

creasing number of researchers engaged in reproductive physiology. It should serve as a valuable reference for data for some years before it is inevitably superseded by a later publication.

Reports of conferences seldom debate in detail a major advance in a particular topic; they tend to cover broad aspects of a subject, with chapters penned by authorities in these different areas. This book is no exception, for there are more than thirty authors involved in thirty-one chapters. In this area of biology the comprehensive description of the subject matter demands an interest in a wide variety of subjects such as endocrinology, differentiation, ultrastructure, tissue culture, immunological reactions between mother and foetus, teratology and uterine musculature. At implantation, as at certain other stages in pregnancy, many events occur simultaneously in the embryo and the mother. There can be no doubt that a full and fair treatment of these events is provided in these chapters, which are well written by authorities in each topic. Naming names would be tedious and unfair: let it suffice to state that almost every conceivable topic touching on the blastocyst is covered somewhere in the volume. Inevitably some authors have chosen to write a brief review of their topic while others have described their own experiments, and this inevitably leads to some unevenness in the book. Yet every chapter offers a wealth of detail or something interesting and stimulating, and it is a pleasure to browse through the pages, picking up ideas or comments. Discussions in the conference have been omitted, which is in many respects a relief from pet ideas or theories unsupported by critical material or analysis.

My major criticism concerns the repetition of subject matter in various chapters. This repetition obviously permitted more contributors to state their views in the symposium, but the combination of some chapters or the exclusion of others could have provided a more streamlined presentation. Some of the chapters contain material of peripheral interest, such as fertilization or the biochemistry of the cleaving embryo, and one chapter could have sufficed for these. Other chapters are somewhat superfluous because two or more contributors cover essentially the same subject matter, for example, there are three on immunology. More rigorous selection of speakers, or even joint chapters, would have led to a more concise and easily presented book.

The book is well produced in a handsome size, contains detailed references and is well illustrated. The editing has been done with care. It will prove a most valuable source of material.

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Bioelectromagnetism

Electromagnetic Fields and Life. By A. S. Presman. (Translated from the Russian by F. L. Sinclair.) Edited by Frank A. Brown, jun. Pp. xix+336. (Plenum: New York and London, 1970.) \$25.

EVER since Franz Mesmer, the Austrian doctor and mystic, started some two hundred year ago to treat patients with iron magnets, controversy has continued over the question of whether magnetic fields can affect biological systems. In this book A. S. Presman, a biophysicist at Moscow University, sets out to review the experimental evidence for biological effects of electromagnetic fields with frequencies below 10^{12} Hz (thus excluding visible and shorter wavelengths, where quantum effects are important) and proposes a new hypothesis to explain them.

In the first part of the book the author describes the naturally occurring electromagnetic fields to which all organisms are continuously subjected. The electrical properties of living organisms are discussed briefly, and various physical mechanisms by which such fields could affect biological systems are listed.

In the second part the author reviews the experimental evidence for electromagnetic field interactions. Especially useful is the extensive bibliography, although references are only listed up to 1967. The principal effect is heating of tissue which leads to death if the heat cannot be quickly dissipated. Surprisingly, however, effects seem to occur at field intensities which are too low to cause appreciable heating. One reads, for example, of the good correlation between the incidence of cerebrospinal meningitis in New York and solar activity, and between magnetic storms and mortality from nervous and cardiovascular diseases in Copenhagen and Frankfurt. Planaria, bees, wingless termites and many flies can orientate themselves relative to the Earth's magnetic field. Seeds of corn and wheat sown with the radicle pointing south germinate one to three days earlier than those with the radicle pointing northwards, though the effect apparently depends on the phase of the Moon. Magnetic fields of greater intensity (120 kg) prove lethal to *Drosophila* if exposed for sixty minutes, while a combination of magnetic field (600 g) and microwaves is very effective in treating tumours in mice.

The fact is, of course, that no known physical theory can explain these low-intensity phenomena because the energy involved in the fields is far too small. There are thus two alternatives: either the experimental results are inconclusive, and the statistical correlations are

misleading, or, alternatively, new processes are occurring about which nothing is yet known. Presman argues that the latter is the case, and thinks the evidence indicates a transfer of information from the environment to the organism which is independent of the amount of energy carried by the waves. The field may produce its effect by modifying the subtle neural interactions between the various parts of the organism, although there are no clues yet as to how this might be accomplished.

Finally, Presman speculates on the consequences of his hypothesis. Animals, for example, may be able to communicate using electromagnetic signals, and the simultaneous changes in the direction of motion of birds in flocks and fish in shoals could be initiated in this way. Eels may sink to great depths in the Sargasso Sea to protect their young from terrestrial electromagnetic waves, and it may prove necessary to protect hospital patients from such fields using suitable metal screens. Intriguingly, telepathy and other parapsychological phenomena may at last have a physical foundation.

It would be pointless to quibble over the many controversial statements made in any book as speculative and wide ranging as this. Two points should be mentioned, however. There is an error in the equivalent circuit of a typical cell (page 35) which leads the author to conclude, wrongly, that no electric current flows through a cell in a static electrical field. Second, the statement (page 85) that the minimum theoretical electric field strength which can affect a biological system is 10^6 V m⁻¹, is difficult to reconcile with the fact that such a field, established in normal pond water, would cause it to boil within 0.01 seconds, and would rapidly be detected by any biological system. Nevertheless, this is an interesting and readable book, and "the author's modest hope, that the ideas which he presents will stimulate further critical discussion and researches" should certainly be fulfilled.

ALUN M. ROBERTS

Living Together

Aspects of the Biology of Symbiosis. (Proceedings of a Symposium held in Boston.) Edited by Thomas C. Cheng. Pp. x+327. (University Park: Baltimore; Butterworth: London, July 1971.) £7.

THE title of this book might mislead some people into believing that this is a text-book, but it is not. It is a collection of twelve papers given at a symposium of the American Association for the Advancement of Science in December 1969.

There is no universally agreed definition of the term "symbiosis". Some