Book Reviews

Phage Studies

The Bacteriophage Lambda. A. D. HERSHEY, Ed. Cold Spring Harbor Laboratory, Cold Spring Harbor, 1971. xii, 792 pp., illus. $24. Cold Spring Harbor Monograph Series, vol. 2.

Like the first book of the series (*The Lactose Operon*, 1970), *The Bacteriophage Lambda* consists of two parts: the first contains review papers written by specialists in the field, the second represents the proceedings of a meeting held at Cold Spring Harbor a year earlier.

"Lambdology" has long remained an esoteric science. The book attempts to make it accessible to all biologists. This is a very welcome effort, since the results and concepts emanating from the study of phage lambda will undoubtedly find applications in a variety of other fields; they already inspire the thoughts of those who study genetic recombination, DNA replication, cell differentiation, morphogenesis, and the transformation of animal cells by oncogenic viruses. The review papers, in general excellent, vary considerably in style. One of them, tedious but useful, will give you all physical and chemical parameters you may wish to know on phage lambda DNA. In another you will find attractive but debatable ideas on how a temperate phage may buy the privilege of establishing its own genes within the host chromosome. A large fraction of the book is devoted to the different types of recombination which the DNA of phage lambda can undergo: "general," "site-specific," and "illegitimate." General recombination, the basis for classical genetics, occurs between any homologous regions of genetic material. Site-specific recombination, like that which allows the phage chromosome to integrate into the bacterial chromosome, occurs at fixed points on the DNA and requires no extensive base-sequence homology (perhaps no homology at all) between the recombining DNA's. Illegitimate recombination, a rare event involving an exchange between presumably any nonhomologous regions of genetic material, and leading to such aberrations as deletions, duplications, insertions, and transducing phages, must be of profound evolutionary importance. In the light of the new data presented, molecular models of these different types of recombination are discussed.

Emphasis is also put on the regulation of viral functions: regulation allowing the proper temporal sequence of gene expression during the lytic cycle and regulation concerned with the choice between the two pathways offered to the infecting phage, lysis of the cell and production of more phage or lysogenization usually involving a harmless integration of the phage genome into that of the host. For instance, a clear account is given of the evidence that the phage repressor, long known to prevent expression of the lytic genes in lysogenized bacteria, is itself regulated by several other genes.

Two years ago, most "reasonable" molecular biologists agreed that replication of a circular chromosome proceeded in a single direction, and also that the replication of genes was totally independent of their expression. Why the same molecular biologists are no longer so positive about these points you will find out by reading *The Bacteriophage Lambda.*

The review papers, completed by spring 1971, give an up-to-date description of lambda biology, and will be of invaluable help to a very large audience. The research articles, on the other hand, intended for the specialist, come a little late, since they contain results obtained by 1969 or 1970. An improvement in the future monographs of the series could be to publish the two sections in separate volumes and make the research papers available as soon as possible.

Aside from this reservation *The Bacteriophage Lambda* is an excellent book, from which, thanks to the editorial ardor and skill of A. D. Hershey, most of the jargon has been excluded.

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Phylogenetic Mechanism

Evolution by Gene Duplication. SUSUMU OHNO. Springer-Verlag, New York, 1970. xvi, 160 pp., illus. $16.50.

Blue Crossopterygian Man dominates the dust jacket. A forewarning? Ah yes—you are warned: you will be stimulated, cajoled, and, unless you have a more than passing acquaintance with at least one of the subject matters from which the author spins his argument, perhaps misled.

Ohno makes clear from the outset that this is no general treatise on evolution; his focus, as he traces the human germ plasm to the purines and pyrimidines of the primeval soup, is on man. His introduction, unnecessarily expounding an "origin myth" for the genetic apparatus, is the standard chapter on the subject. Then, after a brief discussion of chromosomes, he classifies gene mutations as forbidden or tolerable. Forbidden mutations alter active sites of essential macromolecules. Natural selection is cast as an "extremely efficient policeman" that forbids adoption of significant change. Tolerable mutations, such as those that distinguish the hemoglobin chains of related species, yield diversity and adaptation, but not novelty in evolution at the molecular level. Karyotypes are similarly conservative. The number of chromosome arms and their genic contents remain remarkably stable through the cycle of fusions and inversions common in speciation that diversifies chromosome numbers.

Ohno assails the "Lamarckian illusion" in which the process of evolution is visualized "as members of a successful species advancing shoulder-to-shoulder to a higher and higher state of being." He avoids the Darwinist concept that the favored few reproduce disproportionately to become ancestral to entire later populations, opting instead for an Adam-and-Eve ("founder effect") interpretation: close inbreeding in a tiny isolate is indispensable to speciation. Polymorphism in large populations is not the stuff of which new species are made.

True evolutionary progress requires the liberation of a gene from the "relentless" scrutiny of natural selection so that it is free to accumulate "forbidden" mutations until it becomes preadapted to a new function. Gene duplication is necessary, though not as employed for mass production of stable RNA's.

Ohno presents two of the several