Book Reviews

Atomic Energy vs. Eskimos

The Firecracker Boys. DAN O'NEILL. St. Martin's, New York, 1994. xii, 388 pp., illus., + plates. $23.95.

In 1959 when Edward Teller was in Alaska to promote the nuclear excavation of a harbor in the Arctic, he quipped to reporters: "If your mountain is not in the right place, just drop us a card" (p. 92). For the opponents of Livermore Laboratory's Project Chariot, "drop me a card" came to epitomize the untouchability and casual indifference to other people and the natural environment of certain physicists during the early years of the Cold War.

Project Chariot came out of Livermore and the Atomic Energy Commission (AEC) formally in 1957 as part of Project Plowshare devoted to peaceful uses of nuclear energy. To test the feasibility of "geographical engineering" for construction of another Panama canal and also, not incidentally, to continue bomb testing during a moratorium, several nuclear devices would be detonated at Cape Thompson and a harbor created. At first the harbor was promoted as an economic boon to Alaska, a place from which coal and oil (miles away and unconnected by road or rail) would be shipped to Japan three months of the year; the harbor would be icebound at other times.

"Biologist William Pruitt packs caribou antlers back to camp for analysis as part of the AEC-funded environmental studies in the Cape Thompson region. In 1961, Pruitt was dismissed from the University of Alaska after his reports noted relatively high levels of fallout in lichen, caribou, and Eskimos in the Arctic." [From *The Firecracker Boys*; courtesy of Les Viereck]

The Alaskan newspapers and chambers of commerce enthusiastically endorsed the project, but a few biologists at the University of Alaska studying the flora and fauna and a geographer studying human resources at Point Hope near Cape Thompson expressed serious doubts in public about the safety of the project. More important for the future of Chariot, Livermore ignored the Inupiat Eskimos of Point Hope (of whom Teller wanted to make coal miners if their hunting was affected adversely by the project). When the AEC finally sent a team to explain Chariot to the village, the Natives were prepared with embarrassing questions and a tape recorder to preserve for posterity the astonishingly naïve and misleading statements of the scientists.

"Lawrence Radiation Laboratory's Edward Teller (*left*) and Gerald Johnson (*light suit*) promote the idea of "geographical engineering" to a receptive group of University of Alaska officials, including C. T. Elvey (*bow tie*) and Robert Wiegman (*right*) in 1959. [From *The Firecracker Boys*; University Relations Negative Collection, University of Alaska, Fairbanks, Archives]

The Eskimos reaffirmed their strong opposition to the nuclear experiment. The new, minuscule Alaska Conservation Society publicized the biologists' criticism of what they considered AEC misrepresentation of their data. One of them alerted Barry Commoner, who then (1960) was chair of an American Association for the Advancement of Science committee on science and human welfare and founder of the Committee for Nuclear Information. The Sierra Club published the full report of the Alaska Conservation Society. Olaus Murie of the Wilderness Society, with many years of experience as a field biologist in Alaska, objected to using wilderness areas and their wildlife and small human populations to test this "atomic plaything" (p. 216). Two Alaskan clergymen spoke against the project, and one aroused a small group of New Englanders whose opposition was filtered into influential segments of American society. This activism brought the Association of American Indian Affairs to the aid of the Inupiat, who then began to emphasize a legal point: the Bureau of Land Management had withdrawn for the AEC test acreage to which the Eskimos had a legitimate claim. The Department of the Interior under Stewart Udall agreed with the Natives. In 1962 the AEC canceled Project Chariot after nuclear testing was resumed in Nevada.

In Alaskan history the imbroglio politicized the Natives and led eventually to the Alaska Native Claims Settlement of 1971. Nationally, the controversy was a powerful propellant in the emerging environmental movement; it converted Commoner and put Alaska in the environmental spotlight where it remains, and the biological study of Cape Thompson was a pioneering environmental impact report. The Eskimos seem to have invented what we all now call the NIMBY ("not in my backyard") syndrome. More significant, the controversy is a frightening illustration of the danger to democracy of secret, unaccountable science, its practitioners and institutions.

O'Neill's profluent narrative is what he terms "historical investigative journalism" (p. 292). There is more than a touch of wild-western, white-hat–black-hat history here, and although the absence of shading can be justified easily in the story of Project Chariot, the author creates some arguable impressions. Not all biologists are angelic and not all nuclear physicists are demonic. Many of the latter did not agree with Teller's and Livermore's view of how the new power should be used. The decision to drop the bomb on Hiroshima is treated too glibly and the legislative history of the AEC is too simplified, as are other aspects of the background history that might not tend to sus-

Vignettes: Embarrassment

With embarrassment goes blushing. Why do we blush?. . .

Darwin wanted to see how blushing was related to embarrassment in women, who blush more than men. As he regarded it as a social signal, he was interested to discover whether the blushing occurs in places normally hidden by clothes. But being too embarrassed to try the experiment himself, he got his doctor friends "who necessarily had frequent opportunities for observation" to see how far the blush spread down below the neckline. It generally didn't. Whether this was because the visibility-limit was set thousands of years ago by the dress style of cave ladies, or whether it was set by individual experience to conform to their Victorian neckline, is an unanswered question. . . .

One can be embarrassed not only by oneself but by others, especially as a child by one's parents. My father was an astronomer, Director of an observatory, nothing embarrassing in that. But he was decidedly eccentric. . . . At an international Astronomical Convention (note the word!) . . . my father took his clothes off and swam in the national shrine of Napoleon's Carp Pond at the Palace of Fontainebleau. He was surprised to be arrested. . . . There were small headlines commenting on foreign professors. . . .

There is no doubt we try to avoid embarrassments. . . . This extends to editing ourselves. If we are embarrassed by some kinds of ignorance, we edit the text of "what really matters." . . . Very common is the attitude to science that says it is no disgrace to be ignorant of how the universe ticks, and how technologies work. So most people are not embarrassed by scientific solecisms, even so extreme they pass over into being funny which, funnily enough, is just what happens with extreme embarrassment, no doubt as a divine protection.

The bottom line is that as embarrassment is multiplied by increases of social sophistication, which in this country is waning, it is now increased by the new expectations of literacy in languages and science. So—life will go on being blush-making.

—*Richard L. Gregory*, in *Even Odder Perceptions* (Routledge)

tain the moral polarity of the narrative. In an early National Science Foundation annual report, O'Neill finds something sinister in a flat, uninspired sentence about the need for a healthy partnership between science and government; he fails to mention that the sentence appears in an argument against political tests and loyalty investigations of scientists doing unclassified basic research. And in a scattershot windup, he hints at a CIA conspiracy in the death of one of his protagonists following an automobile accident.

In a book with so many literary pyrotechnics, some duds should be expected. *The Firecracker Boys* remains an exciting, generally reliable account of a dismal but significant chapter in the recent history of science and society.

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Fractal Colonies

Fractal Modelling. Growth and Form in Biology. JAAP A. KAANDORP. Springer-Verlag, New York, 1994. xiv, 208 pp., illus. $39.95 or DM78.

The recent discovery of a geometry of structures with non-integer dimension—fractals—has been a momentous event in one of the oldest fields of mathematics. This was not just the discovery of a new type of geometric object, but rather a realization that the field of geometry was immensely bigger than anyone had guessed. The integers are but a small archipelago of infinitesimal islands in the sea of non-integers. Since almost all numbers are not integers, almost all geometric forms must be fractals.

The field took off in the 1960s, when Mandelbrot began showing that fractals both are easy to produce and can closely resemble many real structures that could not be modeled well by Euclidean geometry. This latter possibility has been a mixed blessing. The ease with which "biological-looking" structures can be created with fractal-building algorithms has led some to uncritically "model" everything from morphology to phylogeny by constructing similar-looking fractals. Biologists seeing this could be forgiven for concluding that the entire subject is an exercise in curve-fitting.

Forgiven, but not allowed to continue with such a misconception. The language of fractals provides us with one of the best ways to discuss complex forms. In order to say something interesting, though, we must be able to relate the rules by which fractal structures are generated to the processes by which biological structures develop. A model of biological growth must do more than simply mimic the adult phenotype, it must construct that form in a way that is related to the actual processes by which the organism develops. This is why most organic-looking fractals are not useful to biologists.

Most current work on fractals involves only a few ways to construct them. Many of these are based on iterative processes in which discrete parts of structures are either added or replaced. We might therefore look for organisms whose growth involves the repeated addition of discrete units to a growing core. This is exactly what Jaap Kaandorp does in *Fractal Modelling: Growth and Form in Biology*.

Despite the title, which recalls d'Arcy Thompson's wide-ranging meditation on geometry in biology, Kaandorp focuses almost exclusively on a single type of growth: growth of colonies by accretion at the tips of branches. Even then, he restricts his attention further to branching sponges and corals. There is good biological reason for this; most seemingly fractal-like organisms, such as vascular plants, display a number of developmental processes, such as apical dominance, that coordinate growth in different areas, making models based on iterative addition unrealistic. By choosing to study those organisms whose growth really does look most like the iterative addition of basic elements, Kaandorp is able to draw conclusions from the behavior of his models that he can then test against growth experiments carried out on the actual organisms.

The book describes the actual algorithms in great detail, often inserting page-long segments of code into the text. Though this sometimes makes for awkward reading, it means that those interested in doing similar research can follow along closely, seeing where potential pitfalls arise.

Fractal geometry is clearly a much bigger subject than can be seen by means of the simple construction rules so far studied. Ad-