ture is a set of control mechanisms for governing behavior and that man is precisely the animal most desperately dependent on such extragenetic control mechanisms for ordering his behavior (pp. 106–7). Geertz reasons that the cultural context constitutes the mechanism by which the breadth and indeterminateness of man's inherent capacities are reduced to the narrowness and specificity of his actual accomplishments. Thus we all begin with the natural equipment to live a thousand kinds of life but end, in the end, having lived only one. Here we have an insight into a possible new way of understanding free will, determinism, and the nature of man. This insight seems not to have been appreciated by Platt or by the other contributors to the lecture series: Willard Libby discusses "Man's place in the physical universe." George Wald considers "Determinacy, individuality, and the problem of free will" and oddly concludes that we are wholly determined but we have free will because we are unique and unpredictable. Derek de Solla Price examines "The science of science," and Roger W. Sperry dissects "Mind, brain, and humanist values," dismissing indeterminancy as unpredictable caprice, unaware of the middle ground between freedom and determinism and therefore unable to encompass feedback responses to an occasional randomly initiated event. James Redfield gives a fascinating analysis of the parallels between the Greek city-states and our culture in "The sense of crisis."

The diversity of views on determinism and free will and the resulting indecision on the nature of man and of the world are not dispelled by a third contribution in this area, Lord Russell Brain's **Science and Man** (Elsevier, New York, 1966. 109 pp., illus. $3.75), a collection of four lectures, entitled "Science and behavior," "Perception, a trialogue," "The status of mind," and "Science and antiscience," the last of which has been published in *Science* [**148**, 192 (1965)].

These books on the nature of man are all worth reading more than once and form good companion volumes to *Man Adapting* by Dubos and *Mankind Evolving* by Dobzhansky, reviewed in these pages in 1966 and 1962 by G. G. Simpson. If anything can be said about what society must do to survive it is not explicit in any of these books, but all are highly relevant. Perhaps the most urgent need is to keep the situation open-ended and to encourage scientists like John R. Platt to continue to be involved persons.

VAN RENSSELAER POTTER
McArdle Laboratory,
University of Wisconsin, Madison

Plant Biochemistry

In recent years the field of plant biochemistry has lacked a comprehensive treatise covering the major areas of research within the rather broad scope of the discipline. This gap is nicely filled by the recent publication of **Plant Biochemistry** (Academic Press, New York, 1966. 1072 pp., illus. $19), edited by James Bonner and J. E. Varner. The avowed purpose of the volume is to provide detailed information for both the advanced student and the research worker interested in plants, and in general this aim is amply fulfilled.

The book is divided into five main sections, covering subcellular structure and function, basic metabolism, specialized aspects of plant metabolism, control, and autotrophic nutrition. Subcellular Structure and Function includes a chapter on plant mitochondria and electron transport by W. D. Bonner, Jr., and a nicely illustrated chapter on chloroplasts by R. B. Park, as well as chapters on ribosomes (J. Bonner), the nucleus (J. Bonner), enzymes (Varner), cell membranes (G. A. Thompson, Jr.), and the cell wall (P. Albersheim). In addition to a bibliography of technical papers relevant to each topic, each chapter contains a listing of more general references for the benefit of readers unfamiliar with the necessary background information.

Basic Metabolism covers respiratory metabolism, protein, lipid, and carbohydrate metabolism, the biosynthesis of amino acids and coenzymes, and mineral nutrition. More specialized topics, including plant acids, the biosynthesis of alkaloids, isoprenoids, and porphyrins, and the chemistry of tannins, coumarins, flavonoids, steroids, and so on, are treated in the third section. The section on control includes a discussion of seed development and germination (Varner), fruit ripening (M. Spencer), cell extension (Lockhart), and development (Bonner). This section might well have included a chapter on the biochemistry and related physiology of phytochrome, as well as a more detailed discussion of the relationship of plant growth hormones to RNA metabolism, although some of the latter material is treated in various parts of the book. Also, there is no single chapter which discusses the biochemistry of growth substances. Autotrophic Metabolism includes two informative chapters on the path of carbon in photosynthesis (Bassham) and the path of energy in photosynthesis (Kok), and a discussion of nitrogen metabolism (Burris).

In summary, the book provides a useful compilation of information from many areas of plant biochemistry and should be a welcome addition to the bookshelf of students and research workers in the field.

GEORGE K. RUSSELL
Department of Biology, Princeton University, Princeton, New Jersey

Timberlands in Russia

Although the Soviet Union possesses much greater forested area than any other country and has long been prominent in the international timber trade, it has hitherto been difficult for interested English-speaking readers to lay their hands on a detailed survey of the Soviet forests. The translation of V. P. Tseplyaev's comprehensive work **The Forests of the U.S.S.R.** (A. Gourevitch, Transl. Israel Program for Scientific Translations, Jerusalem, 1965; Davey, New York, 1966. 527 pp., illus., maps. $19), which originally appeared in the Soviet Union in 1961, should therefore be a great boon to many specialists. This applies not only to students of forestry and related subjects, but also to those of Russia in general, since the forests have had a profound effect on the country's development from the beginning.

The book has a short introductory section on the history of forest surveys, general classifications, and the "natural zones," and even briefer concluding sections on the wood-using industries and world forest resources. However, nearly four-fifths of it is taken up by a detailed regional inventory of the forests. This is organized by general species (pine, spruce, and so forth) and, within these categories, by

particular distinctive regional stands (for example, "larch forests of Central Yakutia"). For each region there is presented valuable local detail on the history of forest exploitation and the extent, age, quality, and yearly increment of the forests, and such questions as the connection between age of felling and the process of natural regrowth are discussed. Although due attention is paid to ecological conditions, the orientation is generally toward the economic appraisal of particular stands. The text is liberally interspersed with meaningful statistical tables and photographs, and the end-pocket contains 11 original maps, based on recent data, showing the growing periods of the various species, quality grades, reserves, the state of forest survey, and the extent of reforestation.

The translation is, in general, satisfactory and runs smoothly, in spite of occasional ambiguities such as the rendering of the Russian *kedr* as "cedar," but it would have been well worthwhile to provide this version with certain extra "editing" services—in particular an index, considering that the book is likely to be a prime source of reference on the subject for some time to come.

DAVID J. M. HOOSON
Department of Geography, University of California, Berkeley

Automatic Control in Space Flight

Peaceful Uses of Automation in Outer Space (Plenum, New York, 1966. 601 pp., illus. $22.50), edited by John A. Aseltine, is the proceedings of the First IFAC (International Federation of Automatic Control) Symposium on Automatic Control in the Peaceful Uses of Space, held in Norway in 1965. All but two of the 44 papers in this volume can generally be classified in two allied fields: space flight mechanics, and guidance and control. In the first category, papers are included which deal with thrusting and nonthrusting phases of translational motion, rotational dynamics, and optimal flight-control policy. Papers in the second category concern the conceptual design, techniques, functional configuration, performance, operating characteristics, and equipment descriptions of guidance and control systems. The two papers whose subjects range outside of these two related fields are descriptions of the reactor power control for a nuclear rocket and low-power circuit designs using metal oxide transistors.

This collection of papers will be a valuable reference for designers of guidance and control systems. A considerable quantity of data on the design of components and systems is presented. These data include performance and operating characteristics for sensors, attitude-control torquing devices, and computers. A wide variety of equipment—star, lunar, and planetary trackers, infrared earth horizon scanners, sun sensors, optical and Doppler radars, a cryogenic gyro, a solar pressure reference, reaction wheels and jets, magnetic and fluid dampers and torquers, and gravity gradient stabilizers and dampers, as well as special- and general-purpose digital computers and data processors—is described. The state of development of this equipment can be identified with the space vehicles in which the components and systems were installed and tested. Past, present, and future space vehicles cited in this connection are Vanguard, Explorer, Tiros, Vostok I, Mercury, Telstar, Mariner, Alouette, Relay, Syncom, OGO, Surveyor, Saturn V, and Apollo. A noteworthy feature of this volume is the brief discussion which follows most of the papers and contains, in many cases, important clarifications as well as additional data.

In the last decade or so, an increasing number of international symposiums on aerospace technology have been held in Europe. With respect to the origin and contents of the papers presented at these meetings, several patterns have evolved. First of all, the greatest number of papers is usually presented by authors from the United States, with the Soviet Union sending the next largest contingent to present papers. This pattern is not at all surprising. However, another trend is that the Soviet contributions at international meetings tend to be theoretical, whereas the American papers stress the development and testing of working systems. This pattern was borne out at this IFAC meeting: 14 of the 15 Russian papers were in the field of space-flight mechanics, and 18 of the 21 American papers treated tested guidance or control techniques. For a meeting whose theme was the peaceful uses of space, it would have been of real interest to the international community of aerospace engineers and scientists to learn more about Russian flight-tested equipment design and performance.

ROSS FLEISIG
Grumman Aircraft Engineering Corporation, Bethpage, New York

Hydrology by Computer

Simulation Techniques for Design of Water-Resource Systems (Harvard University Press, Cambridge, Mass., 1966. 230 pp., illus. $7.50), by Maynard M. Hufschmidt and Myron B. Fiering, is a summary report on a study conducted for the Corps of Engineers and is an extension of the concepts presented in *Design of Water-Resource Systems* by the Harvard Water Program Group. As such, its subject is not as broad as the title implies, for the only technique discussed is that of the Harvard Group —the use of principal component analysis of correlation data for historical records to generate synthetic hydrologic sequences which maintain the statistical properties of the historical data. No mention is made of other techniques for hydrologic modeling, either stochastic or parametric, nor of problems inherent in this particular method, such as the built-in time-sampling error.

The reader is led step by step through the construction of a conceptual model for simulation of two river-basin systems, the Lehigh Basin in Pennsylvania, and the Delaware Basin, of which the Lehigh is a sub-basin. Each necessary component in the model is described, and the simplifying assumptions used are stated, with some discussion of possible refinements. The programming of the conceptual models for digital-computer simulation is outlined in some detail, with several flow diagrams. Although the programs described are for particular basin configurations, what is presented is of general interest to anyone interested in hydrologic simulation. The desire for generalization is discussed, with the aim being to design as general a program as possible.

Surface flow only is considered, with no consideration of bank storage in reservoir design or operation. Because of the current state of the art, estimates of both recreation costs and