Chronic granulomatous disease, which is found predominantly in male children, is characterized by inability of PMN to kill ingested catalase-positive bacteria; those that are catalase-negative are killed. R. L. Baehner and R. K. Root discuss this and other inherited defects of microbicidal functions of human leukocytes. Evidence is presented that the principal defect is the inability of the cells to generate hydrogen peroxide. Indeed, when the defective leukocytes are caused to ingest latex particles coated with glucose oxidase the ability of the cells to kill catalase-negative bacteria is markedly improved.

Several papers discuss leukocyte locomotion and directed migration. A number of interesting observations are recorded, and there is no doubt about the importance of this line of investigation. However, at present there appears to be a need for improvement in techniques for conducting such investigations and for careful attention to the property of cells that is being assessed. Some of these difficulties are underscored in the contribution by M. E. Miller and in the summarizing remarks by J. G. Hirsch.

The volume includes an excellent brief review of the activation and role of complement components in phagocytosis (H. J. Müller-Eberhard), a short discussion of activation of macrophages by lymphokines (J. R. David), and some interesting studies concerned with an apparent role of macrophages in causing precocious humoral immune responses in neonates (R. M. Blaese). For a more comprehensive view of the biological roles of phagocytic cells and mechanisms of phagocytosis, the reader would be well advised to supplement this book with the symposium "Function of Macrophages" published in *Federation Proceedings* (**34**, 1723 [1975]).

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Measuring Stellar Diameters

The Intensity Interferometer. Its Application to Astronomy. R. HANBURY BROWN. Taylor and Francis, London, and Halsted (Wiley), New York, 1974. xvi, 184 pp., illus. $18.75.

This book recounts the entire story of a project from conception through completion. Its subject is the optical intensity interferometer utilizing two large, mobile light collectors built at Narrabri, Australia, mainly for the purpose of measuring 32 stars. R. Hanbury Brown has been the protagonist of the project, being responsible for the original idea as well as for its implementation. His training as a radio engineer permeates the style of the project to such an extent that it bears almost no resemblance to customary optical astronomy facilities.

The book is well written and enjoyable and may be particularly recommended to persons having only a marginal acquaintance with the subject. The initial historical chapter especially deserves to be singled out for its refreshing personal flavor, uncommon in scientific work. It includes a genial narration of the storm of controversy that arose upon initial publication of the idea of intensity correlations. Such correlations presented an awkward discord with naive (and erroneous) notions stemming from a quantum viewpoint. The explanatory theoretical chapters unfortunately lapse back into the passive, and their clarity is slightly diminished as a result. The simple and the elaborate aspects of the theory are conveniently sorted into separate chapters, however.

The book does not replace the author's earlier article, "Measurement of stellar diameters" (*Annu. Rev. Astron. Astrophys.* **6**, 13 [1968]). In that article, for example, the fact that the method is restricted to blue, high-temperature stars was more emphatically clear. As another example, the effects of path difference receive an unnecessarily muddled account in this book. Path differences are tantamount to small pointing errors that jiggle the position of the fringes (illustrated in figure 2.2 of the book) so as apparently to smear them out. On the whole, however, the explanations are remarkably clear.

My principal objection is to the restricted, almost myopic, presentation of the topic. There is not a word on how intensity interferometry complements speckle interferometry and there is only one mention of heterodyne interferometry. Both of these more recent techniques are also used for measuring stellar diameters. And the comparison with the older Michelson stellar interferometry is somewhat unjust, because it presupposes visual detection for the Michelson technique whereas the intensity interferometer profits from the advantages of photoelectric detection. A moderately imaginative use of a Michelson interferometer with photoelectric detection might prove to be very beneficial.

The real problem with any interferometer, it seems to me, is the difficulty of being sure that an absence of fringe visibility (or correlation) is truly a result of resolved source diameter rather than of some spurious cause such as maladjustment. Hanbury Brown has been meticulously thorough in addressing that problem. His success may very well be a result of that thoroughness rather than of inherent advantages of the intensity interferometer.

The book does not discuss applications of intensity interferometry other than measuring stellar diameters. Possible spectroscopic applications were once suggested. Was there some reason, other than neglect, for their fading away? Also absent is the discussion of the remarkable fact that laser light does not exhibit intensity correlations. Some comment on that would have been welcome.

It is indeed fortunate that Hanbury Brown had the idea of the intensity interferometer as early as he did. In the present climate it is unlikely that such an exceptional project would receive support. If the conception had been delayed we probably would have been deprived of both the knowledge attained from the project and a good book.

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Improving Plant Protein

High-Quality Protein Maize. Proceedings of a symposium, El Batán, Mexico, Dec. 1972. Dowden, Hutchinson and Ross, Stroudsburg, Pa., 1975 (distributor, Halsted [Wiley], New York). x, 524 pp., illus. $28.

Nutritional Improvement of Food Legumes by Breeding. Proceedings of a symposium, Rome, July 1972. MAX MILNER, Ed. Wiley-Interscience, New York, 1975. xvi, 400 pp., illus. $20.95.

Dietary protein has been in short supply in the economically disadvantaged groups throughout the world. It has been estimated that within one generation there will be a greatly expanded need for food protein, possibly amounting to 100 million tons a year. The cereals and the food legumes (pulses) are now the major source of both calories and total protein for a large segment of the peoples of the world. There is a consensus that increases in protein quantity or quality or both in these groups of crops can be effected more readily than adequate increases in the supply of animal protein. Furthermore, it is well established that cereal-legume dietary combinations provide an adequate amino acid balance. Thus genetic improvement in both crops would be desirable. The books under review are the proceedings of symposia held to explore the nutritional adequacy of and opportunities for improvement in these two important sources of plant protein.

In *High-Quality Protein Maize*, primary

attention is focused on high lysine (opaque-2) maize, but consideration is also given to other cereals: wheat, triticale, oats, rice, sorghum, and barley.

The improved amino acid balance of opaque-2 maize was first reported in 1962. Since that time abundant evidence of a corresponding improvement in nutritive value has accumulated. Studies conducted in Colombia and Guatemala indicate that the protein of opaque-2 maize has a biological value about 90 percent of that of skim milk in the feeding of protein-deprived children. Rat and swine feeding trials also attest to the improved nutritional value of opaque-2 maize.

The book includes reports on the development of opaque-2 maize types from various areas of the world: Brazil, Colombia, Hungary, India, Mexico, Peru, the Philippines, the United States, and the Soviet Union. In spite of the tremendous effort that has been expended on it and its proven nutritional superiority, opaque-2 maize occupies a very limited percentage of world acreage. Strategies for increasing utilization receive some attention.

The current situation with respect to improvements in protein quality or quantity in other cereals is also reviewed; subjects covered include the new high-protein wheats and oats and naturally occurring or induced mutations in both sorghum and barley that improve in protein quality through a reduction in the alcohol-soluble fraction. Consideration is also given to the economic and technical feasibility of improving dietary protein quality through fortification and supplementation as alternatives to genetic improvement. A series of workshops on chemical and biological evaluation techniques for protein, problems involved in the introduction of improved varieties, and social and economic factors involved in public acceptance of these varieties complete the book.

A large number of legume species, which are the subject of *Nutritional Improvement of Food Legumes by Breeding*, are used as human food in various areas of the world. It is possible that the wealth of species available has been a deterrent to progress, as few have received concentrated attention. The six most important types are cowpeas (*Vigna unguiculata*), dry beans (*Phaseolus vulgaris*), chick peas (*Cicer arietinum*), pigeon peas (*Cajanus cajun*), groundnuts (*Arachis hypogaea*), and soybeans (*Glycine max*). The last two are grown primarily for industrial processing though both are also used directly as human food.

Yields of food legumes have not been increased by the Green Revolution. In fact, the increases achieved in the cereals have often been accompanied by decreases in both acreage devoted to and total production of the food legumes. In addition to relatively low yields, the legumes pose other specific problems that limit expanded use, and these are discussed in the book. The six objectives of food legume improvement programs are higher protein levels and better amino acid profiles; reduction of toxic constituents; reduction of flatulence; improvement of processing and consumer acceptance; development of screening methodology useful to plant breeders for measuring relevant chemical, nutritional, and toxicological factors; and expansion of research related to crop yields and productivity.

Within each of the six main types of food legumes, survey data indicate rather striking differences in protein percentages. As in other seed crops, percentage of protein in legumes is markedly influenced by environment, which complicates selection and evaluation. The lack of a simple screening technique has precluded extensive work on methionine and cystine, the amino acids of greatest interest.

Little information is available on the genetic control of various toxic or otherwise undesirable substances present in some or all of the food legumes. The effects of some of these (trypsin inhibitors, phytohemagglutins, and antivitamin factors) can be minimized through cooking; apparently the digestibility of all legumes is improved by heat treatment. Other undesirable substances, such as goiterogens, cyanogenetic glycosides, flatulents, and possible heat-resistant growth depressants, are relatively unaffected by normal cooking procedures. Species and varietal variation of some of these characteristics has been established, but the extent and complexity of genetic control remains largely unknown.

On the basis of the general history of success in plant breeding it appears safe to assume that further increases in productivity in these two classes of food crops can and will be achieved. Improvements in other desirable characteristics (such as an increase in kernel hardness in opaque-2 maize or a reduction in toxic substances in legumes) are less predictable and will take longer. A prerequisite for the desired progress in any plant breeding program is the availability of a simple, rapid, and efficient screening technique for each of the factors of major interest.

These two volumes contain information of interest to specialists in agriculture and human nutrition and to all others who are interested in the adequacy and the protein quality of the world food supply.

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