vation of contemporary societies by archeologists or archeologically trained ethnographers. The object of such studies is to examine the material correlates of human behavior "as a means of discovering relationships within contemporary societies that allow the investigator to specify when and under what circumstances certain kinds of behavior may have been important in relation to overall processes of human adaptation." Using an ecosystemic framework, Gould stresses that the investigator should seek to observe "the flow of materials through the system, seeing what effects the human components of the system are having on the final disposal of these materials." Patterns of cultural residues may be identified in the ethnographic present, correlating with specific adaptations and utilitarian behavior. Using data from Australian Aborigine life and sites from both the desert and better-watered regions of the continent, Gould develops several such adaptive-behavior models (for example, risk minimization by extending kinship ties, stone-tool discard). From such models predictions can be generated concerning patterns of residues at archeological sites, and deviations from the predicted patterns can be identified. The real contribution of living archeology is as an approach to dealing with such anomalies. The observation of social and symbolic causes that is possible in ethnographic situations makes it possible to raise new questions concerning archeological remains.

Gould concludes by presenting several "Antipodean anomalies," or examples of potentially maladaptive practices. An example is "canine commensalism," in which the presence of dogs, which do not hunt and are not used for food or as beasts of burden, at Aborigine campsites appears to elude functional or adaptive explanation.

One of the impediments to Gould's approach is that it presumes an amount of paleoenvironmental information that is not always available. Even if one can find a member of that dying breed, the geomorphologist, to develop a detailed climatic and landform history for one's area, have evolutionary biologists the knowledge of changes in adaptive responses of plants and animals during the Pleistocene required for ecosystem modeling? But this is a practical matter. *Living Archaeology* is a first step only (although a major one), and Gould would be the first to insist that the procedures he advocates as well as specific principles presented in the book should be subject to a cumulative process of testing and refinement.

Living Archaeology is among the more profound statements on archeological theory and practice to appear in recent years. It is quite unlike some recently published compilations about ethnoarcheology that give the impression of being written by a group of the ordained preaching to one another. This is a theoretical book written clearly and sprinkled with expressive metaphors ranging from New York subway art to "black box" cognition. In the hard-fought war to keep archeology jargon-free, Gould does battle using an often jovial expository style. The organization of the book is highly effective: forthright statement of the archeological argument is followed by restatement in terms of concepts from other sciences or everyday life and then by illustrations drawn from Aborigine life. This book is essential for the practicing archeologist, for it has the makings of a classic. It would also be excellent for the student who has some background in archeological theory. In this reviewer's opinion, living archeology is, indeed, an idea whose time has come.

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A Peat Bog

Ecology of a Subarctic Mire. M. SONESSON, Ed. Swedish Natural Science Research Council, Stockholm, 1980. 316 pp., illus. $30. Ecological Bulletins, No. 30.

The Tundra Biome Project of the International Biological Program included a strange mixture of study sites representing habitats ranging from truly arctic tundra to temperate oceanic blanket bogs. The Swedish studies were carried out in a subarctic peat bog in Stordalen near the Abisko Research Station in Swedish Lapland. Permafrost is present in this peat bog, but the peat is shallow, and under most of the bog the active layer (the layer of annual freezing and thawing) reaches into the mineral soil. Nevertheless, the main part of the bog is ombrotrophic, receiving its nutrient and moisture supply exclusively from atmospheric sources.

The emphasis in the volume is on primary production, nutrient cycling, and decomposition. The description of the study site itself, its vegetation, soil, and climate, is very brief, and one should not expect to find much detail on these aspects of the site in the book. This information is readily available in publications on the numerous studies carried out at the Abisko Research Station, however. A chapter on the physical properties of the soil-water system by Rydén, Fors, and Kostov is included in the book. The chapter gives information on permafrost depth, documents the variability of the peat, and presents preliminary conclusions on water movement. In another chapter, Rydén and Kostov provide interesting details on the progression of freezing and thawing, the conditions controlling it, and the striking differences between microhabitats. The rooting zone in elevated sites is thawed out for only 12 of the 23 weeks of the vegetative season, whereas in depressions the active layer does not freeze completely in some winters. Sites that are snow-free early in spring start thawing out at temperatures below freezing if radiation is intensive. Most of the incoming radiation is consumed by processes other than melting; for example, evaporation requires twice as much energy as melting of the soil.

The most important chapters are those on nutrient cycling and energy flow. As have many of the IBP studies, the Stordalen project clearly shows the importance of the detritus pathway. Svensson and Rosswall in their excellent analysis of energy flow point out that only 1 percent of the net primary production flows through herbivores, whereas 99 percent is transferred directly to the decomposer cycle. In addition, herbivores involved are soil invertebrates, mainly nematodes. The absence in this volume of any studies dealing specifically with vertebrates is therefore understandable. Most of the biological activity in the soil is concentrated in the upper 20 centimeters of the peat. Of the total annual net primary production (156 grams per square meter), 69.3 grams, or 44 percent, is added to the peat. This corresponds to an annual increment of the peat layer of 0.7 millimeter.

Malmer and Nihlgård give a valuable account of the supply and cycling of mineral nutrients. Even in this remote area far north of the Arctic Circle the effects of pollution are obvious in the *p*H of the rainfall (mean *p*H = 4.6) and the chemical composition of the precipitation. The oceanic influence on the precipitation chemistry is much stronger in winter than in summer. This is most clearly shown by the concentrations of sodium, which are four times higher in winter. Most of the snowmelt drains from the bog when the peat is still frozen so that nutrients in the snow have little effect on the bog vegetation. The amounts of sodium, calcium, sulfur, and possibly mag-

nesium in the precipitation are sufficient to account for the accumulation in the annual growth of the moss carpet, but vascular plant material is clearly an important source of nutrients in the bog. Rosswall and Granhall discuss the nitrogen cycle. Nitrification and dentrification are absent or negligible. Total input amounts to 0.42 gram per square meter per year; biological fixation is responsible for about half of this (0.20 gram per square meter). Low mineralization rates and large spatial heterogeneity complicate the analysis of the nitrogen cycle.

Other chapters deal with such topics as factors controlling plant distribution, sampling problems, growth of vascular plants and *Sphagnum* species, and carbon dioxide and methane fluxes. The volume does not contain the results of all studies carried out as part of the Stordalen project. The appended list of previous publications is helpful in locating the results of studies that are omitted here. An excellent subject index is included. Unfortunately, the photographs are not printed on glossy paper, which affects their quality. But these minor problems do not detract from the value of this volume as a source of information on processes and conditions in a subarctic peat bog.

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Plant Cells

The Biochemistry of Plants. A Comprehensive Treatise. Vol. 1, The Plant Cell. N. E. TOLBERT, Ed. Academic Press, New York, 1980. xvi, 706 pp., illus. $65.

This volume is the first volume of an ambitious eight-volume treatise on plant biochemistry. These multiauthored volumes are intended to provide current information to people working on plants and to inspire students and workers in other fields with the fascinating problems provided by plant material. The present volume deals with the plant cell compartments and organelles, as well as with two special topics, plant tissue culture and cyanobacteria. The objective of providing information is clearly fulfilled, but inspiration, or even integration of the material, is scarce. The chapters review the techniques and current data in the field, and the quality of many of them is high. There is, however, a missing chapter: an introduction discussing the basic life strategy differences between plants and animals, which would set in context the role of the cell wall, the vacuole, and other plant features discussed in this and subsequent volumes. The inattention to the teaching function the book could have served is unfortunate. There seems to be a growing awareness of plant biology among cell and molecular biologists, and there is a need for basic information about plants combined with surveys of the current data. Also, as a plant chauvinist, I was disappointed that there is very little of the "gee whiz" biology of plants, the kind of information that makes you want to understand how a snow-covered skunk cabbage spadix heats up to 105°F and thus leads you into a study of alternate respiratory pathways.

The best chapters in the book equal or excel those found in typical collections. The general structure of the plant cell, one aspect of the introduction to plants that is provided, is presented in a well-illustrated chapter by Newcomb. Some of the unsolved problems of plant cell structure, such as how cellulose deposition is organized, are thoughtfully reviewed. The cell wall is the subject of another excellent chapter, by Darvill, McNeil, Albersheim, and Delmer, in which the goals and strategies for studying the wall are detailed before the chemistry and organization of the wall constituents are introduced. The cell wall is a challenging problem in cell biology and chemistry, the more so as we realize that pathogens as well as symbionts interact with wall constituents in host recognition.

Other valuable chapters are devoted to well-defined subjects such as the vacuole, microbodies, endoplasmic reticulum, cyanobacteria, protein bodies, and the Golgi apparatus. Comparison is made in these chapters between the role of specific organelles in plants and animals, and pertinent data on function, isolation, and biochemical constituents are presented. A great deal of information missing from standard biochemistry and cell biology textbooks is presented.

Subjects such as the plastids, mitochondria, and nucleus receive less successful treatment. A chapter on the development, inheritance, and evolution of the organelles contains an admirable attempt to discuss the diversity of plastid forms found in blue-green algae, algae, protists, and higher plants. However, the chapter is a highly selective overview of the subject and relies heavily on the author's favorite organism, *Euglena*. The inheritance of plants and what is known of their genetics are better discussed in two recent books, Grun's *Cytoplasmic Genetics and Evolution* and Gillham's *Organelle Heredity*. Because so much is known about plastid biochemistry, the chapters here are really just an outline of material to be covered in entire volumes on photosynthesis, carbohydrates, and lipids. Despite the important advances in the understanding of the transport of proteins into plastids and mitochondria and the interesting regulatory issues such transport poses, very little information is provided on the subject. Only two pages are devoted to protein synthesis in the chloroplast, and protein and nucleic acid synthesis in mitochondria are not discussed at all. None of the current molecular dissection of organelle genomes is described.

A long chapter on the plant nucleus provides a useful review of nuclear structure and chromosome behavior during mitosis and meiosis. However, the reviews of genome organization and transcription in eukaryotes are out of date and not critical. Little information is given on plants and too few of the interesting phenomena found in plants are mentioned. The tolerance of plants for monosomy, trisomy, aneuploidy, polyploidy, and other chromosomal changes is not discussed. Interesting tools for studying chromosomes, for example the chromosome addition lines and existing mutants of chromosome function in maize, are not mentioned.

The book does cover all of the subcellular structures of plant cells. The format and reproduction of photographs are of unusually high quality, so the material is easy to read, and this single volume covers material on plants that is unlikely to be found in textbooks. It is a very good reference work, but only a few of the chapters really engage a reader's attention.

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Pulsating Stars

Theory of Stellar Pulsation. JOHN P. COX. Princeton University Press, Princeton, N.J., 1980. xiv, 382 pp., illus. Cloth, $40; paper, $13.50. Princeton Series in Astrophysics.

Pulsating stars play an important role in astronomy because some of them serve to determine the distance scale of the universe. Even more important, perhaps, the study of the pulsations of a star permits the probing of its interior.

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