the scattered radiation from an oscillator, that it holds only for polarizations perpendicular to the direction of observation. The actual vanishing of the radiation for longitudinal polarization is not implied by the form given. The correct vector dependence on the polarization should be given, or the limitation duly noted.

Despite the above criticisms, I recommend Jackson's book highly for use in a graduate course for physics students. In this relatively undeveloped textbook sphere, there is room for improvement, but the present effort is of great value.

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Genetics and Biochemistry

Cold Spring Harbor Symposia on Quantitative Biology. vol. 26, *Cellular Regulatory Mechanisms*. Long Island Biological Association, Cold Spring Harbor, N.Y., 1961. xv + 408 pp. Illus. $8.

The past 20 years have witnessed the accumulation of qualitative biochemical information sufficiently extensive to make possible the construction of metabolic maps on which are drawn nearly all the chemical reactions carried out in living cells. Within this framework, biochemists have turned to the detailed study of the mechanism of these reactions and the quantitative assessment of their relative importance as the cell is placed in different environments. The latter study was the unifying theme of the 26th Symposium on Quantitative Biology, held in June 1961 at Cold Spring Harbor.

The regulatory mechanisms discussed fall into two categories: a coarse control, involving the rate of synthesis of enzymes, operating at the level of the gene, and a fine control, involving the function of enzymes, operating on the enzyme itself. The former is termed *repression*, and the latter *endproduct inhibition*. As every schoolboy knows, enzyme specificity is determined by the linear order of the amino acids they contain; this information is carried from the gene to the enzyme-forming site, in the form of specific nucleotide sequences, by ribonucleic acid. Thus, a full understanding of repression requires a description of the role of deoxyribonucleic acid in RNA synthesis and of the role of RNA in protein synthesis. Since skeptical schoolboys may question this entire scheme, it is also useful to try to relate the linear order of mutationally alterable sites in a gene with the order of amino acids in the corresponding protein. And so, following the lucid opening address (by B. Davis), the first third of the volume is devoted to papers in these areas. Among several that take up the problem of collinearity between gene and protein, the paper by Yanofsky and his coworkers is noteworthy as an example of the tremendous effort required in this work, particularly in the protein analysis. The DNA-primed synthesis of RNA is then considered, both in vivo (by Spiegelman) and in vitro (by Hurwitz). Next, Brenner summarizes the beautiful experiments, done with Jacob and Meselson, which indicate that ribosomes are nonspecific machinery in protein synthesis. Gros and his coworkers contribute a massive report on the properties of messenger RNA; the section is completed by several descriptions of cell-free systems in which synthesis of well-defined proteins may eventually be demonstrated.

Following these are a dozen papers dealing with the phenomenon of repression itself, in which the union of genetics and biochemistry is essentially complete. In a masterpiece of clarity, Jacob and Monod present the evidence for their regulator/operator model for the control of enzyme synthesis. This model, together with the messenger RNA concept, dominates the discussions of the other contributors to the section: Vogel, Gorini, Maas, Buttin, Yarmolinsky, Kalckar, Novick, Magasanik, Horowitz, H. Kornberg, and Englesberg.

The previously mentioned fine control, endproduct inhibition, is the subject of the next group of papers, to which Umbarger, Changeux, Stadtman, and Moyer contribute. These are neat, informative papers, and one is left with the impression that feedback studies of this sort will contribute much to an understanding of the mechanism of enzyme action. A final section contains several assorted papers dealing with the control of enzyme formation and function in mammalian systems.

The general tone of the papers seems to be one of "patient and cautious optimism," as Monod and Jacob put it in their concluding remarks. This attitude was fully justified, for, following Nirenberg's remarkable discovery last summer, the precise nature of the genetic code appears to be a matter of "mopping up," and the molecular mechanism of repression can be approached directly in a cell-free system. Considered as a whole, the volume presents a useful summary of the state of affairs as of June 1961. It is symptomatic of work in this field that, for the current picture, the book must be read in conjunction with all subsequent issues of the *Proceedings of the National Academy of Sciences of the United States.*

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Avant Garde Science

The Biology of Art. Desmond Morris. Methuen, London; Knopf, New York, 1962, 176 pp. Illus. $6.50.

The *Biology of Art* is an authoritative account of picture making by monkeys and apes. Desmond Morris provides an admirable, accurate, and complete historical record of picture making by chimpanzees, gorillas, orangutans, and even four cebus monkeys, the most instrumentally-minded and adept of the subanthropoid primates. The artistic efforts of representative subhuman primates are illustrated by 57 figures, 38 black-and-white plates, and 13 color plates suitable for framing.

Although Morris measured picture making in at least six chimpanzees and one orangutan, his primary scientific contribution was in the analysis of the 384 pictures made by the chimpanzee, Congo, under as adequately controlled conditions as was possible. While seated at a flat table, the chimpanzee was given pieces of blank paper and pieces of paper on which there were one or more figures, usually squares or circles, centered or not centered. Congo typically covered the single centered design with vertical striations, frequently joined adjacent multiple designs with lines, often balanced a single off-centered figure with an adjacent mass of closely packed scribbles, and achieved left-right and vertical balancing. Somewhat similar drawings had been produced by a chimpanzee, Alpha, studied by Schiller at the Yerkes Laboratory, and Morris makes full use of these data in analyzing chimpanzee pictorial production.

Morris presents convincing evidence that at least some chimpanzees are motivated to draw for the sheer pleasure of producing a design. They may work intently for reasonable periods of

time, beg to be given pencils or crayons, and lose interest in a pencil with a broken point or a dried up brush.

The most striking artistic productions are the multistage colored paintings achieved by giving Congo one brush after another, each loaded with a particular color of paint. This technique made possible the entrancing colored pictures, some with radiating fan patterns and bold circular loops, illustrated in the remarkable color plates.

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Measuring Through Space

Astronomical Spectroscopy. A. D. Thackery. Macmillan, New York, 1961. xvi + 256 pp. Illus. $3.95.

Stars are so remote that not one of them shows the least discernible dimension. Nevertheless, astrophysicists have managed to deduce a remarkable number of details about the physical processes that go on in their outer layers. The clues lie in the spectra of the stars, and here, in the spectra, is the key to nearly all of what we can hope to learn about the nature of cosmic sources of radiation and about the absorbing interstellar medium as well.

The store of information in astronomical spectra seems almost to defy exhaustion: the chemical compositions of stars and nebulae; their temperatures, masses, dimensions, and luminosities; stellar distances and velocities of approach and recession; and such details as stellar atmospheric pressures, densities, magnetic fields, atmospheric motions, and the rate of escape of stellar matter into space.

Thackery describes ways that astrophysicists make the spectra of stars and nebulae give answers. The book is intended for those who have little background in this area of astronomy. Although the discussion is largely qualitative, it is by no means shallow. An early chapter presents some fundamentals of atomic and molecular transitions. The remainder of the book puts these to work in the interpretation of a large and representative variety of sources that range over the sun and planets, normal and unstable stars, nebulae, the interstellar medium, and the galaxies. The chapter on ionization in a stellar atmosphere is particularly well done. Thackery places his emphasis nicely on current problems of astronomical spectroscopy and he raises a wealth of unanswered questions. The final chapter, on questions concerning the evolution of the stars, is a natural culmination.

The book is extensively illustrated with line drawings. However, the peculiarities of astronomical spectra can be conveyed only by reproducing photographic spectrograms. Unfortunately, few of these are used here (only those in the frontispiece). A spectrogram with molecular bands would have contributed to the discussion of molecular spectra and to the discussion of the spectra of the planets and cool stars. A drawing of the radio astronomer's 21-centimeter profile would have added to the discussion of hydrogen in the spiral arms. But these are minor defects. There has been a long-standing need for a book like this. The author's sure hand and friendly style should assure it a warm welcome among undergraduates and serious amateurs.

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New Books

Biological and Medical Sciences

Advances in Veterinary Science. vol. 7. C. A. Brandly and E. L. Jungherr, Eds. Academic Press, New York, 1962. 414 pp. Illus. $14.

Australian Conference on Radiobiology. *Proceedings of the Third Conference*. Held at the University of Sidney, 15–18 August 1960. P. L. T. Ilbery, Ed. Butterworth, Washington, D.C., 1961. 324 pp. Illus. $11.

Biology. Claude A. Villee. Saunders, Philadelphia, ed. 4, 1962. 646 pp. Illus. $7.50.

Carbohydrate Resources within the Perennial Plant. Their utilization and conservation. C. A. Priestly. Commonwealth Agricultural Bureaux, Farnham Royal, England, 1962. 126 pp. 15s.

Cerebral Sphingolipidoses. Stanley M. Aronson and Bruno W. Volk, Eds. Academic Press, New York, 1962. 473 pp. Illus. Plates. $18. Papers (30) from the symposium on Tay-Sachs' disease and allied disorders held at the Isaac Albert Research Institute and the Downstate Medical Center of the State University of New York in March 1961.

Evolution and Genetics. David J. Merrell. Holt, Rinehart, and Winston, New York, 1962. 437 pp. Illus. $6.

Fortschritte der Zoologie. vol. 14. Max Hartmann. Fischer, Stuttgart, Germany, 1962. 556 pp. Illus. DM. 98.

General Biology. William C. Beaver. Mosby, St. Louis, Mo., ed. 6, 1962. 765 pp. Illus. $8.

Genetic Polymorphisms and Geographic Variations in Disease. Baruch S. Blumberg, Ed. Grune and Stratton, New York, 1961. 244 pp. Illus. Proceedings (9 papers) of the conference held at the National Institutes of Health, Bethesda, Md., in February 1960.

Laboratory Manual of Microbiology for Preprofessional Students in the Medical Sciences. George L. Peltier and Keith H. Lewis. Macmillan, New York, ed. 3, 1962. 176 pp. Illus. Paper, $3.50.

Muscles Alive. Their functions revealed by electromyography. J. V. Basmajian. Williams and Wilkins, Baltimore, Md., 1962. 278 pp. Illus. $8.50.

Mutation. An introduction to research on mutagenesis. pt. 1, *Methods*. Charlotte Auerbach. Oliver and Boyd, London, 1962. 188 pp. Illus. Plates. 12s. 6d.

Neuropsychopharmakologie. Symposium der Deutschen Arbeitsgemeinschaft für Neuropsychopharmakologie. Karger, Basel, Switzerland, 1962. 285 pp. Paper.

New Methods of Cell Physiology. Applied to cancer, photosynthesis, and mechanism of x-ray action. Otto Heinrich Warburg. Interscience, New York, 1962. 659 pp. Illus. $35.

On the Morphology and Classification of the Brachiopod Suborder Chonetoidea. Helen M. Muir-Wood. British Museum (Natural History), London, 1962. 140 pp. Illus. Plates. £5 10s.

The Ovary. vol. 2. Solly Zuckerman, Ed. Academic Press, New York, 1962. 613 pp. Illus. Plates. $22.

Pesticide Handbook. Donald E. H. Frear, Ed. College Science Publishers, State College, Pa., ed. 14, 1962. 305 pp. Paper, $2.50; cloth, $3.50.

Plant Taxonomy. Methods and principles. Lyman Benson. Ronald, New York, 1962. 503 pp. Illus. $11.50.

Progress in Comparative Endocrinology. suppl. 1, *General and Comparative Endocrinology*. Kiyohsi Takewaki, Ed. Academic Press, New York, 1962. 398 pp. Illus. Paper, $14; cloth, $16. Proceedings (35 papers and discussion, in English) of the Third International Symposium on Comparative Endocrinology, held in June 1961 at Oiso, Japan.

Rabbit Brain Research. vol. 1, *Atlas for Stereotaxic Brain Research on the Conscious Rabbit*. Marcel Monnier and H. Gangloff. Elsevier, New York, 1961. 83 pp. Illus. $13.

Recent Advances in Anatomy. F. Goldby and R. J. Harrison, Eds. Little, Brown, Boston, 1962. 486 pp. Illus. $12.50.

Soil Animals. D. Keith McE. Kevan. Philosophical Library, New York, 1962. 282 pp. Illus. + plates. $10.

Ultrastructure in Biological Systems. vol. 1, *Tumors Induced by Viruses: Ultrastructural Studies*. Albert J. Dalton and Francoise Haguenau, Eds. Academic Press, New York, 1962. 240 pp. Illus. $9.50.

Die Vegetation der Erde in ökologischer Betrachtung. vol. 1, *Die tropischen und subtropischen Zonen*. Heinrich Walter. Fischer, Jena, East Germany, 1962. 551 pp. Illus. DM. 68.10.

La Vie. Jean Rostand and Andree Tetry. Larousse, Paris, 1962. 466 pp. Illus. Plates.

Your Biology. Ella Thea Smith and Lorenzo Lisonbee. Harcourt, Brace and World, New York, ed. 2, 1962. 472 pp. Illus. Plates.