assumes new importance, although the author estimates that about three billion cubic feet are still lost to the atmosphere each year in burned natural gas.

The book is a good narrative account of the development of the production of helium by the Bureau of Mines, although it is disappointing in certain respects. The scientist or historian of science will find no account of the research responsible for the progressive understanding of helium's unusual properties, nor even a satisfactory explanation of them. The historian of technology must be content with a one-paragraph description of the helium-extraction process without learning the details of its evolution. The economic historian will search in vain for any cost analysis of helium production, and no inkling is given as to the economic efficiency of the government-owned plants. Finally, there is no bibliography, particularly of the government documents examined by Seibel, which might have been useful in any future study. Nevertheless, this book should serve to focus public attention on the important work of the Bureau of Mines in the production of one of the least advertised resources of the United States.

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Northern Life

Ecological Development in Polar Regions. A Study in Evolution. M. J. DUNBAR. Prentice-Hall, Englewood Cliffs, N.J., 1968. viii + 119 pp., illus. $4.95. Concepts of Modern Biology.

The title of this book is perhaps a little pretentious. Its author is a marine zoologist with most of his experience from Arctic Canada, and this explains why plants, terrestrial animals, and the southern polar region receive comparatively little attention. Within its limits the treatment is quite interesting, and some of the author's conclusions have general application beyond the material serving as primary objects of study.

The delimitation of the Arctic and the Subarctic regions (in the northern hemisphere) presents certain difficulties. In the sea, the Subarctic is defined as the zone with mixed Arctic and non-Arctic water; for land, the author follows the usage of Kimble and Good (1955), which implies that the southern limit of the Subarctic is that of "the full boreal forest" and that the inhabitants of Edmonton, Winnipeg, and Quebec City in North America and of Oslo, Stockholm, and Helsinki in Europe barely escape the fate of living in a "subarctic" country. The Old World practice is entirely different, and Hustich (1949), among others, has eagerly stressed the desirability that in North America, too, the term "subarctic" be restricted to the forest-tundra area.

The determination of the southern limit of the Arctic is more important and not purely academic. Dunbar (p. 51) uses the current definition: the 50°F (10°C) isotherm for July, or the timber limit, with which it largely coincides. It is therefore surprising that, later on (p. 97), a close dependence of the tree line upon climatic factors is denied in favor of "the process of soil increment." However, during the postglacial climatic optimum, notably in Scandinavia, the tree limit was situated much farther north than it now is, a fact which seems to corroborate a major influence of climatic factors.

One of the author's main theses is that the importance of low temperature as the primary biologically acting factor in the Arctic has been exaggerated; this is expressed in its sharpest form on page 92: ". . . the low temperature of the polar regions is the least important of the various polar characteristics. . . ." The reader's attention is drawn instead to three groups of other factors characterizing the Arctic: large seasonal oscillation, low production of nutrients (except in the Antarctic), and the youth of ecosystems. Here, again, examples are drawn largely from marine animals, and the conclusions, as far as these are concerned, seem sound enough. And, to do the author justice, he admits, in several contexts, that for terrestrial organisms the thermal factors are more important, especially in connection with hibernation. The author thinks that adaptation to low temperatures (influencing metabolism, growth, reproduction, and so on) is more easily achieved than is usually assumed and that the "difficult" taxonomy of many Arctic animals (terrestrial as well as marine) is an expression of continuous adaptive processes going on simultaneously in many taxonomic groups. My own experience with insects shows that certain taxonomic groups may be entirely Arctic or Arctic-Subarctic, in which case adaptation to a cold environment must have taken place long ago, in pre-Pleistocene time, no doubt in the alpine zone of mountains. And this may very well have been the history of entire ecosystems. Therefore Dunbar's leading principle, that Arctic ecosystems are young, "immature," "non-saturated," which apparently holds true in the sea, is not necessarily valid for terrestrial organisms. The author's final remark, that perhaps ecosystems may "act as units of selection," could therefore, under certain terrestrial conditions, be translated to mean that they act as "units of dispersal," at least in the Beringian region, where the influence of Pleistocene glaciations was slight.

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Anatomist of the Small

Jan Swammerdam (12 February 1637–17 February 1680). His Life and Works. A. SCHIERBEEK. Translated from the Dutch edition (1947). Swets and Zeitlinger, Amsterdam, 1967. vi + 204 pp., illus. $7.

Jan Swammerdam needs little introduction to historians of biology. He was, according to F. J. Cole, the historian best qualified to evaluate him, "the greatest comparative anatomist of the seventeenth century." He developed a number of new dissection techniques for the study of anatomy, especially of minute structures of insects. He was the first to observe a number of organs in invertebrates and in vertebrates, and the first to describe the cleavage of the egg. But perhaps his greatest importance was, as Cole tells us (and Cole expresses debt to Boerhave for the judgment), that "he was . . . one of the first anatomists to develop the *technique* of research." His principal work, the *Biblia Naturae,* completed around 1675, was published only in 1737–1738, through the good graces of Boerhave.

It is astonishing, in view of Swammerdam's excellence, that no modern biography of him exists; the chief source of information about his life remains Boerhave's introduction to the *Biblia Naturae.* Schierbeek's book is an English version, somewhat abbreviated, of a volume published in Dutch in 1947. It gives an account of Swammerdam's life, leaning heavily on Boerhave, and of his somewhat eccentric personality, and then it discusses his work. The content is very awkwardly arranged within the chapters, and the analysis difficult to follow. An attempted bibliography of Swammerdam's works is included. There