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 SCIENCE & TECHNOLOGY
 

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metabolism," say the authors, and the surviving hosts became aerobic.

Perhaps 100 million years later, the authors speculate, a new type of organism entered the host cell—the forebear of plastids, which make food from water and sunlight. Quickly ingested by a large bacterium, like Jonah swallowed by the whale, it nonetheless kept its light-trapping properties alive. The evolving cell now had mitochondria to metabolize oxygen and plastids to provide food.

The very motions of many nucleated cells, caused by rapidly undulating whips called undulipodia (cilia and flagella), may have resulted from yet another bacterial merger, 2,000 million years ago—with tiny, whiplashing spirochetes. Had a spirochete-propelled organism been able to find more food and thus reproduce more often than its fellows, natural selection would have favored such an alliance. Thus our cellular ancestors may have evolved from "a sort of symbiotic *ménage à trois*" involving host bacteria, mitochondria, and spirochetes, the authors say.

The "traditional view of a cutthroat Darwinian world," they conclude, may soon give way to a new vision of the biosphere: "an endless dance of diversifying life forms, where partners triumph."

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### *Land Scam*

"Crimes Against Nature" by John Baden, in *Policy Review* (Winter 1987), 214 Massachusetts Ave. N.E., Washington, D.C. 20002.

Environmentalists often urge the federal government to buy up the nation's unexploited land. Washington, they hope, will prevent private developers from despoiling the country's remaining forests, marshlands, grasslands, and mountain ranges.

But federal agencies, says Baden, director of Southern Methodist University's Maguire Oil and Gas Institute, are more eager to protect their own program budgets than preserve endangered land. Ironically, by supporting these agencies, Baden argues, U.S. taxpayers "have been financing the destruction of environments they increasingly value."

Washington first acquired many of today's federal lands during the late 19th and early 20th centuries. Progressive Era reformers believed that the public should own—and that "scientific resource managers" should oversee—the nation's best natural resources. Today, the U.S. Forest Service (established 1891), the U.S. National Park Service (1916), and the Bureau of Land Management (1946) manage roughly 85 percent of all federal territory. Washington owns 33 percent of the nation's land area—including 92 percent of Alaska and 40 percent of California.

Unfortunately, the officials who run these agencies, Baden says, are "motivated by self-interest no less than private entrepreneurs." An "iron triangle" of politicians, agency bureaucrats, and commercial interests serves itself, rather than the U.S. taxpayer or Mother Nature.

The U.S. Forest Service, for example, seems more interested in building roads for the logging and construction industries—which lobby for the

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agency's budget—than in preserving the country's timberlands. Indeed, "the world's largest socialized road building company," as Baden calls the Service, has laid down some 340,000 miles of roads, often tearing away soil-holding vegetation from high, mountainous regions in the process.

Supported by U.S. taxpayers, federal agencies have also not learned how to operate economically. Last year, the U.S. Forest Service cut timber from the fragile backcountry of the northern Rockies; when the Service sold the timber, it recovered only five percent of its expenses. The Bureau of Land Management has cleared some three million acres of piñon and juniper trees in the Southwestern United States. To keep ranchers happy, it sells grazing rights for one-tenth to one-fifth of the market price.

Unlike federal officials, the nation's landowning ranchers and timbermen, Baden says, have shown that they take good care of ranges and woodlands. Because such entrepreneurs value their assets, natural resources, Baden believes, are better off in private hands.

### *The Seed War*

"Seeds of Struggle: The Geopolitics of Genetic Resources" by Jack Kloppenburg and Daniel Kleinman, in *Technology Review* (Feb.-Mar. 1987), Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, Mass. 02138.

When Columbus returned to Spain in 1493, he brought not only news of a New World but also maize (corn) seeds. Columbus's venture sparked a continuing global hunt for useful agricultural plants. During the early 1900s, an era botanists call "the golden age of plant hunting," the U.S. Department of Agriculture sponsored 50 search operations worldwide.

The ingredient that breeders use to grow foreign species or to cross-breed for new varieties is "germplasm," the genetic component of plants. By long-standing convention, germplasm has been viewed as the "common heritage" of all nations. Yet only a few nations possess this vital resource in significant quantity; the last glaciation of the Northern Hemisphere (20–25,000 years ago) concentrated most terrestrial plant species in what is now termed the Third World.

During the past two centuries, industrial nations have created billion-dollar seed industries—soybeans, barley, wheat—by selling "elite" commercial germplasm (typically high yield, uniform quality) bred from the developing nations' "primitive" germplasm. Now, Third World members of the U.N. Food and Agricultural Organization (FAO) want firms in the United States and Europe either to make "elite" germplasm available free of charge, or else compensate them for their genetic raw material. In the scuffle, all parties are rushing to patent their germplasm, and a few nations (including Ethiopia) are refusing to export it.

The "seed war" could have severe consequences, warn Kloppenburg and Kleinman, a professor of rural sociology at the University of Wisconsin and a graduate assistant, respectively. Industrial nations must have continuing access to the thousands of "landraces" (primitive native varieties), bred by peasant farmers over millennia, to combat pests, diseases, and