the sorts of investigation necessary for anyone to venture a guess. But one thing is certain, if evolutionary scenarios are just-so stories then the causal claims made about the course of science warrant no greater credence.

Grene's anthology is primarily historical in intent, but several papers deal with the status of present-day evolutionary biology. Turner, Antoni Hoffman, and John Maynard Smith evaluate recent controversies in paleontology and evolutionary biology. In this connection, Eldredge and Gould's model comes in for some harsh and at times sarcastic treatment. For example, Turner terms the version of evolutionary theory proposed by Eldredge and Gould the "theory of evolution by jerks." I am afraid that the double entendre was intended. As Turner sees it, "The theory of evolution by jerks is being largely created by juggling with definitions and using a diagram whose vertical axis, time, is clear enough, but whose horizontal axes conflate, in a most confusing way, phenotypic change and geographical separation. . . . These diagrams, and the theory they represent, undo eighty years of progress in population genetics" (p. 155).

Richard Burian and D. S. Peters conclude the volume with careful discussions of the notions of adaptation and fitness. Proper attention to Burian's classification of various senses of these important terms would go a long way in eliminating the conceptual confusion that continues to plague evolutionary biology.

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A Boreal Biota

Biogeography and Ecology of the Island of Newfoundland. G. ROBIN SOUTH, Ed. Junk, The Hague, 1983 (U.S. distributor, Kluwer Boston, Hingham, Mass.). xii, 724 pp., illus. $130. Monographiae Biologicae, vol. 48.

The Island of Newfoundland, lying between 46° and 52°N, is the easternmost extension of the North American continent. Its climate is boreal-maritime, chilled but yet moderated by the Labrador current from the north; it has been extensively glaciated, and agricultural land occupies only 1 percent of the area. Discovered by Leif Eriksson about the year 1000, and rediscovered by John Cabot in 1497, it remained for centuries a distant colony, valued mainly as a base for fishing. Later an important forestry developed, but modern cultural and scientific progress belongs to the postwar period only.

This multiauthor book on the biota of Newfoundland, written mainly from Memorial University, considers successively the geological origins, climate, soils, ecological regions, peatlands, heathlands, lichens, mosses, marine algae, marine ecology, seabirds, land mammals, introduced insects, aquatic insects, and amphipods. Work is in progress on all these subjects, and the chapters have been chosen largely on this basis. Some earlier work, such as the biogeographic results of the Scandinavian entomological expeditions of 1949–1951, is not reviewed, and other important themes, such as the boreal forest (which occupies nearly one-half of the land area), are also missing.

The editor provides an informative synoptic introduction, and there follows the chapter on geological origins. The island is the northeasternmost section of the Appalachian system in North America and preserves in its structure the history of the North Atlantic area, from the proto-Atlantic Ocean of early times to the collision of continents that generated the Appalachian orogen and the later rifting that led to the Atlantic of today. But the Pleistocene glaciations eliminated most or all the preceding fauna, flora, and soils. The significance of foreland or offshore refugial areas remains uncertain—a problem that returns in several later chapters.

There are good discussions of the climate and the soils and a chapter on peatlands with an interesting series of aerial photographs and profiles. The flora of lichens and mosses, the first of the individual groups to be dealt with, is large and diverse; they have achieved a nearly complete recolonization in the 10,000 years since deglaciation. The case of the mammals is different. There are only 14 native species, as against 34 in Labrador, and the fauna is evidently disharmonic. Most species probably came in by the narrow Strait of Belle Isle, but recolonization has been very incomplete owing to the insularity of Newfoundland or simply to its great distance from areas of Pleistocene survival. Finally, a chapter on aquatic insects discusses the different modalities of aquatic life in the several orders and leads to interesting views on habitat selection and the determination of present-day ranges. In the event, the dragonflies, caddisflies, and water beetles are now represented by an almost full eastern boreal zone fauna, whereas the stoneflies, like the mammals, are very sparse.

Overall, this is a significant contribution to the ongoing study of the biology of Newfoundland and of the boreal life zone at large.

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Protists

Radiolaria. O. ROGER ANDERSON. Springer-Verlag, New York, 1983. x, 355 pp., illus. $59.

The stated purpose of this book is to encourage interdisciplinary research on a "remarkable group of aesthetically pleasing mineral-secreting protists." The author has contributed much to the understanding of the biology of radiolaria through his own research, and his book emphasizes the biological aspects of radiolarian studies over paleontologic and stratigraphic themes. It provides an extremely broad view of studies that have addressed the morphology, systematics, cellular structure, physiology, ecology, and evolution of the radiolaria. The discussions of symbiosis, bioluminescence, parasitism, and skeletal structure and morphogenesis are particularly enlightening.

Anderson is acutely aware of the great gaps in our knowledge of the radiolaria. Many of these gaps derive from our inability to follow them through a complete reproductive cycle in a laboratory setting—let alone maintain a long-term culture suitable for ecologic studies. Although fission and the production of "swarmers" have been observed, a full cycle of sexual reproduction has not. "There is . . . no convincing evidence that the flagellated swarmers are gametes." Yet sexual reproduction and even hybridization have been inferred by many authors. The lack of long-term laboratory studies, combined with the very complex nature of the pelagic realm inhabited by the radiolaria, has limited investigations to the techniques of careful observation and strong inference.

The first major strong point of this book is the completeness of its treatment of the literature. The second is that the author never fails to point out where further research is needed and often suggests how some of the remaining problems might be addressed. A weakness (if it is to be considered such) is that the

author does not attempt to evaluate the work of others. Rather he provides a précis of their major conclusions. In so doing he has largely avoided bias in the overall presentation at the expense of a more concise synthesis.

The reader should be aware that species names mentioned in the book are those used in the cited articles; thus, the same species can appear with two or three different generic names. There are several glaring errors in the references and figure captions.

In summary Anderson's book provides an excellent reference and introduction to the literature on radiolaria. It bridges the disciplinary gap between the cell biologist, the ecologist, and the paleontologist and encourages further research that will lead to a better understanding of this long-ranging, diverse, and somewhat mysterious group of single-cell organisms.

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Centuries of Geology

It Began with a Stone. A History of Geology from the Stone Age to the Age of Plate Tectonics. HENRY FAUL and CAROL FAUL. Wiley-Interscience, New York. 1983. xviii, 270 pp., illus. $38.95; paper, $23.95.

The subtitle of this book written by Henry Faul and completed after his death by his wife indicates an immensely ambitious project: "A History of Geology from the Stone Age to the Age of Plate Tectonics." To accomplish this in a mere 230 pages of text calls for a choice between detailed treatment of a few key episodes and more or less uniform compression. Unfortunately Faul chose the latter course. I say unfortunately because the end product is a pedestrian recitation of events almost completely devoid of material to engage the intellect or stimulate the imagination.

For the early history, for which our knowledge remains sketchy, this approach proves more or less adequate, with the usual acknowledgement of the contributions of a succession of important figures, from Theophrastus and Pliny to Steno and Hooke. It is from the more thickly populated 18th century onwards that the method starts to come unstuck. In the first place, there are notable omissions or examples of excessive compression. How can a serious history of geology afford to ignore the work of, for instance, von Buch or Elie de Beaumont in Europe or T. C. Chamberlin in North America? Dana's research on coral reefs is noted, but his fundamental contributions to geotectonics are neglected. No consideration is given to the nappe theory of the Alps, which was of immense significance in its time. As for the 20th century, half a dozen pages is all there is to be found on subjects as momentous as radiometric dating, continental drift, and plate tectonics.

In the second place, and perhaps more serious, Faul almost totally ignores the recent reevaluations by historians of science, who attempt to place leading thinkers in their social and intellectual milieu, the better to understand the interplay of empirical discovery, new ideas, research techniques, and personal rivalries. Instead he is content to accept the conventional wisdom largely dating back to Lyell's tendentious and now somewhat discredited account of the history of geology. Thus no one would appreciate from this book that it was the Wernerians who represented the scientific mainstream, with Hutton a rather isolated and atypical figure, or that Lyell's insistence on an extreme version of uniformitarianism was strongly attacked on good grounds by contemporary scientists of considerable stature. Nowhere in the book, in fact, is there an adequate explication of the development of geological thinking on particular subjects—things apparently just happened in succession, and we are evidently not meant to concern ourselves with the whys and wherefores.

For the reader lacking any prior knowledge of the history of geology this account may provide a helpful primer, particularly if use is made of the extensive reference list, but the more ambitious and discerning had better look elsewhere.

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