with some of the results of intra- and inter-type transformation with this organism. The paper by Mills and Smith continues in the same vein with the attempt to relate the effects to the metabolic defects of the various mutants. One is left feeling that if this work is to be extended to the hundred odd immunological types of Pneumococcus more data on the composition and biosynthesis of the capsular polysaccharides will be necessary if the non-specialist is not to become entirely confused with roman numerals.

The genetics of the Enterobacteriaceæ are fully described by Hayes on " Conjugation in *Escherichia coli* ", by Sneath on " Sex Factors as Episomes " and by Smith and Stocker on " Colicinogeny and Recombination ". The latter is a most interesting paper, being an account of work which shows that genetic transfer may be facilitated by colicinogenic factors. Although the experiments are concerned specifically with coliform bacteria, the results suggest that similar studies of bacteriocinogeny in other organisms may assist in the search for conjugation and recombination in them. A useful reminder of the gulf between the geneticists' idea of the bacterial chromosome and the cytologists' is given by Robinow in his survey of present knowledge about the organisation of bacterial DNA, entitled " Morphology of the Bacterial Nucleus ".

Aspects of bacteriophage genetics are covered by three papers. Symonds' " Genetics of Bacteriophage " is devoted to the virulent T2 and T4 coliphages which from recent work appear to have circular linkage groups like *Escherichia coli* K-12. Temperate phages are the subjects of articles by Whitfield and by Anderson on " Lysogeny " and " Genetic Basis of Bacteriophage Typing " respectively.

The Bulletin ends with discussions of three problems which have so far defied genetic analysis. Burrows describes various factors which confer virulence upon *Pasteurella pestis*, and Mitchison reviews work, mainly on the chemotherapy of tuberculosis, which on the whole supports the mutational origin of drug-resistant bacteria. Finally, Pontecorvo suggests a new approach to genetic analysis in man based on the phenomenon of mitotic segregation found in *Aspergillus nidulans* and similar fungi. This beautiful idea is spoilt by the ugly fact that almost no suitable genetic markers have yet been discovered in human cells. If, however, this difficulty can be resolved, and if the expectation of mitotic segregation is fulfilled, the foundation may well have been laid for a future Bulletin on genetics in which tissue cultures have the prominence that bacteria have in this one.

R. G. TUCKER.

CELLULAR REGULATORY MECHANISMS. Cold Spring Harbor Symposia on Quantitative Biology, Vol. 24. Long Island Biol. Ass., Cold Spring Harbor. 1961. Pp. xv+408 417 figs. and 12 plates. Price: Institutions and Booksellers $12.00, Individuals $8.00.

This is an important and timely volume dealing with a leading problem in biochemical genetics. The actual content of formal genetics is relatively small, the major mode of treatment being biochemical. However, the genetics, which pervades many of the papers and which provides indispensible tools, is highly significant. The extent to which genetics and biochemistry have become interdependent in this field is most impressive. While most of the research discussed dealt with micro-organisms, its significance in relation to normal and abnormal growth and differentiation in higher organisms is not neglected.

Two important essays respectively opened and closed the symposium. Their titles employ the term *teleonomy*, suggested by Pittendrigh, to make clear that the teleological flavour, inseparable from discussions of physiological significance, nevertheless implies natural selection as the responsible agent for the development of valuable structures and mechanisms. Davis's opening address is most stimulating, contributing ideas on economy in biosynthesis and the economics of messenger RNA as well as a critical survey of the major mechanisms for control of biosynthesis.

In their general conclusions Monod and Jacob consider the mechanisms of the different regulatory effects, noting the similar, if not identical, controls, which are particularly striking in the cases of inducible and repressible enzymes and of lysogenic systems. They note that the regulatory problems posed by differentiation in multicellular organisms are not only more complex, but are different in nature from those so far studied mainly in bacteria. Nevertheless, the genetic systems of control discovered in maize by McClintock and by Brink are remarkably similar in principle to the bacterial ones.

The main body of papers, forty-two in number, arranged under eight topics, falls into two broad groups. One deals with the role of the genetic material as a code of information in protein synthesis and with the mechanism of transfer of this information from DNA, via RNA, to the site of protein synthesis. The other, accounting for the larger proportion of the papers, deals with cellular mechanisms governing the rates of enzyme activity and of enzyme synthesis.

Attention can be drawn to only a few of the more exciting developments. Yanofsky reported that certain suppressor mutations restore the normal peptide structure in a small fraction of the enzyme molecules formed by a tryptophan synthetase mutant. It is suggested that these suppressor mutations modify the specificity of an enzyme, which activates a particular amino acid, in such a way as to allow compensatory errors in the choice of the amino acid activated. It follows that there should be a limited number of genes (about twenty) capable of yielding such suppressors and each should be capable of correcting, in part, the effects of primary mutations affecting several different enzymes.

Repression by the end product affects all the enzymes in a biosynthetic pathway, and may usually be co-ordinate, *i.e.* to the same extent on all enzymes. In the arginine system (as Vogel, Gorini *et al.* and Maas show) one regulator gene appears to control several unlinked genes governing the different enzymes of the sequence. Close linkage of the genes is therefore not a requisite for their unified control. Similar regulators may yet be found in higher organisms.

This symposium, well up to the Cold Spring Harbor standard, should be read by all geneticists. But they must be warned that it will be hard going.

D. G. CATCHESIDE.

GENETICS AND EVOLUTION: SELECTED PAPERS OF A. H. STURTEVANT. Ed. E. B. Lewis. W. A. Freeman, San Francisco and London. Pp. x +334. 54s.

Dr Sturtevant's publications cover a full half-century. The first of the 137, listed at the end of *Genetics and Evolution*, appeared in 1910 and dealt with the inheritance of colour in horses. The latest (may we hope it will not be the last?) is dated 1960 and is on the subject of radiation effects in