use of extra words. But something has gone wrong when an author consistently uses far more words than are necessary to express his ideas and employs abstract and technical terms to say things that could have been put more clearly in simple language. Consider, for example, a passage on page 123 explaining that political cultures vary both in the extent to which people trust predictions from some minority as compared to their own empirically tested judgments and also in the type of person whose opinions are so trusted; in some societies people trust priests, in others business men, in still others scientists. This has paraphrased in 49 words almost all the unambiguous meaning from an original passage of 228 words. The idea which this paraphrase has expressed by the words, ". . . both in the extent . . . and also in the type . . ." is amplified by a complete sentence in the original: "With respect to this dimension, all specific political cultures can be classified along a continuum and according to a typology."

In writing like this the author is only following a fashion. But why should such a style be fashionable in some academic circles? It can be explained as the product of a culture in which people write primarily for prestige, not because they have something interesting or important to communicate. A style which can give the simplest statement a superficial appearance of complexity and profundity is very convenient for someone who wishes to raise his academic reputation by publishing, though he really has very little to say. But it is a very serious hindrance to someone who, like the author, is trying to answer an interesting question. It may be possible to think clearly and write in this style but it is almost certainly very difficult.

If the author had had the courage to be unfashionable by expressing his ideas as clearly and simply as possible, it would then have been obvious that his analysis had hardly begun to answer his original question, Why should transitional societies have such great difficulties in creating an effective modern state system? And he would have saved so many words that a half or more of the book could have been devoted to working out an analysis that did provide at least the general outlines of a possible answer.

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Modern Applications

Classical Electrodynamics. John David Jackson. Wiley, New York, 1962. xvii + 641 pp. Illus. $13.

Jackson's book satisfies the long-standing need for an advanced, graduate level, textbook on classical electromagnetic theory, oriented toward modern applications. The best texts previously available, such as Panofsky and Phillips' *Classical Electricity and Magnetism* and J. Stratton's *Electromagnetic Theory*, are well suited for a senior course and for the needs of many graduate students, but they are not sufficiently sophisticated for another group of graduate students interested in modern physics, those with an undergraduate background in electricity and magnetism and certain mathematical methods. By failing to take advantage of an early use of advanced mathematical methods and of relativistic covariance, these books proceed more slowly than necessary and thus restrict the time available for examining the properties of complex electromagnetic systems and for considering several of the many important applications to modern fields of research. Another group of texts, such as Landau and Lifshitz's *Electrodynamics of Continuous Media*, is too specialized to serve as the only text for an entire course. As a result the student in an advanced graduate course had no single book to serve as a focus, but only 'reference material.' While graduate students should indeed be expected to use reference material, a central textbook makes it unnecessary for them to buy several books or to spend much additional research time in the library. I have had to recommend that students in a two-term graduate course use not only the previously mentioned texts but several other texts on tensor analysis, relativity, rotation groups, mathematical methods, and magnetohydrodynamics, as well as journal references.

The book presently under review reduces greatly the need for other reference material, although it does not eliminate the usefulness of specialized references. Subjects included in this text are vector multipole expansions, diffraction, wave guides and cavities, magnetohydrodynamics and plasma physics, charged particle scattering and *bremsstrahlung*, particle orbit calculations, and radiative reaction.

In addition to covering the classical material in fields of contemporary interest, such as plasma physics and *bremsstrahlung*, the author uses every opportunity to note where the classical picture breaks down and to sketch in the qualitative quantum mechanical effects. He introduces the concepts of de Broglie and Compton wavelengths, and of quanta of energy, momentum, and angular momentum. He "second guesses" these into quantitative corrections, and even introduces the Klein-Nishina formula. This undoubtedly acts as a stimulus to those students interested in modern quantum physics, and it puts the classical theory into perspective. However it seems to me that, in this context, there are drawbacks in the extent to which this treatment is pursued. It is not necessarily helpful to the student to be introduced to important quantum mechanical and quantum field theoretical effects as intuitive corrections to classical problems. The lack of a well-defined quantum approach can lead to more incorrect than correct answers in the hands of those not already thoroughly acquainted with quantum principles. The well-defined nature and unity of the quantum approach is obscured here, and, in addition, the full range of the classical theory is not always explored, for quantum effects are referred to as dominating in that region. For instance, a more complete classical discussion of renormalization and a consistent point electron picture, as discussed recently by F. Rohrlich, may be more useful to the student when he eventually tackles the quantum field theory problem than the brief quantum discussion given in this book. A chapter on the macroscopic electromagnetic properties of crystal media may be more useful in the context of a course on electromagnetic theory than a long discussion on quantum mechanical features of photon and charged particle scattering. Companion textbooks on classical and quantum mechanics, with cross references, would be a more effective approach, in my opinion.

While the book is generally excellent in developing physically meaningful and mathematically correct derivations of important results, the derivation of the frequency distribution of Cherenkov radiation (page 497) is more than "nonrigorous," as described by the author. This derivation, which is based on a formula that omits the velocity field altogether, would seem to be entirely fallacious. It should also be noted with respect to formula 17.62, for the angular and polarization dependence of

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