shifts of galaxies are caused by velocities of recession and that these velocities, leaving aside a small component due to individual motion, result from the expansion of the universe. A small minority of astronomers maintain, however, that some few galaxies, and perhaps all quasars, exhibit anomalous redshifts that are caused by some as yet unknown physical process unconnected with their peculiar motions or with the universal expansion.

The volume under review contains the proceedings of two conferences devoted to these issues. The conferences were held consecutively; they had the same participants and organizers and were, in effect, one conference. The organizers apparently wanted to have a wide range of viewpoints represented and to stimulate as much controversy as possible. Some, perhaps skeptical of the value of public debate in furthering critical inquiry, chose to stay away. Nonetheless, the published proceedings provide a useful and fairly complete summary of work recently done within the framework of the Hubble program as well as of the work of its critics.

Reading this volume I could not escape the impression that there is something slightly odd about the tone of discussion in contemporary observational cosmology. It is at once inconclusive and strangely dogmatic. Opinions seem to be more strongly held than the evidence for them warrants. Some cosmologists seem to live in private worlds and are deeply persuaded by evidence and arguments that seem to their colleagues to be quite unpersuasive. Few make observations whose implications they find surprising; there are not many discoveries reported here. But if you want to know the state of play in the continuing effort to determine the characteristics of the universal expansion or just how weak the case for nonvelocity redshifts is, this is a good place to begin.

Aside from these well-worn paths, there are many new and interesting things here: Tully and Fisher on their new program of radio redshifts, Tinsley and White on different aspects of evolutionary change in galaxies and clusters of galaxies, Kellermann and Shaffer on apparent faster-than-light motions in radio sources, and Roberts on how constant some of the natural constants are. There are also two superb reviews of the whole cosmological enterprise: one by Gunn on observational tests in cosmology and the other by Rees on the nature of the redshifts. Both of these *vaut le voyage*.

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Hemoglobins and Their Disorders

Human Hemoglobins. H. FRANKLIN BUNN, BERNARD G. FORGET, and HELEN M. RANNEY, Eds. Saunders, Philadelphia, 1977. x, 432 pp., illus. $18.

As a result of three decades of intense investigation, human hemoglobin and its abnormalities have been established as the prototype for understanding the mutational origin and the molecular pathology of hereditary disease in humans. Hemoglobin research has flourished in several fields. Clinical investigations have elucidated the natural history and pathophysiology of hemoglobin disorders, some of which (the sickling and the thalassemia syndromes) are among the most prevalent genetic defects in African, Mediterranean, and Asian populations. Genetic studies have uncovered a multitude of abnormalities; human hemoglobin is unique in that it is the only mammalian genetic system in which abnormalities in protein structure as well as in protein synthesis and in developmental patterns are known and well characterized. An equivalent to the number and heterogeneity of the structural human hemoglobin mutations can be found only in bacterial genetic systems. In parallel, biochemical investigations during the last decade have led to the delineation of the structure and function of normal and abnormal hemoglobins at the stereochemical level and to the discovery that abnormalities in hemoglobin synthesis reflect problems in the production, structure, or function of globin messenger RNA. This book brings all these products of basic and clinical investigation together.

The book has ten chapters, four presenting introductory information and the remainder discussing specific hemoglobin abnormalities. The coverage of the subject is of uniformly high quality. The early chapters of the book contain the best available syntheses of hemoglobin function and its modulation in health and disease; this material provides an excellent background for the analysis of the physiological effects of mutation in the chapters describing the sickling disorders, the unstable hemoglobins, the variants that have abnormal oxygen affinity, and the hemoglobins that produce methemoglobinemia. The bibliographic coverage in these chapters is complete, and the tables provide good summaries of the described mutants and their properties. The clinical descriptions are accurate and to the point.

About a third of the book is devoted to the most common hemoglobin abnormalities, the thalassemias and the sickling disorders. These chapters are excellently balanced between review and synthesis, reflecting the research and clinical experience of the authors. The chapter on thalassemia is preceded by a vigorous review of globin biosynthesis and globin messenger RNA through 1976, but this part of the book will soon be outdated by the rapid progress in the investigation of mammalian globin messenger RNA and DNA.

The only weakness of the book is in matters of population genetics. There is only sporadic reference to the population frequencies of hemoglobin defects, and Allison's demonstration of the selective advantage of the sickle cell trait carriers vis à vis falciparum malaria, one of the major contributions in human population genetics, is allotted only eight lines.

The book is readable, lucid, and comprehensive. It contains almost everything known about human hemoglobins, and it will be a useful companion for clinical and experimental hematologists as well as for teachers who want to use hemoglobin to illustrate principles of biochemistry or human genetics.

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Anatomy of Domestic Birds. R. Nickel, A. Schummer, E. Seiferle, W. G. Siller, and P. A. L. Wight. Translated from the German edition (Berlin, 1973). Parey, Berlin, and Springer-Verlag, New York, 1977. xii, 204 pp., illus. + plates. $42.30. *To order this book circle No. 351 on Readers' Service Card*

Biology of Benthic Organisms. Papers from a symposium, Galway, Ireland, Oct. 1976. B. F. Keegan, P. O. Cédigh, and P. J. S. Boaden, Eds. Pergamon, New York 1977. xxxiv, 630 pp., illus. $50. *To order this book circle No. 352 on Readers' Service Card*

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