cycle to the length of the productive life of the biologist!" The volume begins with a dedication to William Rowan in honor of his classic work on the junco in which he showed increases in the duration of illumination to be associated with developmental changes in the testes. A short biography by Rowan's research assistant, Robert Lister, followed by a reproduction of Rowan's 1925 *Nature* paper introduces the volume.

One central concern of the papers in the book is the demonstration of persistence of the rhythms in constant conditions, that is, a cataloging and documentation of the existence of circannual rhythms. The most convincing data are those for hibernation in ground squirrels (data from Heller, Poulson, Pengelley, Asmundson). The recognition of hibernation as based on an endogenous rhythm by Pengelley and Fisher (1957) generated interest in the field, and it is appropriate that the volume is edited by Pengelley. Other physiological variables in a variety of species are suggested as having circannual rhythms: body weight, locomotor activity, food and water consumption, and reproductive competence in ground squirrels; aging, growth, and development in a marine colonial cnidarian; reproduction in cave crayfish; molt, body weight, nocturnal restlessness, testis size, juvenile development, and orientation and migration in birds; and antler replacement in deer.

The field has progressed beyond the demonstration of the existence of circannual rhythms, and some of the new directions are delineated in the book. While the circannual clock has apparent endogenous components, it is clear to all the investigators that in the normal environment the clock is synchronized with (or "set" by) environmental cues so that the biological functions occur in their turn at the appropriate seasons. Light may be one such important cue, or "zeitgeber." Other possible time cues such as temperature changes, food availability, and prior physiological state are considered.

Problems associated with the circannual clock besides its zeitgebers are covered. The effect of temperature on the working of the clock has been studied, and the clock appears to be temperature-compensated. The possibility of a blood-borne trigger for the endogenous cycle is being explored. The conditions that will produce a persistent circannual rhythm in the laboratory may depend on the period of the constant light-dark cycle maintained. Furthermore, the period of the circannual rhythm can be forced to synchronize with artificial "annual" photoperiods—Gross found that the cycle of antler growth in deer could synchronize with cycles of from 2 to 24 months.

Some of the aspects of the circannual rhythms (persistence, zeitgebers, temperature compensation) are of concern also in studies of circadian rhythms. In the summary paper, Menaker considers whether exploring the analogy between circadian and circannual rhythms is likely to be fruitful for further studies and concludes that the most productive approach will be to study the "series of sequential steps of which circannual rhythms are surely composed" at the physiological level and that, because of the length of the circannual rhythm, some studies analogous to circadian studies are impractical.

A reading of this book leaves one convinced of the existence and interesting nature of circannual rhythms and curious about their physiological origins. The evolutionary justification for circannual clocks is considered and remains unexplained. While it is clear that a "calendar" would be of use in anticipating and adapting to seasonal events, it is not clear why an endogenous calendar would be necessary when there are so many environmental cues. This is just one of the many thought-provoking questions raised in the book.

SUE BINKLEY

Department of Biology,
Temple University,
Philadelphia, Pennsylvania

Life on a New Island

Surtsey. STURLA FRIDRIKSSON. Halsted (Wiley), New York, 1975. x, 198 pp. + plates. $14.95.

In November 1963 an eruption took place on the Mid-Atlantic Ridge 30 kilometers south of Iceland and a new island, Surtsey, was formed. This book is the story of the island, and of the living things that reached it, in the first 10 years. It is written in easy style and is not intended as a formal evaluation of research, but it is full of interesting observations and is well documented.

The Surtsey Research Association was organized within months of the first eruption, and coordinates the work of many observers and scientists. It is apparent that the Surtsey event is providing an opportunity to study dispersal movements and processes of colonization under boreal conditions over the range of a whole fauna and flora. It is apparent also that it is giving a valuable impetus to ecological work in Iceland generally.

Surtsey began as a single cone of tephra and ash, and a second vent was added later. Two smaller island cones formed nearby, but were quickly eroded. As the main island grew, the sea was walled off from the pool of magma and the explosive phases of the eruption came to an end; a denser lava then flowed out and covered much of the surface, and Surtsey was assured of a certain permanence. It is 2.5 square kilometers in area and 172 meters in height.

Sea birds landed as soon as the surface was cool, and various species are now nesting; they depend on the ocean for food and their excreta and carcases are the only considerable source of organic material inland. Marine life and flotsam thrown up by the waves provide the impermanent beginnings of soil in a narrow zone on the upper part of the beach, and this has now been colonized by a few halophytes such as sea rocket and lyme grass and a still smaller number of scavenger insects. But the porous ash and lava retain no moisture, and further progress is difficult. The ash is still devoid of macroscopic life, but in 1967 mosses appeared on the lava and have increased steadily in range and variety. These mosses, with the lichens and smaller organisms that shelter among them, seem to represent the first step toward the grassy heathland of adjacent islands.

But in sharp contrast to the slow development of the initial biota, there is a remarkable inflow of viable organisms by air and on the surface of the sea. "Showers" of spores, seeds or other parts of some 40 species of vascular plants, 158 species of insects, and so on, have been observed in the short space of 10 years. Reflecting on these observations, Fridriksson suggests that the fauna and flora of Iceland itself may well have been built up, species by species, within the postglacial period; there is no need to propose, as many authors have done in the past, a more ancient origin by land bridges from Europe.

J. A. DOWNES

Biosystematics Research Institute,
Agriculture Canada, Ottawa

Materials Science

Diffusion in Solids. Recent Developments. A. S. NOWICK and J. J. BURTON, Eds. Academic Press, New York, 1975. xiv, 492 pp., illus. $45. Materials Science and Technology.

The study of diffusion in solids has had a long and exciting history. Research in the field has not merely provided material that may be of routine interest in relation to reaction rates in solids but has also yielded special insights concerning the ways in which normal and defect structures combine to produce effects that are often unex-