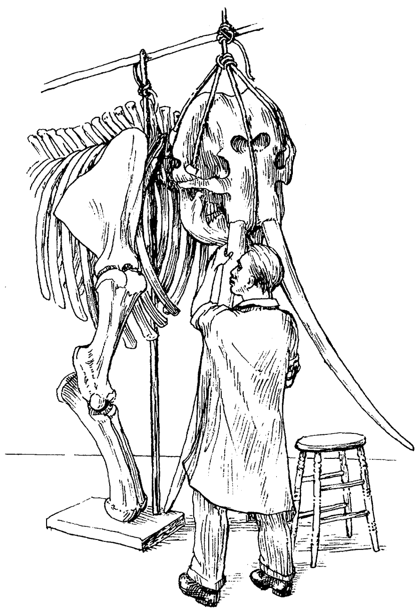

"Mounting the fossil skeletons [at the University of Nebraska museum] was invaluable training for me since it gave me the opportunity to learn one phase of paleontological museum work that is not often available to students of the science." [From *Digging into the Past*]

cate of continental drift.

The museologist will be interested in Colbert's ideas on museum administration, based on problems at the American Museum. He provides an account of the establishment of the professional museum journal *Curator* and the problems of designing and installing the exhibits in two large halls devoted to dinosaurs.

Colbert stresses the importance of publishing the results of scientific collecting. Only on publication of the identification and description of a fossil "does it become a truly significant object." Colbert's own scientific work abundantly illustrates this precept.

Throughout his career his wife, Margaret Matthew Colbert, daughter of a distinguished predecessor at the American Museum and illustrator of many of his books, shared in his scientific endeavors. She accompanied him on most of his foreign excursions.

The historian of science should find many points of interest, not only in Colbert's own career but in his account of events leading up to a major shift in the ideas of geologists on the driving forces in geological history and on geographic patterns of past ages. His impressions of many leading scientists with whom he was acquainted are likewise of interest. General readers will find adventure, hardship, and the pleasures of discovery set forth in a highly readable account.

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Many-Body Theory

The Fractional Quantum Hall Effect. Properties of an Incompressible Quantum Fluid. T. CHAKRABORTY and P. PIETILÄINEN. Springer-Verlag, New York, 1988. xii, 175 pp., illus. $45. Springer Series in Solid-State Sciences, vol. 85.

The fractional quantum Hall effect was discovered experimentally in 1982. It was immediately recognized as a fundamentally new macroscopic manifestation of the quantum laws underlying electrical conduction in solid matter. Initially puzzling to theorists, it was explained in its essentials within a year by R. B. Laughlin with his proposal of a liquid wave function. This work spawned a number of novel concepts, most notably that of fractional charge—the idea that an interacting many-electron system could appear, for example, to consist of a two-dimensional gas of particles of charge equal to one-third of the charge of the electron. Because of this and other remarkable features, the theory of the fractional quantum Hall effect is often felt to be the most significant advance in many-body theory of this decade.

These initial breakthroughs have been followed by progress in experimental techniques; in particular, steady advances in semiconductor technology have improved the quality of the transport measurements that identify the quantum fractions. Theoretical progress has been made as well, especially in developing the hierarchy picture, which extends Laughlin's original work to most (though not all) of the currently observed quantum states. Much remains to be done, however. On the experimental side, the development of other measurements to complement the transport data, the extension to multilayer structures, and the clarification of the even-denominator fractions are most pressing. On the theoretical side, the issues associated with higher-order and even denominators, finite temperatures, and multilayers still need a great deal of work.

One virtue of Chakraborty and Pietiläinen's book is therefore its timeliness. The field has completed an initial phase in which the most fundamental issues have been identified and largely clarified. This means that there is plenty of material for a full-length monograph. There has now come a realization that there are a number of interesting and rather diverse research paths to be followed. Any theoretical physicist who wants to be involved in these efforts needs a thorough grounding in the basics. This new book offers that.

The three main computational methods of the field—exact diagonalization of small systems and Monte Carlo and diagrammatic methods—are each explained in detail. Particularly welcome is the exposition of the "hypernetted chain" approach, which has never received a unified and clear treatment in the context of the Hall effect. The book explains the well-established applications to various aspects of the problem—the ground state and its excitations, both quasiparticle and collective. The authors discuss spin-reversed states at considerable length, a welcome choice of topic because of the experimental discovery of these states since the book was written. In sum, all of the topics for which there are firm results are covered, and covered in detail sufficient to equip anyone who has digested the contents for beginning research.

This book invites comparison with the only other comprehensive survey of the field, the second half of *The Quantum Hall Effect*, edited by R. E. Prange and S. M. Girvin. Chakraborty and Pietiläinen's focus is narrower in that they discuss theoretical issues mainly on the level of internal consistency and technical detail and mostly ignore broader implications. This is perfectly appropriate in a very specialized treatise, but the air does get a bit thin at times. Still, one could contend that this makes a good contrast and complement to the earlier book, which offers a much broader perspective. Prange and Girvin is still the best place for a beginner to start.

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Immunogenetics

Immunoglobulin Genes. T. HONJO, F. W. ALT, and T. H. RABBITTS, Eds. Academic Press, San Diego, CA, 1989. xviii, 410 pp., illus. $79.50.

One could argue that immunoglobulin genes and proteins, their structure, function, and expression, are the most intensively studied gene-product system in biology. Of course, several other genes and proteins have also been studied in detail (for example, α- and β-globin), but none displays the specificity and diversity of immunoglobulins or the programmed DNA rearrangements of immunoglobulin genes. Simply, immunoglobulin (or antibody, the alternative term) genes have been investigated more because there is so much more to investigate. This wealth of experimental results is summarized in *Immunoglobulin Genes*.

There are several characteristics of immunoglobulin expression that make it interesting. An individual mammal can produce more than ten million different immunoglobulins, each with the capability to bind one or a few antigens with great specificity. Moreover, one part of the immunoglobulin protein (the variable region) has all of the diversity; the other part (the constant region) is invariant among antibodies of the same type. Of the two immunoglobulin genes on the homologous chromosomes of a cell, only one expresses immunoglobulin protein; the other is inactive in protein production. As a cell differentiates, however, it can express the single variable region from this chromosome with several types of immunoglobulin proteins. Immature immunoglobulin-producing cells first express variable regions on a cell-surface IgM molecule, then later express variable regions on both IgM and IgD molecules. When those surface immunoglobulins recognize antigen, the cell may further differentiate to produce a secreted form of IgM, or of IgG, IgA, or IgE. How do antigen-binding diversity and specificity of immunoglobulins arise? How can the immunoglobulin protein have a highly variable and an absolutely constant part? Why is only one of two possible immunoglobulin genes expressed? How can one type of immunoglobulin be expressed in both membrane-bound and secreted forms? How can one antigen binding site be expressed on two different types of immunoglobulin simultaneously or sequentially? These are the experimental questions that immunologists defined in the first three-quarters of the 20th century and that molecular biologists answered in a few short years following the advent of recombinant DNA technology and the discovery of rearrangement of immunoglobulin genes by Hozumi and Tonegawa in 1975. *Immunoglobulin Genes* includes a discussion of these central questions, the corollary investigations that arose during these studies, and the new directions in which immunoglobulin genes have taken immunologists and molecular biologists in the '80s.

The book contains 19 chapters by more than 40 authors. About half of it is devoted to the basics of immunoglobulin gene arrangement, rearrangement, and expression in normal human and mouse cells. Additional chapters discuss the evolutionary variation of immunoglobulin genes (using chicken and lower vertebrates as examples), the rearrangement process as it goes awry in lymphoid tumors, the developmental pathways of cells that produce immunoglobulins, and the molecules that are closely related to immunoglobulins. The writing is uniformly careful and there is little redundancy among the chapters, nor are many important aspects of immunoglobulin genes neglected. (An exception: the process of and theories concerning somatic hypermutation of variable regions receive very little space.) There are few factual errors, although a few typographical and mechanical errors appear.

This book will be most useful to experienced immunologists and, as the editors point out, to molecular biologists. The chapters are usually extensively referenced, and even in those with restricted reference lists excellent review articles are cited. The authors have conscientiously defined the remaining unresolved issues in each aspect of immunoglobulin genes and cited the relevant data on both sides. Each chapter will bring the reader up to date.

In a text of only 387 pages, it is not surprising that something had to be sacrificed. The novice may find this book difficult to use, since it lacks a basic chapter on the structure and function of immunoglobulin proteins and some chapters presuppose information from later ones. The authors have covered the past succinctly. For example, the elucidation of the nucleotide signals that mediate assembly of variable region genes by Tonegawa, Leder, and others is covered in a little more than a page. This reviewer would have allotted more space to these studies, but they are covered in many textbooks of immunology and biochemistry. Finally, the writing in *Immunoglobulin Genes* is very terse. Readers should be prepared to concentrate on every sentence.

Immunoglobulin genetics is a mature science. Most of the fundamental mechanisms have been sketched out; ongoing research concentrates on the details of those mechanisms. The timing of *Immunoglobulin Genes* is excellent. It summarizes the experiments and theories in a field with a solid foundation. It should be an important reference book.

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