prone to seek the "Grand Solution." And, with respect to the third issue, Lilienthal scorns the claims made by such scientists as Rabinowitch that science has some special role to play in the search for international political stability.

Lilienthal's criticism that scientists get carried away in their search for Grand Solutions is frequently too true, but as a criticism that might be directed at Rabinowitch, it is far less applicable. Although it is true that Rabinowitch sees hope only in some Grand Solution to the nuclear arms race and continually calls upon his fellow scientists to join in the search for one, he himself, at least since the collapse of the Baruch Plan, has never claimed to have found such a solution. His writings reveal instead an acute awareness that there are political limitations within which one must operate. Though I disagree with Rabinowitch's stand on many issues, the political insights of this scientific visionary far exceed those of many practical men of affairs.

Only time can tell whether Rabinowitch, the scientist, or Lilienthal, the practical man of affairs, is the wiser with respect to the nuclear arms race. I believe that Rabinowitch is correct in emphasizing the need to deal directly with the problems presented by nuclear weapons. In addition, Rabinowitch's book has something vital which Lilienthal's does not; it has a political dimension. On concrete issues, such as that of Germany, over which war could come and upon which time and change must work if peace is to be secured, Lilienthal has little or nothing to say, and this is a serious flaw in his attempt to establish the beneficence of change; change has done little to make the German problem more manageable.

Far more disconcerting, however, is the fact that, though Lilienthal undertakes to excoriate both natural and social scientists for their advice on nuclear affairs, he himself appears very uninformed on the many ideas they have put forth on such questions as nuclear deterrence, arms control, and civil defense. Nor does he appear to appreciate the changes that are currently being made in our national security policy, largely as a result of advice given by these scientists. It is precisely because of the influence of the individuals he criticizes that the United States is shifting from a policy of massive retaliation to a more flexible response to aggression. As a consequence, many of his criticisms are far less relevant today, if they are relevant at all, than they would have been 2 or 3 years ago.

The value of Lilienthal's book is that he reminds us how frequently we have deceived ourselves about the political and economic atom. He correctly warns us against the "false peace" a nuclear test-ban agreement may bring. He points out how often we have placed our faith in panaceas, such as the peaceful exploitation of atomic energy, only to come slowly to the realization that our hopes were very much exaggerated. Science will not save us, he argues; the problem we face lies within ourselves.

Rabinowitch agrees that the problem of war and peace lies within man. Yet he has a faith that science is bringing about human unification and that scientists working in such organizations as COSWA can speed that unification. To the accomplishment of this goal, a "world order of law," Rabinowitch has given much of his life since the dawn of our new age. In so doing, he has said well what many natural scientists have thought; and he has deservedly come to represent, perhaps more than any other individual, the political conscience of the American scientific community.

The Cell Surface

The Structure and Function of the Membranes and Surfaces of Cells. The Biochemical Society symposium held in London, March 1962. D. J. Bell and J. K. Grant, Eds. Cambridge University Press, New York, 1963. vi + 172 pp. Illus. $6.50.

Three points about this brief volume may be noted at the outset. (i) The content is instructive, interesting, and sometimes provocative. Detailed treatment of material repeatedly reviewed elsewhere is avoided except when it is relevant for the general structural-functional complex, the whole cell surface. In several chapters the chemical composition of cell surface structures is emphasized, and the problem of how the chemical units may be put together is considered. Only in this way will we eventually obtain the chemical names, so to speak, for the functional properties of the cell surface. (ii) The six chapters deal with microsomal membranes, with mammalian, bacterial, and plant cell surfaces, and with so-called vectorial metabolism in trans-surface processes. (iii) Because of the juxtaposition of data from sources often widely separated in the literature, and because most of the comfortably familiar material in the general area of cell-membrane physiology, although used, is not overly stressed or belabored, some readers may find the material difficult to fit into existing patterns of thinking. This could be the book's major value.

The chapter on microsomal membranes is a critical discussion of the powerful centrifugation and density-gradient methods for separating subcellular components, and it summarizes their use in resolving microsomal material into functionally differentiable fractions. It will be helpful to those who consider using these techniques.

In chapter 2 the question of how protein may be bound to cell-membrane lipid is considered. Several omissions are noteworthy. (i) An important paper by Salem [*Canad. J. Biochem. Physiol.* **40**, 1287 (1962)] is not mentioned. (ii) It is postulated that protein bound to lamellar lipid may be denatured, but not that such attachment might also prevent complete extension. (iii) The improbability of hydrogen bonding between cholesterol hydroxyl and membrane phospholipid polar groups in the geometry proposed by Finean is neglected.

Discussions of reaggregation of separated cells, and of *p*H at interfaces, are interesting.

In the valuable chapter on bacterial cell walls much analytical information is conveniently tabulated. The presence, probable arrangement, and possible functional roles of polymerized mucopeptides are considered in some detail. The chapter on plant cell walls is largely nonspeculative, but it contains worthwhile chemical tabulations.

Challenging problems associated with transmembrane movement of large molecules and particles are considered in detail. Discussion of stimuli and possible mechanisms underlying pinocytosis and phagocytosis emphasize how little we know these phenomena in molecular terms.

The final chapter deals with so-called vectorial metabolism and its possible meaning for transmembrane movement of molecules, groups, and

electrons. Any firmly based, major physical insights to be gained from this point of view are not yet well developed.

I found this volume well worth reading.

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Genetics

Elementary Genetics. W. Ralph Singleton. Van Nostrand, Princeton, N.J., 1962. xiv + 482 pp. Illus. $8.25.

This pleasant, easily read textbook for beginners in genetics is aimed at about the sophomore college student; somewhat less than usual emphasis is placed on the mathematical aspects of the subject. Examples are drawn from most of the major experimental organisms, with maize perhaps replacing *Drosophila* as the favorite organism.

The first 16 chapters give a standard account of basic genetic theory; this is followed by a chapter on radiation genetics, two chapters each on biochemical genetics and population genetics, and a concluding chapter in which the author discusses current investigations on the chemistry of the gene. The book is profusely illustrated, and the illustrations and tables are well coordinated with the text. The bibliographies at the end of each chapter could be used to direct students to further reading, but the "problems," which are also given at the end of each chapter, do not appear to challenge students in a satisfactory manner. Each set of problems begins with the same tasks: (i) define certain terms, and (ii) identify certain scientists. The definitions requested are usually identical with those provided in the glossary at the back of the book; this spoils the teaching value of the problem. The lists of scientists to be identified have been drawn up by including everyone mentioned in the chapter, an unsatisfactory way of getting students to recognize the "major contributions" of many of these persons.

The most striking characteristic of this book is its personal nature. The author's interests and his work history have shaped its contents to a remarkable extent. Local newspaper items, various neighbors, the family pediatrician, and the pedigree of what appears to be the family horse occupy the reader's time. A whole chapter on mammalian coat color and an extensive appendix on linkage groups in maize are related to papers published by the author. These items and a number of others form a set of unimportant digressions which an instructor with a different background will find wasteful of time. The intensive selection of examples from the work of the author and his colleagues probably results in a less than desirable representation of the important experiments in genetics.

While annoying errors and ambiguous statements occur every few pages, these are not intolerably frequent. However, the errors are such that, in courses which emphasize *Drosophila* or statistics, the use of this text would result in an extra burden on the students; the relative lack of material on the genetics of microorganisms would also limit the use of the text for some instructors.

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Solitary and Social Wasps

Wasp Farm. Howard Ensign Evans. Natural History Press, Garden City, N.Y., 1963 (available from Doubleday). x + 178 pp. Illus. $3.95.

Almost everyone, except a few students of wasp biology or animal behavior, looks upon wasps as nasty creatures that should be combatted "tooth and nail," or at least with an aerosol bomb, a fly swatter, or some other means of destruction.

In this small book, published for the American Museum of Natural History, Howard Evans gives vignettes of a few of our predaceous solitary and social wasps. Many of the observations were made at "wasp farm," the country home which Evans formerly owned near Ithaca, New York. These were supplemented by studies made in other parts of the country by Evans and by a few other observers. The 15 brief chapters thus present engaging accounts of several dozen species, ranging from the most primitive kinds of solitary wasps through the increasingly complex behavioral patterns exhibited by solitary wasps that nest variously in the ground or in wood, or construct mud cells, and they culminate in an account of a few social species. Evans' stories of the evolution of the wasps' prey-carrying mechanisms and of the comparative behavior of species of *Bembix*, fields in which he has made invaluable basic contributions, are especially interesting. For instance, how many entomologists know that predatory wasps have developed 13 different ways of transporting their paralyzed insect or spider prey to the nest? Among the illustrations are a number of high quality, close-up photographs taken by the author to illustrate various facets of wasp biology. Several unfortunate minor errors have occurred here: Figure 18 is upside down (the cells of the pipe-organ wasp actually open downward) and, in the caption for figure 21, *Leptochilus* is certainly a slip of the pen for *Symmorphus*, a close relative.

These accurate, popular accounts of the wonderful array of behavior patterns and differing life histories, particularly those of the inoffensive solitary wasps, should do much to dispel the general dislike of these insects; perhaps the accounts will induce some to indulge in observational work of their own. Were I not already so convinced, this book would certainly persuade me that wasp-watching should supplant bird-watching! The book should also be required reading for those scientists who think there are no additional frontiers to explore in natural history.

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Textbook of Limnology

Fundamentals of Limnology. Franz Ruttner. Translated from the German by D. G. Frey and F. E. J. Fry. University of Toronto Press, Toronto, Canada, ed. 3, 1963, xvi + 295 pp. Illus. $6.50.

Frey and Fry have again done American and other English-speaking limnologists a fine service by translating the third edition of the late Franz Ruttner's *Grundriss der Limnologie*. In its topical organization, this edition does not differ markedly from its predecessor; about 40 percent of the volume is devoted to sections on water