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