

interactions. He does not seem fully to appreciate the enormous achievement of the past 40 years, which has culminated in the Standard Model. This model provides a fully relativistic quantum theory of the electromagnetic, weak and strong interactions that predicts physical phenomena with incredible accuracy. But Lindley gives the impression that this theory of particle physics is a mess, and that it is necessarily so because that is the way the world appears to work. Thus, we are told: "The quark model and the theory of electroweak unification may be neither the most obvious nor the most beautiful of intellectual constructions", despite the fact that they have elegantly described a plethora of states and their interactions in terms of a simple set of fundamental states, with interactions dictated by a generalization of the universal 'gauge' principle implicit in Maxwell's theory. The beauty and simplicity of the theory lies in an appreciation of the symmetries of the system, the patterns that relate apparently dissimilar particles and forces. Perhaps more than anything else this appreciation has shaped the way we think of the modern world of subatomic physics. It is not, as Lindley would have us believe, that simplicity has become the religion of the modern physicist, but rather that the experimental success of theories based on recognizing this simplicity has led us to an understanding of the importance of symmetry.

Unfortunately, this lack of understanding of the status of modern physics pervades the rest of the book. We are given no sense of the motivation behind the search for Grand Unification, which seeks to explain some of the questions left unanswered by the Standard Model by looking for larger symmetries. The author argues that such theories are in limbo with "no prospect of doing experiments to check it in even the barest detail". This blithely ignores one of the most important predictions of the theory of Grand Unification, which relates the strengths of the fundamental interactions and has been experimentally tested in detail in recent years following the precision measurement of these couplings at the accelerators at CERN (European Laboratory for Particle Physics) and elsewhere. The fact that one of the simplest Grand Unified schemes gives a prediction that is in excellent agreement with experiment is one reason why such theories are taken seriously.

The confusion remains in other parts of the book. In dealing with cosmology, Lindley introduces us to the idea of inflation, a period of rapid growth in the early Universe caused by a phase transition thought to have occurred shortly after the Big Bang. He ascribes this hypothesis to an "even more extravagant use of Grand Unified theories". But phase transitions

abound in physical systems and one does not need Grand Unification to motivate one to consider this possibility in the early Universe. It is true that the field-theoretic use of a phase transition to give mass to the W and Z bosons is an untested aspect of the Standard Model, but that is one of the central reasons for building the new accelerators at CERN and in Texas: namely, to test the mechanism responsible for the origin of mass. Further, Lindley does not even discuss one of the most important implications of inflation. In addition to explaining the large-scale smoothness of the Universe, it also predicts that inevitable quantum fluctuations will generate inhomogeneities at a low level. The recent measurements of inhomogeneities by the Cosmic Background Explorer (COBE) allow us to use observation to probe the structure of the Universe during the inflationary era.

Of course, as Lindley notes, cosmological models are so far only hypotheses. The subject is young and physicists are still trying to build a viable theory. Far from having reached the end of physics by building the myth of an untestable unified theory, we are at a profoundly exciting stage in which observation, both astronomical and in the laboratory, offers the prospect of new insights into the nature of physical law. □

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Psycho-analysis

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Molecules and Mental Illness. By Samuel H. Barondes. *W. H. Freeman/Scientific American Books: 1993. Pp. 216. \$32.95, £18.95.*

NO field of medicine has been so radically transformed in the modern era as psychiatry. In the late nineteenth century, giants such as Emil Kraepelin made astute clinical observations to delineate what we now call schizophrenia and manic-depressive illness. Similar descriptive medical approaches led to such breakthroughs as the discovery of bacteria as the cause of certain diseases. Throughout the twentieth century, psychiatry lacked comparable fundamental insights. As a result of its domination by psychoanalysts in the United States, the field lost much of its link with biology and the disease concept of mental illness. But with the advent of psychotherapeutic drugs in the past 30 years, biological psychiatry has re-emerged as a dominant force; we now have a much better understanding of the molecular basis of synaptic transmission

and drug action and of the genetic mechanisms that may underlie the main mental illnesses.

In an exquisitely elegant volume, Samuel Barondes chronicles these changes in psychiatry and provides rigorous yet highly readable explanations of the biological underpinnings of mental illness. Barondes is uniquely qualified for the task. Fully trained in psychiatry, he has a long record of important advances in molecular neuroscience and is currently the director of the department of psychiatry at the University of California, San Francisco, while still maintaining a research laboratory.

Barondes looks at the beginning of biological psychiatry, describing how Sigmund Freud was himself trained as a neurobiologist. Years after elaborating the theory of psychoanalysis, Freud still regarded the underlying causes of the main emotional disorders as biological. Two chapters are devoted to genetics, including the genetic basis of illnesses such as Huntington's disease as well as a reasonably thorough description of the molecular biology of genes. There follow chapters on neurotransmitters, receptors and actions of the principal psychiatric drugs. In three separate chapters, the author deals with the main psychiatric illnesses: schizophrenia, manic-depressive illness and obsessive-compulsive disorder. The final chapter is a 'recapitulation' of the entire book in verse.

Throughout, Barondes carefully balances clinical descriptions with the biological features. He creates a better feel for emotional distress than most psychiatry texts by providing extensive accounts of different cases, including recollections by patients of their own disturbances. This mixture of vivid clinical portrayals with molecular mechanisms goes a long way to dissipate the conceptual tension between organic and psychological approaches to psychiatry. Although the author is committed to an organic aetiology for the principal psychiatric conditions, he appreciates their psychodynamic aspects and the role of psychotherapy.

The volume is written in a lively, lucid style that makes complex ideas eminently accessible. Like others in the Scientific American Library series, the book is superbly illustrated with diagrams clarifying scientific concepts as well as photographs and portraits ranging from Howard Hughes at the controls of his aeroplane to a mildly surrealist portrait of Sigmund Freud by Ben Shahn. It is an important contribution that will interest all thoughtful readers, whether scientists or educated lay people. □

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