knowledge from "missionary work" and direct foundation funding from projects supported through intermediary committees, he arbitrarily circumscribes his perspective. As a result he has no place from which to describe such enduring Rockefeller interests as sex, which included support for anti-vice campaigns, sea urchin embryology, primate psychology, and the Kinsey surveys. Study of such efforts is central to understanding the pattern of intersections between private money, ideology, new knowledge, and the changing conditions of human life in this century.

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A Force Advancing Nationhood

Inventing Canada. Early Victorian Science and the Idea of a Transcontinental Nation. SUZANNE ZELLER. University of Toronto Press, Toronto, 1987. viii, 356 pp. + plates. $35; paper, $15.95.

Science may often be the disinterested pursuit of knowledge, but it is surely always an artifact of culture. For American historians who want to demonstrate that truth, however, it has proved difficult enough to integrate science into the country's intellectual life, and harder still to show that it has influenced the way Americans thought about themselves. One might imagine an even more problematic history for science in Canada, a country with substantially less wealth and population that did not achieve nationhood until 1867. But in Suzanne Zeller's powerful and subtle study we get a surprisingly different answer and a model of how to write the history of a country's science.

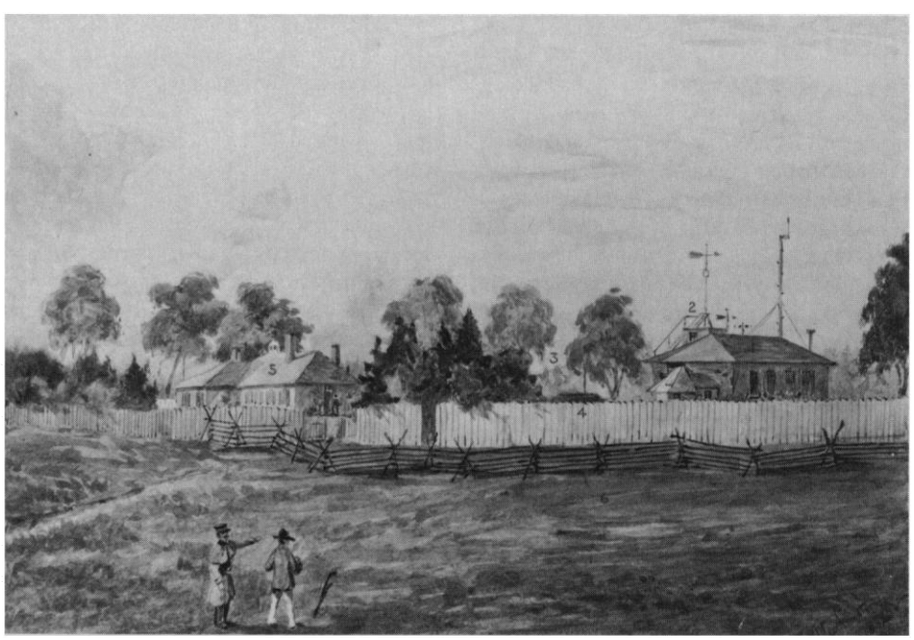
Zeller's central argument is that in the application of the "inventory" sciences of geology, terrestrial magnetism, meteorology, and botany Canadians discovered the idea of a transcontinental nation. Never was the agenda to develop a "Canadian" science—as development of a national science sometimes was for Americans bent also on creating a national literature and language. Rather, it happened that in the pursuit of British scientific programs Canadians came to believe in the possibilities of a country of their own, from sea to sea.

The general patterns of the process were similar across the front of these various disciplines. In its socially and politically most important forms, science came to Canada through the imperial connection. A series of colonial administrators remarkably well informed about science governed Canada during the first half of the 19th century, and besides urging its practical benefits they gave the subject social cachet. Military officers were the other principal agents for the transmission of science to Canada. They embodied the traditional interest of the British upper classes in natural history and played an important role in the formation of local scientific societies. For some the practice of science was an explicit assignment. Lieutenant John Henry Lefroy of the Royal Engineers, for example, was posted to Canada to help set up a magnetic and meteorological observatory at Toronto as part of a worldwide program to map variations in terrestrial magnetism. In the United States West Point graduates made significant contributions to civil engineering; in Canada British officers gave status and substance to the study of science.

The more formal content of science came to Canada largely from the University of Edinburgh. It would be hard, in fact, to overestimate the impact of Scottish education on most aspects of the history of English-speaking Canada. Edinburgh was particularly important in geology, medicine, and botany. Sir William Logan, director of the Geological Survey of Canada, graduated in medicine, but like so many students trained in Scotland he was deeply influenced by instruction in Wernerian geology. Zeller points out that the Scots pursued science not as a genteel avocation but to lever themselves out of economic backwardness, and that was a lesson the Canadians learned, too.

These substantial connections to the world of British science and to the culture that supported it account for many of the differences in the way the subject was perceived in Canada and the United States. But it was what Canadians did with science that helped lead them to their political conclusions.

Geology is a case in point. As a consequence of preliminary surveys by military officers and the avocational interests of members of the Natural History Society of Montreal, the professional and business classes of that community came to see the need for a systematic inventory of the colony's natural resources. Once established, Logan's Geological Survey saw as its central question whether Canada could reproduce Britain's industrial success, and that led naturally to a search for coal. In fact, Logan was confident that none would be found within the Province of Canada (Ontario and Quebec), and he turned the Survey toward its outer boundaries, looking for an understanding of the geology of all of Britain's North American colonies. That expansionist approach led him to incorporate into his geological research agenda the coalfields in the eastern provinces of New Brunswick and Nova Scotia and the northwest territories of the Hudson's Bay Company, where coal discoveries were expected. Simultaneously, he focused attention on the pre-Cambrian rocks on the north shore of the Great Lakes in expectation of other mineral resources



"Toronto Observatory, 1852, on the site of Convocation Hall, University of Toronto." [Metropolitan Toronto Library Board; from *Inventing Canada*]

there. Thus the urge to comprehend the entire geology of British North America also helped define an entity that might logically find political expression.

In Canadian usage science was seldom perceived simply as a tool for material ambitions. Like the Scots, Canadians saw science as way to learn about and develop their resources, but—with the American Revolution and their own rebellion of 1837 always in the back of their minds—they defined the objective of prosperity as a contented and orderly society. Egerton Ryerson's educational activities illustrate even more explicitly the concept of science as social glue. A reformer, Methodist clergyman, and superintendent of schools in Upper Canada, he argued for the extension of the public school system, for science teaching in it, and for the creation of meteorological stations at each grammar school. This effort linked Ryerson with Lefroy, an Anglican and political conservative, in a campaign to collect magnetic and meteorological data across British North America. By employing the telegraph Ryerson envisioned "a storm alarm on a stupendous scale," as well as climatological data useful for the extension of agriculture into undeveloped parts of British territory. In his view, this sort of collective effort in the public interest mediated the conflict between sectarian groups and political opponents, creating "a bridge from the individual to the community and from the community to the nation."

In Zeller's interpretation practical applications are not a subverted form of science pursued only in places without enough wealth or leisure for the real thing but an instrument linking theory to the concept of community. Botany, for example, also had immediate relevance for agriculture and forestry. Just as Logan understood that geological data on valuable minerals were the honey to attract capital, Ryerson and others realized that agricultural potential lured settlers. But in its theoretical form botany also served the idealization of nationhood. The concept of geographic distribution became a metaphor for Canada's future development, with variation in nature as the way to describe the growing sense of the country's cultural differentiation from England. In this model, Canadians were in the process of forming a North American variation of the English nation, a hardy northern people ready to compete with the United States in the exploitation of the continent, but without renouncing their British heritage. This was the kind of thinking that led Ryerson to propose, on the visit of the Prince of Wales in 1860, that all native-born Canadians wear maple leaves in their lapels as a symbol of their unity.

We have been taught to think that economic and social forces are the determinants of nationhood. Suzanne Zeller aims to enrich our understanding of that process, and she does so in a way that shows us how science can be made an integral part of the story, too.

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An Environmentalist Lineage

The Rights of Nature. A History of Environmental Ethics. RODERICK FRAZIER NASH. University of Wisconsin Press, Madison, 1989. xiv, 290 pp. $27.50. History of American Thought and Culture.

In his preface Roderick Nash, a professor of both history and environmental studies, represents his history of environmental ethics as a work of scholarship untainted by advocacy. This is a claim, however, that is belied throughout the text. His respectful treatment of the most extreme advocates of environmental ethics and his virtual neglect of their critics make clear his true position. In his epilogue, a labored comparison of the rights-of-nature movement with the anti-slavery movement, Nash's identification with the former becomes very nearly complete. A few *perhaps*es notwithstanding, the real message of this book, as the author himself puts it, is that "changes in ethics seldom occur peaceably." His theme, in short, is how violence advances morality—not at all what most people have in mind when they think of environmentalism.

By now everyone recognizes that nature constitutes a diminishing resource that must be husbanded to meet the needs of future generations. Many also agree that aspects of it having no practical use ought to be saved anyway if they are beautiful or awesome or in some other way possess desirable qualities. Few concerns are of greater importance today, but they are not what Nash has written about. His subject is the school that holds that the utilitarian approach to conservation, here called "anthropocentrism," is wholly inadequate. By viewing nature in terms of its relation to mankind, anthropocentrism denies the larger truth, which is that the natural universe has intrinsic rights equal to those of human beings. This doctrine, which Nash calls "biocentrism" or, more often, "deep ecology," has profound, not to say dangerous, implications.

Biocentrism has a short history. The notion that cruelty to animals is wrong seems to date from the 17th century, but Nash does not find much awareness of the rights of nature as such before the 1800s, and it is not until the 20th century that environmental ethics really takes wing. Its key figure is Aldo Leopold, best known as the author of *A Sand County Almanac* (1949). In that book Leopold advanced the idea of biotic right, the concept that everything on this planet, including soil and water, is ecologically equal to man and shares equally in "the right to continued existence." In thus rising above utilitarianism, Nash says, Leopold became the "most important source of modern biocentric or holistic ethics."

Few subscribed to biotic right until the 1960s, when, in common with so many other radical ideas, it suddenly gained attention. But after the '60s "bioethics" did not die out. Instead it has flourished to a remarkable degree. As described by Nash the movement takes two different forms, though individuals may participate in both. On the level of theory there has been a proliferation of books, articles, and indeed whole journals devoted to "ecophilosophy," "ecotheology," and as many related subjects as the neologist can devise.

Judging from Nash's quotations bioethical literature seems to be marked by a competition to see who can make the wildest statements. Thus one theologian writes that "human beings transgress their divine authority when they destroy or fundamentally alter the rocks, the trees, the air, the water, the soil, the animals—just as they do when they murder other human beings." There is much ethical hairsplitting as to which is worse, for example, to wantonly kill an innocent blossom or in self-defense to slay an armed attacker—flowercide, needless to say, being the greater offense. And why not, since, in the words of another writer, man is the "tyrant species"? At its most absurd, bioethics leads to such conclusions as that put forward in what Nash calls a "landmark" essay by a "perceptive philosopher" who argued that a proposed ski resort should not go up because building it would violate the rights of the valley where its construction was to take place—thus assigning to terrain a privilege that even humans do not enjoy.

On the practical level these ideas are acted upon by a number of groups that have moved beyond such established organizations as the Audubon Society and the Sierra Club into more perilous waters. They include the Sea Shepherd Conservation Society, which sinks whaling vessels, the Animal Liberation Front, notable for its destruction of laboratories and facilities employed in animal research, and Earth First, whose adherents spike trees so that if milled they will disable saws and possibly their operators. These crimes are rationalized on the