memory transfer in worms instead of the discovery of DNA as the material of heredity, and cold fusion instead of superconductivity? The strong way to prove the point Collins and Pinch are concerned to make would be to take a seemingly obvious, or quickly resolved, case and show that it was, after all, Culture alone that was responsible and that Nature had nothing to do with it. I am not really recommending this, of course, since I do not think it will help us better understand science. Epistemologically, it is high time to turn the question from What's wrong with science? to How come science works at all? This would seem more fruitful than the continued fight against an idealized picture of science that nobody really holds any longer.

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American Plants

Flora of North America North of Mexico. Flora of North America Editorial Committee. Vols. 1 and 2. Oxford University Press, New York, 1993. Vol. 1, Introduction. xiii, 372 pp., illus. $75 or £40. Vol. 2, Pteridophytes and Gymnosperms. xvi, 475 pp., illus. $75 or £45.

Botanical workers yesterday and today. *Top*, Marcus E. Jones and N. L. Britton. *Bottom*, Laurie Lang drawing ferns and Deborah Kama demonstrating TROPICOS to Bruce Parfitt. [From *Flora of North America North of Mexico*, vol. 1]

The seeds of this project, so to speak, were first sown in 1965, perhaps as a result of North American botanists' seeing the first volume of the now-complete *Flora Europaea*. If the Europeans could cooperate successfully on such a collective venture, why couldn't the North Americans? The first incarnation of the *Flora of North America* (*FNA*) project incubated for several years, then died in 1973 when a squabble between the National Science Foundation and the Smithsonian Institution resulted in neither organization's offering financial support for the project. Two subsequent attempts to revive the project in association with the Man and the Biosphere project and the National Park Service also failed. The fourth and last revival was initiated in 1982, housed at the Missouri Botanical Garden, and for the first four years was supported by the Garden and other participating institutions; in 1988 external funding was secured and the project acquired a sound financial base.

The introductory volume to *FNA* is a free-standing one containing essays on diverse topics related to the flora and vegetation of North America and the history of the development of botanical knowledge of the continent. The second volume, which covers pteridophytes and gymnosperms, is the first of a projected 12 volumes that will describe the vascular plants and bryophytes that grow "naturally" in the continental United States, Canada, Greenland, and the French St. Pierre and Miquelon islands. Thirty collaborating institutions in the United States and Canada are involved, as are "hundreds" of botanists; this binational effort should be completed in 12 years.

The first volume contains an interesting account of various individuals important in developing current knowledge of the North American vascular flora (why equally colorful bryologists are omitted is unexplained). Portraits of many of these individuals are included, drawn from the extensive collection of the Hunt Institute. These portraits bring this history to life. Marcus E. Jones, horsewhip and plant press in hand, covered wagon in the background, wears a facial expression signaling his "defiance" that helped end Harvard botanist Asa Gray's "domination" of western American botany. Jones's visage shares a page with that of easterner N. L. Britton, placidly seated in his herbarium but no less an antagonist of the taxonomic tradition of Gray. The colorful Reverend E. L. Greene is credited, along with Jones, with ending Gray's domination of western botany, yet otherwise the two men were hardly allies. In his obituary of Greene, Jones referred to him as "the pest of systematic botany." The authors lament the lack of a biography of Greene, this "western dissident," yet he is well served by the perceptive accounts of him as a person and as a botanist in *Landmarks of Botanical History* (1983) edited by F. N. Egerton.

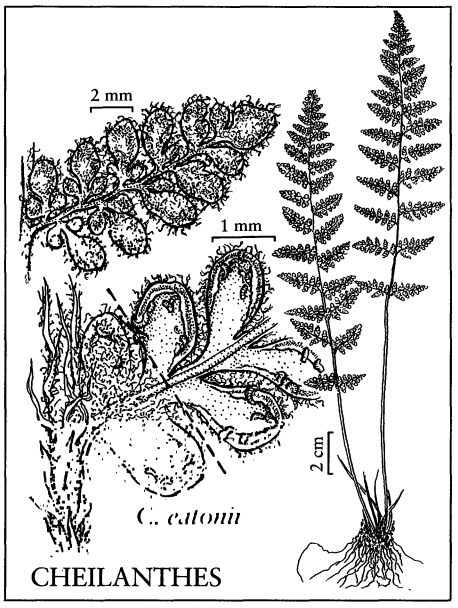
The circumscription and sequence of flowering-plant families in *FNA* will follow those of A. Cronquist, who provides an interesting commentary on his widely

adopted system. There is an overview chapter outlining the Cronquist system, but the 18-page tabular exposition of this system lacks an index to families and thus will frustrate prospective users. Indeed, the index to the first volume is very sketchy; in spite of the attention given to Greene his name does not appear in the index. Clayton, Kalm, Michaux, fire, endemic, Tertiary, and Greenland also are missing from the index, though discussed in various levels of detail in the text.

In a chapter reviewing concepts of species and genera, G. L. Stebbins states that it would be useful if the numerous contributors of taxonomic treatments to *FNA* would work according to the same standards. He warns that "subjective opinions differ so much from one botanist to another as to produce anarchy if every contributor were left to his or her own devices." Wisely, the editors of *FNA* have not attempted to impose a uniform taxonomic philosophy upon contributors to the project and, happily, anarchy is not evident in the taxonomic treatments of volume 2.

The general editors for the pteridophytes, W. H. Wagner and A. R. Smith, discuss the bases and background for taxonomic circumscriptions and policies adopted in this diverse group. They argue for a conservative delineation of the fern genera *Woodwardia* and *Asplenium* but for disassembling *Athyrium*. How they convinced authors of their views is not revealed. They admit that some features of their approach "may prove to be . . . untenable." Gymnosperm editor J. E. Eckenwalder merges the cypress (Cupressaceae) and bald-cypress (Taxodiaceae) families into a single family. Though the arguments for this procedure are convincing, my guess is that tradition will delay its general acceptance for the indefinite future.

The treatment of conifers presented me with a few surprises. The most common montane white fir in California is now *Abies lowiana*, not *A. concolor*. The rare edaphic endemic pygmy cypress of northern California (*Cupressus pigmaea*) is "sunk," that is, relegated to synonymy under the more widespread *C. goveniana*. The federally listed Santa Cruz cypress (*C. abramsiana*) suffers the same taxonomic fate, scarcely with comment. Since the intended audience of *FNA* includes conservationists, a more detailed argument for the non-recognition of these two "sensitive" cypress taxa would have been useful. Indeed, the California Native Plant Society has provisionally agreed to advocate continued protection for several taxa that were not recognized in *The Jepson Manual* (1993), edited by J. C. Hickman; my guess is that it will adopt the same stance for *FNA*. Just how state and federal conservation agencies will handle this issue remains to be seen. These problems might be circumvented if legislative language concerning rare taxa were extended to include evolutionarily significant races or populations of species that are not necessarily accorded formal taxonomic status.



Taxonomic illustration from *Flora of North America North of Mexico*, vol. 2.

The keys and taxonomic descriptions in volume 2 are concise, straightforward, and consistent in format from group to group. Taxonomic treatments are sometimes accompanied by descriptions of breeding systems, chromosome numbers, natural hybridization, economic importance, and other curiosa. I would have welcomed more discussion of geographic variation in morphological and ecological features of the species as well. The format for giving geographic ranges of species risks overgenerosity: *Selaginella eatonii* is said to occur in Florida in habitats that occur widely in that state, yet its distribution map limits it to extreme southern Florida. The maps are often problematical: that showing the geographic range of Bishop pine (*Pinus muricata*) suggests a continuous distribution in California from the Oregon border southward to the Santa Barbara area, yet populations of this species are highly discontinuous, and only a single small population occurs between San Francisco Bay and central Santa Barbara County, a distance of about 300 kilometers.

What will be the shelf life of *FNA*? Wagner and Smith point out that "approximately 75 species [of pteridophytes] in the flora have undergone a name change" since the 1985 treatment of the group in *A Field Manual of the Ferns and Fern-Allies of the United States and Canada* by D. B. Lellinger. In addition, 58 taxa have been added to the pteridophyte flora, some newly described, others as a result of revised circumscriptions or range extensions. Thus, differences between the treatments in Lellinger's book and in *FNA*, separated by less than a decade, involve about 30 percent of the pteridophyte flora of the region. Perhaps the pteridophytes have received an unusual amount of systematic study in the past decade, but this magnitude of difference suggests that by the time the final volume of *FNA* appears the earlier ones will already be out of date to one degree or another. A database for *FNA* is maintained at the Missouri Botanical Garden; although the mechanics and details of its long-term financial support are not described, this database is expected to be continually updated and will be made accessible to the public, the botanical community, and various agencies. This continuing upgrading and free accessibility to a broad constituency should instill a form of immortality for *FNA*.

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Plasmid Transfer

Bacterial Conjugation. DON B. CLEWELL, Ed. Plenum, New York, 1993. xvi, 413 pp., illus. $89.50.

Bacterial conjugation and phage studies were the two pillars of molecular genetics at its inception. Basic concepts such as intercellular DNA transfer, autonomous replication and infectious spread of genetic elements, genetic and molecular circularity, and cytoplasmic regulatory proteins arose largely out of the pioneering efforts by Lederberg, Hayes, Wollman, and Jacob to understand and utilize conjugation. Together with transposable elements and temperate bacteriophage, F and other bacterial plasmids brought us a revolution in thinking about the fundamental mechanisms of genetic change. In particular, they led to the picture we now have of a fluid genome subject to natural genetic engineering, an idea that allows us to make sense of all the evolutionary surprises that greet us as we wander through sequence databases.

Because bacterial conjugation has disappeared from the radar screens of most biologists, the appearance of a book summarizing recent work on the subject is especially welcome. Reading the chapters in Don Clewell's compilation is like sitting down to two smorgasbords at once. One set of delights comprises all the intricate details of