nevertheless has the scientist's faith that only the isolation and control of variables will yield trustworthy data. The book is useful, therefore, in showing the anomalies, puzzles, and complexities of the existing data on the perception of size and distance.

Physiological optics and the concept of the retinal image are accepted as the basis of perception. The author thinks of space perception as the seeing of the sizes and distances of objects in empty air, which justifies his title. The doctrine of *cues* for the third dimension of space is taken for granted. He is uninfluenced by the recent tendency to think of space perception as the seeing of the layout of surfaces in a terrestrial world as distinguished from the seeing of objects in the sky.

The investigation of the tendency toward invariance in the phenomenal size of objects with varying distance has become a genuine specialty in modern psychophysics. There is a large body of research here surveyed. The reader may judge whether or not any pattern has emerged. If so, it is obscure.

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Agricultural Improvement

Outlines of Perennial Crop Breeding in the Tropics. F. P. FERWERDA and F. WIT, Eds. Veenman, Wageningen, The Netherlands, 1969. xvi, 512 pp., illus. Paper, N.fl. 49.50. Landbouwhogeschool Miscellaneous Papers, No. 4 (1969).

Many tropical countries are dependent largely upon agriculture, and perennial crops are often a major source of their income. The number of plant breeders working with tropical perennial crops is small compared with their colleagues in temperate countries, but their contributions have often been immense. The breeding of vigorous, high-yielding, disease-resistant, interspecific hybrids of sugar cane, a crop rather surprisingly not included in the volume under review, has been of the greatest value. The best clonal *Hevea* rubber gives three to four times the yield of the nonselected seedling material of 50 years ago and has permitted the industry to survive in competition with synthetic rubber. However, this measure of success has not been achieved with all crops. Although we now know a very great deal about the origin and cytogenetics of bananas, we are still only on the threshold of breeding useful commercial cultivars of this crop.

The editors of this volume, which "is intended as a guide to the student and a source of reference to the scientists in the tropics," have brought together contributions from 28 specialists of different nationalities on a wide range of crops. The crops dealt with are agave, avocado, banana, cacao, cinchona, citrus, clove, coconut, coffee, date palm, fig, kapok, kola, mango, nutmeg, oil palm, papaya, pepper, rubber, tea, and tung. In addition to sugar cane, crops omitted include cashew, guava, passion fruit, pineapple, pyrethrum, and vanilla. For each crop information is usually provided on systematics, physiology of development, floral biology, breeding, and possible future developments. The lists of references seem to be adequate and reasonably up to date.

Many perennial tropical crops are very heterogeneous and, although in many cases it is possible to perpetuate the clone by vegetative propagation, the genotype can be improved only by purposeful breeding. The importance of preserving variability in gene banks before some is irretrievably lost should be stressed. Because of their long breeding cycles, genetic improvement of these crops entails long-term projects, often with inevitable changes of staff, particularly in recent years. The published results are often fragmentary and dispersed. The bringing together of the information in this way should be much appreciated by present and future workers in this field.

One of the most important aspects of crop improvement is the breeding of disease-resistant cultivars. The discovery of coffee leaf rust, *Hemileia vastatrix*, earlier this year in Brazil, when it had already invaded a substantial area in eastern Brazil, may well have far-reaching consequences for the political and economic stability on those South and Central American countries which depend largely on coffee, particularly as the New World crop appears to be susceptible to nearly all the races of the rust. Ferwerda, in the chapter on rubber, describes the attempt being made to breed clones resistant to South American leaf blight, *Dothidella ulei*, in Liberia and testing them out in Guatemala, where the disease is endemic. Of the 7542 clones tested, only 1.7 percent exhibited resistance, and the advent of new, extremely virulent physiological races of the pathogen has added further complications. No reference is made to work of a similar nature which is being carried out by the Rubber Research Institute of Malaya in Trinidad.

The book is well produced and illustrated; it is commendably free of typographical errors. It can be recommended to all who are interested in the improvement of tropical perennial crops. It is sad that Toxopeus, one of the first joint editors, to whom this volume is now dedicated, did not live to see its completion.

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Mechanisms of Inheritance

Genetic Organization. A Comprehensive Treatise. Vol. 1. ERNST W. CASPARI and ARNOLD W. RAVIN, Eds. Academic Press, New York, 1969. xiv, 528 pp., illus. $29.

Starting with an unusually interesting historical introduction (by L. C. Dunn), this first volume of a set of three deals with the structure of nucleic acids (H. M. Sobell) and chromosomes (J. H. Taylor), genetic transformation and recombination (W. F. Bodmer and A. J. Darlington; S. Emerson), and chromosome pairing (R. F. Grell). The later volumes are to deal with gene action, mutation, and evolution.

The first application of scientific method to the study of the laws of inheritance led to the concept of genes as particulate units of inheritance, normally stable but subject to rare, sudden inheritable changes called mutations, a term borrowed from paleontology. As the history of genetics is traced in Dunn's account, it seems that the most farsighted achievement of the early work was the recognition of the genetic apparatus as a chemical system, requiring the application of physical and chemical methods for its elucidation. Garrod, who was a chemical pathologist studying congenital metabolic disorders in man, aptly referred to these disorders as "inborn errors in metabolism" and introduced the concept that the enzymes of metabolism might be controlled by genes. Avery discovered that pneumococcal transformation was due to a fibrous polymer, deoxyribose nucleic acid, and so opened the way for Watson and Crick to arrive at the molecular structure of