an adaptive edge throughout evolutionary history. Now natural history is coming back to biology in a way that will expand its base into a more human-oriented and humane science.

How best to cultivate a naturalist's intelligence in every child? And how to promote excellence in those who prove talented in natural history? These questions having received very little

attention from research psychologists, I will presume to draw again on my personal experience and what I have learned by talking with parents and teachers, as well as children, over a period of many years.

A child's mind opens to living Nature early. If stimulated, it then unfolds in stages that strengthen the bond to nonhuman life. The brain is programmed for what psychologists call prepared learning: we remember with ease and pleasure some experiences. In contrast, we are counterprepared to avoid learning, or else to learn and then avoid, other experiences. For example, flowers and butterflies yes, spiders and snakes no.

The rationale from evolutionary biology concerning such biased learning is straightforward: the cues that signal the healthful, productive part of the environment result in genetically swift positive reinforcement and do not need to be taught or repeated; those that signal danger result in similarly swift negative reinforcement.

I have several time-tested suggestions for parents and teachers, including religious leaders, who wish to cultivate the naturalist's capability in a child. Start early; he is ready. Open doors to Nature, but don't push him through. Think of the child as a hunter-gatherer. Provide opportunities to explore the outdoors and its surrogates in zoo and museum exhibits. Let the child search, alone or in small, like-minded groups. Let him disturb nature a bit, on his own and without coaching. Provide field guides, binoculars, and even microscopes, at home if possible and at least at school. Encourage and praise his initiative. With adolescence, allow him to undertake adventures with others, to wild areas and foreign countries as opportunity and finances allow. Let him learn all things at his own pace. At the end of this

process he may choose a career in law, marketing, or the military, but he will be a naturalist all his life, and thank you for it.

I hope the foregoing recommendations make it clear that becoming a naturalist is not like studying algebra or learning a foreign language. It would be a mistake to introduce a child to Nature by a walk through a park or arboretum, with labels naming the species of trees and shrubs. The child is a *savage,* in the best meaning of this word. He needs to thrill to the excitement of personal discovery, to mess around a lot and learn as much as possible on his own.

Try this. Buy him a small compound microscope; they are now available at no greater cost than a skateboard or airfare to Disney World. Suggest that he look at drops of pond water, sampled with an eyedropper from aquatic plants or algae. Don't tell him what to expect, only that it will be unlike anything he has ever experienced. He will see what astonished Robert Hooke, Antony van Leeuwenhoek, and Jan Swammerdam, the first microscopists of the seventeenth century: a miniature Jurassic Park, inhabited by translucent shape-changing rotifers that snake their way through the detritus, settling and opening out their hairlike cilia on the head to create circular water currents; protozoans darting and spinning through the water and bumping into obstacles like drunken drivers; crystalline diatoms; and more, almost infinitely more.

I had this experience at the age of eight. My parents gave me a microscope. I don't recall why, but no matter. I then found my own little world, completely wild and unconstrained, no plastic, no teacher, no books, no anything predictable. At first I did not know the names of the water-drop denizens or what they were doing. But neither did the pioneer microscopists. Like them, I

graduated to looking at butterfly scales and other miscellaneous objects. I never thought of what I was doing in such a way, but it was pure science. As true as could be of any child so engaged, I was kin to Leeuwenhoek, who said that his work "was not pursued in order to gain the praise I now enjoy, but chiefly from a craving after knowledge, which I notice resides in me more that most other men."

The thirst for knowledge can be heightened by repeating the archetypes that rule the developing mind. At eight to twelve years of age, many children establish secret places, ideally caves or abandoned buildings, but in fact any out-of-the-way spot that offers privacy. A shelter can be built from saplings (which I used, although they turned out to be poison oak!), scraps of lumber, abandoned cinder blocks, or other makeshift materials. A tree house is ideal, because it offers maximum privacy and protection. Woodland, even a small fragment of second growth, is a logical choice of habitat. In the secret place the child, perhaps along with a couple of friends, collects magazines, reads and talks a lot, and monitors the surrounding terrain.

Children are born treasure hunters and collectors. Given any access to natural environments, they are likely to start searching for minerals ("gems"), specimens of butterflies and other insects, and small live animals of any kind. Encourage this activity. Do not allow yourself to be squeamish. Pet toads, snakes (nonpoisonous), and minnows are just fine. Testing the outer limits of my parents' tolerance, since I already brought home snakes, I kept and bred black widow spiders, feeding them live flies and cockroaches. Ant colonies housed in artificial nests ("ant farms") are potent in every way: the workers are

in a flurry of activity day and night; they quickly convert a small pile of earth into a home, from which they lay down invisible odor trails to newly discovered food. Ants are as relaxing as fish in an aquarium and make excellent science projects for school.

For maximum impact in a short period of time, take a child to the seashore and challenge him to make a collection of creatures he finds on his own. In settled areas and heavily used beaches, use a digital camera for all but the smallest animals, and otherwise collect everything live for return to the sea. Along sandy beaches, legions of little insects, crustaceans, and bivalve mollusks lurk in drifts of stranded seaweed; mysterious dead animals or their fragments wash ashore from deeper water. In the tide pools of rocky shores dwell a seemingly endless variety of small crustaceans, snails, sea anemones, sea urchins, starfish, and other, less familiar inhabitants of the shallow marine environment. After a while, open a field guide and help the child put names on the discoveries. And if a small compound microscope is available as well, encourage him to sample drops of water drawn from around the algae and rock surfaces. Thus add another and even richer world of biodiversity.

Adventure with a different feel to it awaits the child who joins a group of birders. As an adult I thrill, even myopic entomologist that I am, at the sight of eagles, cranes, and ibises. Recently I sat in a skiff on Mississippi's Pascagoula River, transfixed by a dozen swallow-tailed kites that wheeled overhead and swooped to take sips of water from the river.

It is among birders, all of them naturalists and adventurers, that the child can find role models. There are a few eccentric

loners in their ranks, but also physicians, ministers, plumbers, business executives, military officers, engineers, and in fact members of virtually every trade and profession. They are united in a common focus. At least while in the field, they are among the most congenial and enthusiastic people I have ever known.

Take the child to the zoo, with a purpose. Don't wander through the exhibits passively, but instead pick a kind of animal for close-up study. Reptiles are popular, and of course large mammals always, but so are the littlest of the creatures on display. For years one of the parts of the National Zoological Park in Washington, D.C., that has attracted the most visitors has been the insect collection. Among the exhibits there, since their inception in 1987, the most popular has been the Soil Table, a long trough filled with soil and leaf litter from a nearby woods. Visitors, mostly boys and girls, explore this miniature terrain to glimpse the myriad insects and other small invertebrates living there. They are allowed to comb and pick through the material like entomologists in the field to expose and identify the inhabitants.

Visit an aquarium for similarly high impact. People, including children, love sharks almost as much as they do dinosaurs—and sharks can be seen *alive*. But they are drawn equally to the brilliance of reconstructed coral reefs and the great diversity of life in and around them that can be taken in with one glance. Visit a botanical garden, enter a simulated rainforest and drink in the grandeur it represents. Or study the occasional exhibitions of orchids as you would fine paintings in a gallery. They are the most diverse flowering plants on Earth as well as arguably the most aesthetically pleasing.

From the freedom to explore comes the joy of learning. From knowledge acquired by personal initiative arises the desire for more knowledge. And from mastery of the novel and beautiful world awaiting every child comes self-confidence. The growth of a naturalist is like the growth of a musician or athlete: excellence for the talented, lifelong enjoyment for the rest, benefit for humanity.