complement a dehydroquinate-hydrolase-deficient *E. coli* mutant.

Lodish *et al.* give a comprehensive review of messenger RNA translation regulation, and Berget and Sharp and Gelinas *et al.* introduce the exciting and immensely important subject of splicing of the late messenger RNA's of adenoviruses, work in which great advances, extending to a growing number of eukaryotic genes, have been made since the symposium.

The symposium lecture by Charles Thomas constitutes a sensible look at the recent history of research and attitudes in genetics. He is clearly not impressed with the prospects of gene therapy and even considers much of the talk about it to be irresponsible. Some of it obviously is, some may not be. The fanciful expectations of today are the reasonable expectations of tomorrow, and the therapeutic use of some genetic techniques will certainly come to pass.

The volume is valuable, generally reads well, and should prove useful as a part of the review literature on genetic transfer into eukaryotic cells.

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Mathematical Physics: Bielefeld Lectures

Many Degrees of Freedom in Field Theory. Proceedings of an institute, Bielefeld, Germany, Aug. 1976. L. STREIT, Ed. Plenum, New York, 1978. viii, 248 pp., illus. $27.50. NATO Advanced Study Institutes Series B, vol. 30.

In 1975–76, the University of Bielefeld sponsored a special year in mathematical physics, emphasizing quantum field theory and statistical mechanics. A lecture series (*Quantum Dynamics: Models and Mathematics*, L. Streit, Ed., Springer-Verlag, 1976) inaugurated the year, and in mid-year these topics formed part of the annual Schladming lectures (*Current Problems in Elementary Particle and Mathematical Physics*, P. Urban, Ed., Springer-Verlag, 1976). A lecture series at the end of the year dealt in part with mathematical physics and in part with multiparticle phenomena at high energy. The proceedings of this last series are reviewed here and in the following review. Altogether, these volumes provide a perspective of the field up to 1976. The entire Bielefeld project and these symposia owe much to the indefatigable Ludwig Streit.

Lectures by J. Fröhlich provide an overview of constructive quantum field theory, starting with the Wightman axioms and their Euclidean counterpart in terms of Schwinger functions. For various models the Schwinger functions are given by a random process, the expectations of which are an infinite-dimensional version of Gibbs averages in statistical mechanics. Formally—rigorously after renormalization and suitable limits—such averages are the imaginary time continuation of the classic Gell-Mann-Low formula in quantum field theory. Fröhlich gives a detailed account of integrability for the Gibbs factor in the $(\theta^4)_2$ theory, avoiding explicit use of hypercontractivity for the free field. A brief sketch of spontaneous symmetry breaking and critical behavior for $(\theta^4)_3$ may be amplified by reference to Fröhlich's Schladming contribution. For an introduction to spontaneous symmetry breaking within the axiomatic framework, there are lectures by R. Streater. Since 1976, however, the thrust of research in field theory has been the extension of this genre of techniques to superrenormalizable gauge field theories.

Two sets of lectures deal with topics of current interest in gauge field theory. K. Pohlmeyer reviews the role played by solitons in classical field theory, with A. Luther's applications to the energy spectrum for the Thirring model which were arrived at by way of the eight-vertex, *XYZ*, Heisenberg, and sine Gordon models; L. O'Raifeartaigh gives an in-depth account of the mathematics surrounding the t'Hooft-Polyakov soliton for the SU(2) Yang-Mills field. Each of these is a worthy supplement to the journal literature. The one other set of lectures related directly to quantum dynamics is by D. Robinson on descriptions of time evolution by means of unbounded derivations in operator algebras. This is a very readable introduction to a rather technical subject that is in danger of burgeoning beyond classical semigroup theory in Banach spaces to a full theory in its own right. For strongly continuous evolutions, a key role is played by the analog of self-adjointness for the derivation.

The remainder of the volume contains shorter comments by J. Tarski on nonstandard analysis, by M. Cassandro and G. Jona-Lasinio on the central limit theorem for Ising models, and by M. Reed on some problems for nonlinear wave equations. Reed's more detailed (1975) Bielefeld lectures appear in his book *Abstract Non-Linear Wave Equations* (Springer-Verlag's Lecture Notes in Mathematics, vol. 507).

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Many Degrees of Freedom in Particle Theory. Proceedings of an institute, Bielefeld, Germany, Aug. 1976. H. SATZ, Ed. Plenum, New York, 1978. viii, 566 pp., illus. $45. NATO Advanced Study Institutes Series B, vol. 31.

The idea of coherent phenomena is old to physics: a system acting as a whole exhibits behavior entirely different from that of its individual components. It is as fundamental as it is old, so it is natural that it finds a place in the modern theory of elementary particles. The present volume of Bielefeld lectures is mainly phenomenological in its review of the rich variety of coherent effects in high energy physics. It thus fails to reflect the theoretical activity in 1976, in particular the development of the role that classical solutions of quantum theories play in the description of coherent nonperturbative quantum effects.

The book is worth reading, however, as a solid, comprehensive preparation for the exciting developments expected in particle physics. The lectures of J. B. Kogut on lattice gauge theories of the strong interactions start with the original ideas of A. M. Polyakov and K. Wilson, which led to the study of quantum field theory by statistical mechanical methods. The lectures continue with the introduction of the Hamiltonian formulation on the lattice, which is then used to estimate the low energy spectrum of the theory. Using block spin techniques with an array processor, Wilson is now in a position to make further estimates of the hadron spectrum. We may thus soon have more detailed calculations with which to evaluate the success of lattice gauge theories.

A paper by H. Fritzsch, "Unified interactions of leptons and quarks," presents a highly articulate overview of present-day weak interaction theories and the connections they may have with the strong and electromagnetic interactions. In particular Fritzsch reviews models for the number of quark and lepton flavors and the relationship between them. In the next two to five years, with the new accelerators PETRA at Deutsches Elektronen-Synchrotron and PEP at Stanford Linear Accelerator Cen-

ter, we should have data to support or eliminate some of these theories.

K. Johnson reports on the results as of 1976 of the MIT bag model. Predictions of the hadron masses are sufficiently good in this model to make its derivation from a fundamental field theory one of the important tasks of particle physics today. Efforts to derive the model have been made most recently by C. Callan, R. Dashen, and D. Gross at Princeton, and it will be interesting to compare the quantitative properties they promise to derive with the predictions in Johnson's paper.

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Seabirds

Sulidae. Gannets and Boobies. J. BRYAN NELSON. Published for the University of Aberdeen by Oxford University Press, New York, 1978. xii, 1012 pp., illus., + plates. $98. Aberdeen University Studies Series, No. 154.

The sulids are goose-sized seabirds, closely related to the pelicans and more remotely to the cormorants, that nest in colonies on remote cliffs and islands and capture their fish prey in spectacular dives from the air. The nine species of the family (genus *Sula*) display both phylogenetic compactness and adaptive radiation in morphology, ecology, and behavior that has enabled them to occupy widely different cold temperate and tropical habitats. Two species are still economically important producers of guano fertilizer.

The best-known species is the North Atlantic gannet, which is currently increasing in numbers and spreading. The other two gannets (the three together form a superspecies) inhabit South Africa, southern Australia, and New Zealand. All the boobies frequent tropical or subtropical waters. Three species are pantropical, two closely related forms are restricted to the eastern Pacific Ocean, and one endangered booby now breeds only on Christmas Island southwest of Java in the Indian Ocean. This last, Abbott's booby, discovered in 1892 on an island north of Madagascar, used to be more widespread in the Indian Ocean, but guano mining and deforestation on many islands destroyed the tall trees in which it nested. Even now phosphate mining seriously threatens the last 7000 to 8000 birds on Christmas Island.

Because the sulids have never been treated in detail as a unit before, Nelson's book, the results of a 17-year study, is a landmark.

Instead of the long introduction usual in works of this type Nelson presents the reader with a two-page résumé and proceeds directly to the species accounts. The accounts follow a standard format: nomenclature, external features (including molt and voice), population and distribution, breeding ecology, and breeding behavior. They begin with 226 pages on the North Atlantic gannet. Nelson then summarizes the other two gannets and compares the species before tackling each of the boobies. The entire family is then reviewed and the species are compared in a concluding 146-page chapter. The text and its 135 tables are exhaustive in their presentation of details. But Nelson had many more data (most collected by himself) that didn't fit into his regular chapter scheme, so he added 19 appendixes in 31 pages.

Nelson's forte is breeding ecology and behavior, which he has studied at first hand in all species except the two Southern Hemisphere gannets. These subjects receive by far the most extensive treatment, and the discussions of them are informatively and profusely illustrated with Nelson's (and a few others') excellent photographs and John Busby's charming drawings. The detailed lists of breeding localities, which are supplemented by photographs, maps, and tables, provide a compendium of present distribution as well as documentation of past population changes. Total breeding population censuses are possible for the three gannets and Peruvian and Abbott's boobies, but the three pantropical boobies will remain impossible to census reliably.

The information on scientific nomenclature is presented inconsistently, and the treatment reflects the author's unfamiliarity with the subject. A one-page appendix list of common and scientific names is similarly riddled with errors.

Although some 1976 papers are included in the 12-page bibliography, coverage of the recent literature is spotty, and relevant information on boobies in some Hawaiian leeward islands, St. Helena, and Isles Glorieuses published in the 1970's has been overlooked.

The author "supposes" that he ought to apologize for the length of the book, which he concedes is "hardly a thriller," but says that "the idea has been to make a browsable book with ideas and atmosphere as well as facts." The leisurely pace of the text does make reading or browsing enjoyable, but Nelson's informal, verbose style and his endeavor to present (at least once) everything you ever wanted to know about sulids have, in adding to the length of the volume, also added to its cost. Alas, the resulting restricted circulation of this important book may prevent the sulids from receiving the attention they warrant as paradigms of radiation and adaptation.

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