

The Scientists' Bookshelf

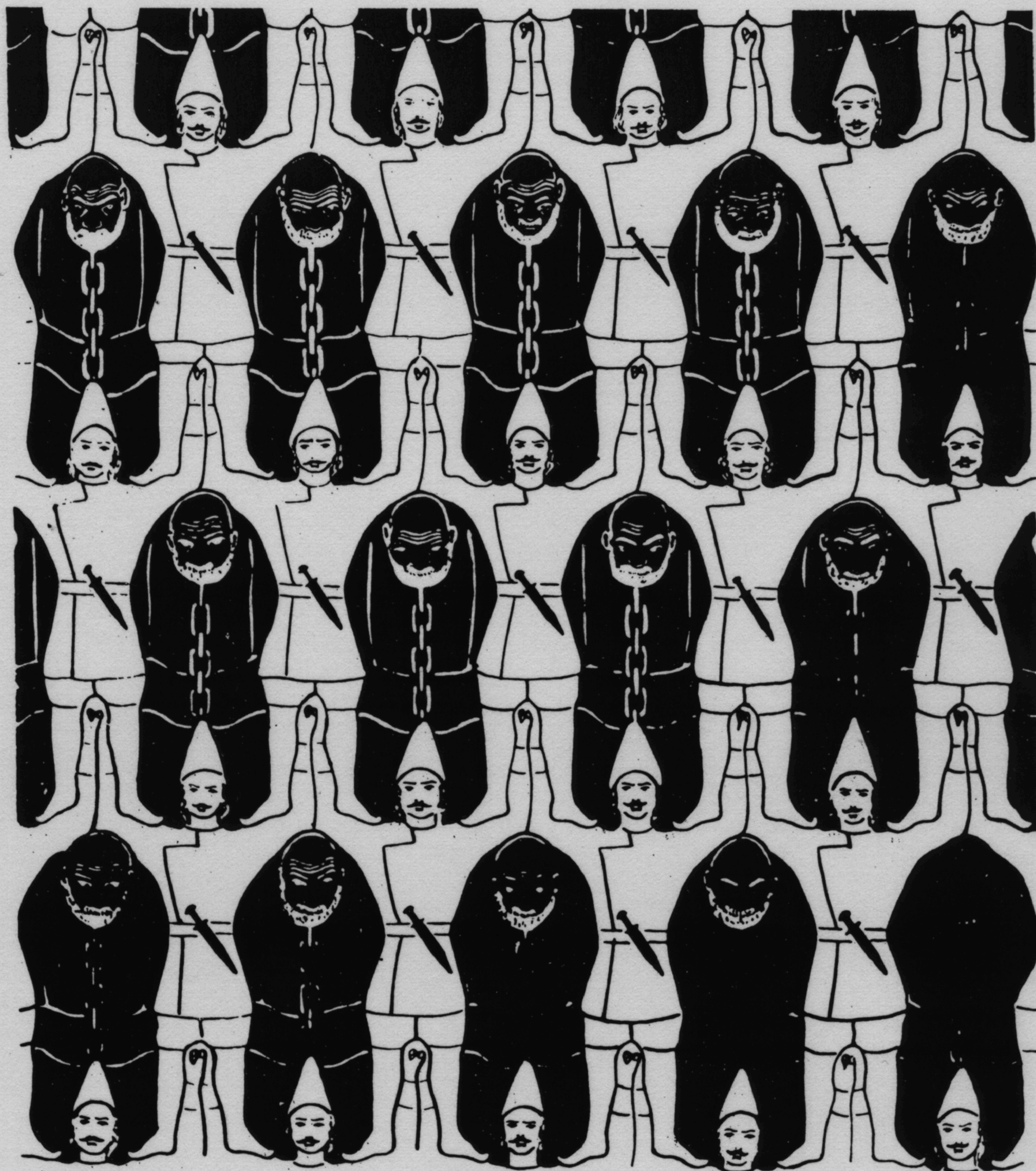
Symmetry

Unifying Human Understanding. István Hargittai, ed. International Series in Modern Applied Mathematics and Computer Science, Vol. 10. 1,045 pp. Pergamon Press, 1986. \$140.

"In the world of human thought generally, and in physical science particularly, the most important and most fruitful concepts are those to which it is impossible to attach a well-defined meaning." This is an intriguing and potentially dangerous idea, from the physicist H. A. Kramers, but perhaps it is appropriate to the concept of symmetry. Symmetry is one of those grand ideas that pervade human thought, particularly in the arts and sciences. Together with the related concept of form or shape it helps us to distinguish individual objects from the rest of the universe and is therefore to some extent essential to the very process of understanding the external world.

There is one great modern treatise devoted to the panoramic sweep of symmetry, Hermann Weyl's *Symmetry*. Of more limited scope, but perhaps deeper, are *Symmetries and Reflections*, by E. Wigner, and *Basic Notions of Condensed Matter Physics*, by P. W. Anderson, both of which concentrate on aspects of physics; *On Growth and Form*, by D'Arcy Thompson, a literary jewel on the origins of form and symmetry in biology; *The Scientific Reinterpretation of Form*, by N. E. Emerton, which traces the historical and philosophical approaches to the concept of form or shape; and *Tilings and Patterns*, by B. Grünbaum and G. C. Shephard, which is a mathematical study of the notion of pattern.

Symmetry: Unifying Human Understanding has a worthy goal: it aims to present an overview of the contemporary status of the concept of symmetry, primarily in



Unity, a drawing by Kh. S. Mamedov. Illustrations on these two pages are from *Symmetry*.

the arts and sciences, emphasizing its scope and importance. Rather than attempt to improve on Weyl (an ambitious goal!), Hargittai has instead chosen as format a collection of many short original articles, written by a great variety of contemporary scholars. In a review of this length of a book containing 65 articles it would be inappropriate to give details about more than a few; using this predicament as a convenient excuse, I will refer only to a small subset that most interests me.

First there is a group of three articles authored or coauthored by Alan Mackay. They have a distinctly philosophical flavor and are a bit hard going for a scien-

tist, but they are rewarding upon digestion. He brings together common features from a wide range of subjects, from inanimate matter to communication and the human thought process itself. In these areas, Mackay examines the structures in which information is stored and makes some intriguing arguments about their hierarchial nature and the role that symmetries play.

The other two articles I wish to note are by L. Fejes Tóth and M. Senechal and are concerned with the problem of the origin of symmetry. To be more precise, they show that there is a wide class of unsolved optimization problems including, for example, the sphere packing problem

The opinions expressed by reviewers are their own and do not represent the views of the editors or of Sigma Xi, The Scientific Research Society. Reviews have been grouped under broad headings, with the reader's convenience in mind. Some books could appropriately be included in more than one category, and the editors suggest that the reader consult the Index to Books Reviewed on page 414 for interdisciplinary titles.

in mathematics ("find that arrangement of nonoverlapping unit spheres in three dimensions which occupies the **greatest** fraction of space") and the crystal problem in condensed matter physics ("find that arrangement of interacting molecules with the **lowest** potential energy") for which the optimum solutions seem to be forced to have a high degree of symme-

spread our enjoyment over a long period of time without loss of continuity. Though few articles have the depth of the monographs listed earlier, this practical consequence of the format will make *Symmetry: Unifying Human Understanding* an enduring and influential contribution to a profound subject.—Charles Radin, *Mathematics, University of Texas*



A passage from Chopin's *Etudes* op. 25, no. 1 demonstrates a symmetrical path visually and melodically.

try—of a crystalline type. From this perspective one is trying to find a common underlying principle that, within our current scientific theories or models, is responsible for much of the symmetry of the inanimate world.

Included also are essays on the decorative art of Escher and the Alhambra and articles on the bilateral symmetry in biology, fractals, Milton's poetry, Western music, chemical reactions, and much more, which suggests the magnitude of the work.

The great advantage of Hargittai's choice of format is only evident upon use. No matter how fascinated with symmetry, we bring to the book our own intellectual abilities and limitations. Not many would ever read a large portion of the thousand-page treatise on symmetry but all of us can enjoy dipping into those essays that strike our fancy, and the encapsulation of the material allows us to

Breakthrough/ПРОРЫВ

Emerging New Thinking: Soviet and Western Scholars Issue a Challenge to Build a World beyond War. Anatoly Gromyko and Martin Hellman, eds. 281 pp. Walker and Company, 1988. \$9.95 paper.

"In this book, scholars on opposite sides in the world's two greatest armed camps have assembled evidence that war must end. . . . While every contributor may not agree with every word which is contained here, the fact that all are willing to be published simultaneously in the Soviet Union in Russian, and in the United States in English, is itself evidence of a breakthrough in communication between these two diverse societies." The book required more than two years of work during which representatives from The Beyond War Foundation (Palo Alto) and The Committee of Soviet Scientists for Peace against the Nuclear Threat (Moscow) were able to recruit outstanding authors, discuss concepts and principles, obtain and edit manuscripts, and finally publish the essays. The title is thus appropriate. The result is a powerful, succinct, clear, political statement of humanity's fears and promise: data, principles, and conjoined ongoing and proposed action, in the realization that war is obsolete.

The first section quantifies and forcefully reiterates the nuclear imperative that "war has been made obsolete by the total, suicidal, destructive power of nuclear weapons." Emphasis is placed on the danger inherent in the stock of nuclear weapons and plutonium around the world—now in 36 countries—and on the security networks—each a tightly coupled integration of warning, command, and control of nuclear weapons in which a perturbation, accidental or not, can in minutes amplify through the entire system into a chain of potential disaster. Repeated examples of near misses are given.

A second, shorter section reiterates

"the global thinking which must replace war thinking." Each human being "is an original" in a system so intermeshed that damage to another "damages the whole system and therefore oneself" making cooperation in a new global understanding imperative. Morality hinges on individual action, and in this period an imperative is that everyone see that "he or she is responsible for everything."

The concluding and longest section approaches how to begin and how to achieve change. The two groups of scientists outline some of the difficulties of taking action. Essays present findings of scientists from the fields of economics, politics and public policy, neurophysiology and cybernetics, psychology, physics, and communications sciences, and touch on the changing structures of the two societies. They suggest human possibilities and theoretical bases for changing the "we/they" syndrome to a more healthy "we," appropriate to our absolute interdependence. All means must be used to bring home to people that "so long as we pretend that conventional war is still feasible, we will never eliminate nuclear weapons." Further, because mutual vulnerability is the real name for the nuclear age, and nuclear war is another name for assured mutual destruction, we all must change to new thinking and build a world beyond war. A call is issued for not only scientists but also the greatest writers to write with passion capable of reaching all the world, so that a change in consciousness is achieved.

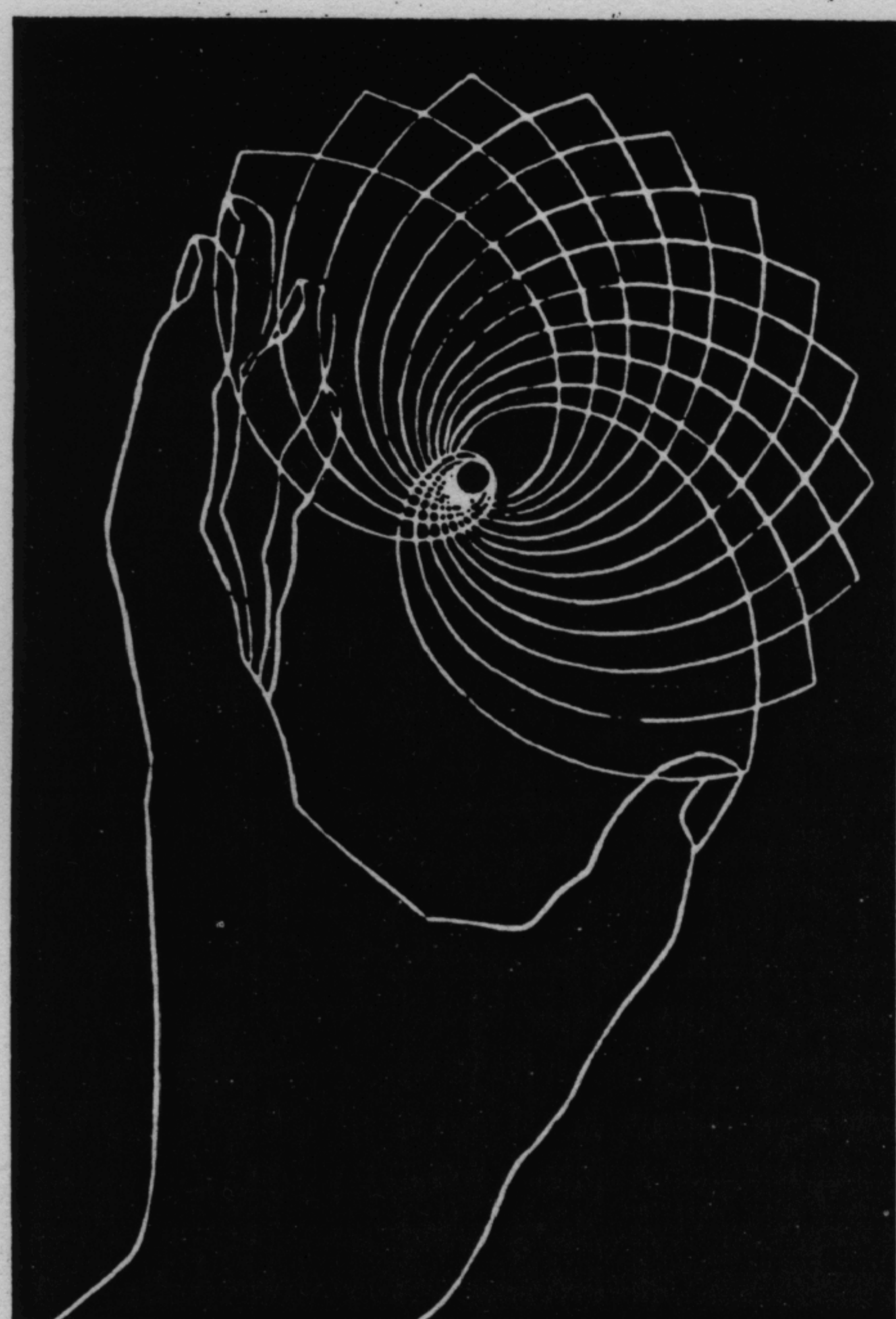
The book is well documented, but lacks an index. It could well be the most important new book in print and should be widely distributed and studied in all homes and schools in the world.—Harold G. Cassidy, *Chemistry, Hanover College*

The Evolution of Sex

An Examination of Current Ideas. Richard E. Michod and Bruce R. Levin, eds. 342 pp. Sinauer, 1987. \$55 cloth, \$29.95 paper.

Sex, like god, means quite different things to different people. For some, sex is essentially equivalent to recombination, which even bacteria can occasionally manage. For others, sex involves both recombination *and* meiosis—a large part of the variation generated by sex is achieved through crossing-over between homologous chromosomes during meiosis. Sex is an "editor" of parental mutations. It is about recombination and mixis (that is, the generation of new combinations of existing alleles), or, at least for some of the authors in this volume, it concerns outcrossing and physical recombination—the taking apart and reunion of the genetic material without necessarily generating a new combination, or sex as a mechanism of DNA repair.

For some, sex is reproduction, while



As a hand opens from a fist, it creates logarithmic spirals with its fingers.