for example the clarification of such topics as force of crystallization and the nature of progressive metamorphism—and Spry is correct to point to chronological analysis as a vital tool for the metamorphic petrologist. But from reading this book I would judge the significance of textural studies to be that of a valuable corrective rather than a pointer to new directions in research, unless they emphasize the need for more experimental work on crystal growth in the solid state.

The reader will find ambiguities in some definitions and classifications adopted in the book. For example, it seems a disservice to define polymetamorphism as repeated metamorphism "of the same kind" and then proceed to discuss the case of thermal metamorphism followed by regional metamorphism. What is meant by "kind" here? Also, the definition makes no distinction between metamorphic complexes that have undergone episodic crystallization during a single metamorphic event and those that have received the imprint of two quite distinct metamorphisms.

However, this is a very useful book and it will be welcomed by research workers. In addition it is hoped that it will be used to broaden the scope of undergraduate teaching of metamorphism.

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Microbial Genetics

Episomes. ALLAN M. CAMPBELL. Harper and Row, New York, 1969. xiv + 194 pp., illus. $5.95. Modern Perspectives in Biology.

Following infection of a sensitive cell by a temperate bacteriophage, the phage DNA may be duplicated in either of two mutually exclusive states. Should the infection proceed in the "lytic" direction, the DNA is duplicated about once per minute, the structural proteins of the mature virus particles are produced, particles are assembled, and the host cell lyses. If the infection proceeds in the "lysogenic" direction, such "autonomous" DNA duplication is repressed, as is the expression of most of the phage genes. One (usually) copy of the phage genome attaches to the host cell genome, and any remaining, unattached copies are diluted out of the culture as the infected bacterium resumes its own duplication. The attached phage genome is now duplicated exactly once per cell generation, as are the other, "normal" parts of the host DNA. In 1958, François Jacob and Ellie Wollman pointed out that these features of temperate phages (acquisition by infection, duplication in two mutually exclusive states, attachment to the host genome) are shared by agents which confer fertility or the ability to produce bacteriocins upon their bacterial hosts. The occurrence of the features simultaneously in apparently unrelated biologic entities suggested a fundamental relationship among the features. In order to underscore this relationship, Jacob and Wollman proposed to call by the same name all entities which manifested this constellation—thus, "episomes."

Campbell has recounted, in a personal though modest way, progress to date in the studies of temperate phage, fertility agents, bacteriocinogeny agents, and the medically important and evolutionarily fascinating agents which transfer antibiotic resistance. In so doing he has utilized the Jacob-Wollman definition in a not completely successful attempt to impose coherence upon his review. The book will be bought with high hopes by embryologists, evolutionists, epidemiologists, maize geneticists, and others who feel, rightly, that bacterial episomes may be pertinent models for phenomena of their immediate interest. Many of them will be disappointed. Campbell, though explicitly aware of his potential audience, has forgotten that many people who want to know about episomes do not already know about "marker rescue," "early mutants," "late genes," "anneal" meaning the reassociation of DNA chains by slow cooling of a heated solution of duplex molecules, "hybrid" meaning a duplex composed of annealed chains from genetically distinct individuals, "hybrid" meaning intertypic recombinant, "transfer induction," and "zygotic induction." All these terms and more are used without prior definition. Furthermore, help will not be found in the index—none of the terms listed above are there. For active workers in microbial genetics, *Episomes* will be useful, although, like any primarily technical review, it will not retain a high degree of usefulness for very long. The lasting contribution which could have been made to biology at large lies buried in laboratory slang.

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Cell Infection

Enzyme Induction by Viruses. SAUL KIT and DEL ROSE DUBBS. Karger, Basel, 1969 (U.S. distributor, Phiebig, White Plains, N.Y.). x + 114 pp., illus. $6.50. Monographs in Virology, vol 2.

This book collates in a straightforward manner a great deal of information on enzyme synthesis in virus-infected cells. As might be expected, a large percentage of the information is concerned with phage-infected bacteria, and much of this information has been reviewed before. The new enzymes found in infected cells are described and evidence concerning their induction and synthesis is presented and discussed. In spite of the brevity the uses of host mutants, virus mutants, and inhibitors are clearly described.

The information on virus-infected animal cells is handled in a similar manner, but, because the subject has not been as frequently reviewed, this section seems fresher. It suffers, however, from extensive use of unfamiliar terminology such as letters, which are not listed in a convenient table, to designate particular cell lines. A list of abbreviations used for common biochemical terms is given, but not for less well known terminology.

I believe the book would be a useful reference for classes in virology or biochemistry or for an individual because it provides a ready means of locating a complete list of original references on metabolic changes in virus-infected cells. In addition, a brief insight is provided about relevance of the papers.

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Cardiovascular Prostheses

Engineering in the Heart and Blood Vessels. GEORGE H. MYERS and VICTOR PARSONNET. Wiley-Interscience, New York, 1969. xvi + 208 pp., illus. $14.95. Wiley Interscience Series on Biomedical Engineering.

In order to expand the possibilities of cardiac surgery, several artificial devices have been developed in the last decade. These include artificial hearts, assisting heart devices, artificial heart valves, cardiac pacemakers, artificial blood vessels, and other implantable devices. Some of these devices are the result of highly sophisticated electronics and mechanical

engineering, and often the terminology used is difficult for physicians to comprehend. On the other hand, the physiologic response to these devices is somewhat different from the descriptions found in ordinary textbooks of physiology, and it is difficult, particularly for nonmedical personnel, to understand the specifications required of their devices. It is therefore quite important to have a textbook that can easily be understood by both medical and engineering personnel.

Engineering in the Heart and Blood Vessels is such a book. The authors, representing both the field of engineering (Myers) and that of surgery (Parsonnet), show their particular experience with and knowledge of cardiac pacemakers. Their account of these devices, which includes description, physiologic explanations, history, requirements, and surgical problems, is clear, understandable, and sufficient. The wordage given to implantable materials, artificial hearts, and artificial vessels is not sufficient, however. Granted, it is a difficult task to cover all of the problems extensively, but for the reader interested in the latter subjects the book may be somewhat disappointing. It succeeds in giving an overall review of the field, however, and is a good starting point for the novice. For engineers and physicians interested particularly in cardiac pacemakers and in electrical stimulation of the body, this is a most valuable text and reference book. It would be useful as a textbook for biomedical engineering and medical school students.

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Metabolism of Hormones

Androgens and Anabolic Agents. Chemistry and Pharmacology. JULIUS A. VIDA. Academic Press, New York, 1969. xii + 332 pp., illus. $16.50.

The androgens provide an attractive opportunity for studying the relationship of chemical structure to biological activity. The separation of the anabolic (nitrogen-retaining) from the androgenic activity would prove very useful.

The first comprehensive study of correlation of chemical structure with androgenic-anabolic activity was made by the utilization of the renotrophic effect of the androgens in the mouse. A simple correlation between tissue weight and chemical structure was found. The saturation of the α,β-unsaturated 3-keto group resulted in primarily a decrease in androgen activity without a comparable decrease in the renotrophic activity. The most effective compound was androstane-3α, 17β-diol. On the other hand, oxidation of the 17β-hydroxyl group produced a greater reduction in renotrophic than in androgenic activity. These studies were extended to the skeletal muscles of the guinea pig. The temporal and other head and neck muscles gave a relative response practically identical to that of the mouse kidney. Furthermore, androstan-17β-ol,3-one was more potent than testosterone on the seminal vesicles and prostates, and still more potent on the muscles.

The presentation of a practical assay and the observation that the removal of the 19-methyl group resulted in a compound, nortestosterone, which had much more relative activity on the levator ani muscle than on the prostate prompted many of the pharmaceutical companies to prepare large numbers of compounds. Use of the levator ani as representative of the anabolic action has been questioned by many investigators, but the assay of a large number of steroids has nevertheless made it possible to attempt comparisons of biological activity with chemical structure. The author evaluates and compares the several suggested theories and systematically examines the effect of various changes in the molecule on the relative response of the two types of target tissues. The major portion (203 pp.) of the monograph consists of a tabulation of the activities of 650 compounds. The biological properties and metabolism of the androgens are summarized in the first chapter to provide background information for the purpose of the monograph—correlation of chemical structure with the relative response of the levator ani and the ventral prostate (and seminal vesicle) of the rat.

The suggested theories are based on the assumption that the steroids must fit a specific tissue receptor. Each of the theories is supported by some of the biological data, but in every instance several unexplainable facts persist. This is not too surprising. Many factors have to be taken into consideration in the response of any organ to the injection of specific substances. One that has been almost completely ignored is the solubility of the substances in tissue fluid. Unfortunately, the parenteral studies were done by the subcutaneous injection of oily solutions, and the amount of material actually absorbed from the injection site is unknown. The route of administration is another important factor. A good example is 17-methylandrostan-17β-ol, which when administered via a subcutaneously implanted pellet is practically inactive in the mouse because of the inability of the tissue fluids to dissolve the steroid from the pellet, but which when given orally proves to have renotrophic activity comparable to that of methyltestosterone and a much lower androgenic activity. Another important consideration is the chemical nature of the hormone at the site of action. Not only are these hormones metabolized to a variety of compounds but the qualitative and quantitative changes vary among tissues and also among species of animals. The author provides a brief discussion of these factors.

The monograph is a valuable reference source in that it brings together and evaluates all the material in this particular assay. The 85 pages of text are written concisely and clearly. The book does not provide any further enlightenment, however, regarding the relationship of chemical structure to androgenic or anabolic activity. The question still remains: can the anabolic activity of the androgens be separated from the androgenic activity, or is it part of the sex-linked response, as some investigators have claimed, and therefore inseparable from the effect on the accessory sex organs? The differential response of several tissues with alterations in chemical structure, however, provides the possibility of the synthesis (or even the natural occurrence) of a steroid with primarily anabolic activity.

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Wall-less Cells

The Mycoplasmatales and the L-Phase of Bacteria. LEONARD HAYFLICK, Ed. Appleton-Century-Crofts, New York, 1969. xxii + 738 pp., illus. $30.

That organisms which lack cell walls are under intensive study is evident from the table of contents and the size of this book. The editor has drawn together 26 chapters by 35 contributors, mostly from the Second International