ment a few of the weaknesses of Landau's cocksure, ad personam, open-and-shut judgments."

Equally admired by his compatriots appears to be C. V. Raman (1888–1970) of Raman spectroscopy. Raman has recently been the subject of a lengthy biography, *Journey into Light* by G. Venkataraman (reviewed in *Science* **244**, 848 [1989]), that included considerable technical detail about his work in physics as well as recounted his activities as a leader of science in India. Now only a year later we have a more informal account by a scientist who was for 11 years an associate of Raman's at the Raman Research Institute in Bangalore. Organized according to theme rather than strict chronology, the book treats virtually all aspects of Raman's more publicly known activities as well as gives information about such matters as his attitudes toward his protégés, his interest in gardens, his investments, and various personal habits. The author draws heavily on published (though not always easily available) sources but also includes many personal anecdotes. On the scientific side, there are expositions, aimed at a general readership, of the problems in optics and acoustics with which Raman's research was concerned, and there are also accounts of Raman's travels and of visits to his institute made by eminent scientists and others from India and abroad. The difficulties of Raman's personality, which led among other problems to his dismissal from the Indian Institute of Science and a rancorous controversy with Max Born, are frankly acknowledged, but the author repeatedly stresses Raman's love of nature and his "seriousness and fearlessness, clarity and honesty."

Apart from their appeal to casual curiosity and the gratification they may provide to their authors and sponsors, how useful ultimately are works of the types represented here? This of course is a matter that in part has to be assessed by those knowledgeable about the particulars of individual cases, but one observation that might be permitted here is that those of the subjects' peers whose assessments are negative are seldom willing to commit them to print. It is further noteworthy that a general reader who turns to such works for insight into the workings of science is likely, whatever else, to encounter much about meals and entertainments, struggles to locate and acquire suitable real estate, the rearing and careers of offspring, and comic episodes and remembered *bons mots*, not to mention household hints and assessments of scenery and weather. Given that such few academics in non-scientific fields as are moved to recount their lives are likely to be schooled to more literary modes, such works as these may have prime value as sources on the life-styles of the academically well placed.

KATHERINE LIVINGSTON

Metrology in Physics

The Art of Measurement. Metrology in Fundamental and Applied Physics. BERNHARD KRAMER, Ed. VCH, New York, 1989. xiv, 335 pp., illus. $66. Research—Measurement—Approval. From a symposium, Berlin, F.R.G., 1987.

The Art of Measurement is an account of the symposium "Metrology in Fundamental and Applied Physics" held on the 100th anniversary of the founding of the Physikalisch-Technische Bundesanstalt. With its great history of precision and measurement, the German "National Bureau of Standards" is an ideal place on which to focus the work discussed in this book. The book is divided into parts on fundamental physics, precision experiments, and medicine, all connected by the primary thread of *precision*, and is an unusual marriage of the most fundamental with the highly applied.

Wilhelm Walcher's long introduction provides an even treatment and smooth weld of the history of gravity experiments from Kepler's time up to the fifth force work going on now, but in an analytical context of the practicalities of assuring the precision of the results. The manner of exposition of the progression of electrical work from Coulomb's law through the unification of electricity and magnetism through light and radiation also seems right for this purpose. In both topics, Wilhelm discusses the fundamental questions that still remain or have recently surfaced in the steps of these progressions. And because the point of view taken is that of precision measurement, this is not just a rehash of the usual history.

Albert Schmid's paper takes us through some effects in the borderline region between microscopic physics (where quantum mechanics is necessary) and macroscopic physics (where classical mechanics dominates). The Josephson junction is viewed in several interesting ways. The dynamics of two weakly coupled superconductors is shown to be equivalent to that of a particle in a potential with two degenerate minima. This leads into a section on dissipative objects and the effect of dissipation on the dynamics and other behavioral features of precision low-temperature devices. The analogous physical models Schmid uses to illustrate the basic mathematical properties of two weakly coupled superconductors encompass a surprising richness of phenomena due to quantum coherence effects.

Two papers, "Precision when dealing with atoms" by Peter E. Toschek and "Optical frequency standards: atomic clocks of the future?" by Jurgen Helmcke, are timely in view of last year's Nobel prizes. The first is a fairly extensive and interesting review of atomic processes, with a nice, brief discussion of trapped ions, including single, cooled ions in a trap. The second intensively puts to use principles and technology evolving from Ramsey fringes in an explanation of frequency chains from the cesium clock to visible light.

"Lasers in medicine" by Werner Schmidt is both a gee-whiz exhibition of some unexpected (to me) laser phenomena and a serious review of a number of important, or potentially important, uses of the laser with the human body. It is surprising how much more there is to the use of laser light in the eye than just as a simple "surgical knife"—I would not have anticipated the ways in which laser metrology becomes the basis for diagnostic or therapeutic processes.

This book is different from most conference proceedings, both in its overall structure and in the way in which many of the individual contributions come across. It reads as if the various authors were instructed to make their papers a combination of brevity and completeness (not necessarily thoroughness) and to write them on a nontrivial scientific level yet make them readable for the nonspecialist. In this they achieve varying degrees of success—some papers seem too superficial to interest any reader—but my proclivity is to like most of them. It is nice to be taken, in a succinct and understandable manner, into and through a topic one has heard with stiletto thrusts for some years. One would have to be a world expert indeed, not to find many new things about precision measurement in this book.

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Heat Shock

Stress Proteins in Biology and Medicine. RICHARD I. MORIMOTO, ALFRED TISSIÈRES, AND COSTA GEORGOPOULOS, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY 1990. x, 450 pp., illus. $97. Cold Spring Harbor Monograph Series 19.

In the early 1960s, Ferruccio Ritossa inadvertently heated a preparation of *Drosophila* salivary glands and observed a new pattern of chromosomal puffing, an activity that we now associate with transcriptional activation of genes in polytene chromosomes. Thus began a research area that now

touches virtually every major discipline of experimental biology and several areas of medical research as well. The proteins encoded by Ritossa's puffs were discovered in 1974 by one of the editors of this book, Alfred Tissières, working with H. Mitchell and U. Tracy. Known initially as heat shock proteins, these proteins are now frequently included with more recently discovered environmentally inducible proteins under the banner of stress proteins. The heat shock response remained a curiosity of *Drosophila* biology until heat shock genes became favorite subjects of molecular geneticists applying the then new techniques of recombinant DNA technology, and they quickly became some of the best-understood eukaryotic genes. Soon, closely related heat shock genes and proteins were discovered in bacteria, humans, and virtually everything in between, establishing the heat shock response as one of the most highly conserved genetic systems known.

Stress Proteins in Biology and Medicine provides the most convincing collection of evidence to date that a general theme for heat shock protein function and physiology has emerged, and that theme is protein homeostasis. As the chapters flow by, one's imagination is filled with images of heat shock proteins "chaperoning" newly synthesized or partially assembled proteins to their final destinations in the cell, working as "molecular crowbars" perhaps fueled by the energy of ATP hydrolysis to pry proteins out of nascent multiprotein structures such as DNA replication complexes or as "molecular nurses" to help refold denatured proteins.

The book begins with an excellent overview of the stress protein field by the editors that will be valuable to the newcomer. Notable aspects of the book include chapters by organismal biologists giving an ecological and evolutionary perspective on thermal adjustments, an overview of febrile responses from the physiological perspective, and contributions from medical scientists from the field of radiation oncology. The radiation biology literature contains many studies of cellular responses to hyperthermia, and there are numerous studies in the organismal biology literature of the responses of whole animals to thermal stress. The inclusion of these perspectives here will, it is hoped, stimulate more frequent cross-fertilization with the molecular and cell biology literature and more multidisciplinary collaborations. In addition, readers will find an intriguing chapter on possible links among stress proteins and infectious diseases, two chapters offering preliminary evidence that hyperthermia may aid in the treatment of some types of cancer if formidable obstacles in the delivery of heat to tumors can be overcome, and a number of excellent contributions from investigators studying the complex regulatory pathways of heat shock genes in yeast, in cultured mammalian cells, and during developing in *Drosophila*. The value of cultured animal cells in unraveling the cellular physiology and biochemistry of the mammalian stress response is highlighted, and as befits a monograph series that helped introduce a generation of budding molecular biologists to the power of *E. coli* and bacteriophage genetics, two chapters are included showing that these systems have not lost their punch when it comes to rapidly dissecting cellular responses, gene regulation, and protein functions.

The editors and their contributing authors have captured much of the excitement and promise of stress protein research. This book is recommended to all biologists interested in stress responses from the organismal to the molecular levels as well as to medical scientists interested in the responses of animal tissues to trauma.

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