

mental processes in the premixed laminar flame is impressively presented in their book, and it serves as an example of what can be done, an example that may stimulate others concerned with these alternate types of flames.

In comparing this book with other recent combustion treatises, I found that the treatment overlaps to some extent that of C. P. Fenimore's *Chemistry in Premixed Flames* (Macmillan, 1964) but contains a far more comprehensive account of experimental techniques. Fenimore discusses a greater variety of chemical processes, however (soot formation, nitric oxide decomposition, and halogen effects, for example). Neither book explores the theory of flame structure in depth. The recently published volume, *Com-*

bus-tion Theory, by F. A. Williams (Addison-Wesley, 1965) covers entirely different ground; for example, its eight-page author index fails to list either Fristrom or Fenimore (Westenberg is briefly mentioned). Students who wish to acquire an overview of current combustion research should certainly look at *Combustion Theory* as well as *Flame Structure*.

Flame Structure is remarkably free from errors, as far as I noted. On page 139, Fristrom's "frustrum" is really a frustum, and (p. 30) the H_2-F_2 flame is actually much hotter than the authors are willing to concede.

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Biological Energy Transformations

Bioenergetics: The Molecular Basis of Biological Energy Transformations.

Albert L. Lehninger. Benjamin, New York, 1965. xvi + 258 pp. Illus. Paper, \$2.95; cloth, \$6.

This book presents in a clear and easily readable form the transformations and use of energy in biological systems. It is very welcome because it is good to be reminded that the flux of energy through a living system is essentially what makes the system alive, and that an understanding of energy feed-in into biosynthetic processes was the necessary premise, for example, for today's dramatic comprehension of the biochemistry of information transfer.

It is agreeable that, in a text geared to students largely in biology and medicine, thermodynamic formalism is kept at a minimum and its meaning is explained in a commonsense manner rather than in abstraction. In this commonsense environment, one is all the more surprised to find the old complaint that the terms "energy-rich" or "high-energy" bonds are misnomers, repeating the, by now, rather stale reference to a usage in a different context of the term "bond energy" as the energy liberated in the formation of a bond (for pertinent discussion, compare W. P. Jencks, in *Survey of Progress in Chemistry*, vol. 1, p. 249). Nonetheless, the book is filled with squiggles (~); the urgent need for this symbol standing for energy-rich bonds has, indeed, made some sections of

metabolic literature almost a kind of "squiggology." If one does not like high-energy or energy-rich bonds, one might well speak instead of "high group potential," a useful and more flexible term that is not introduced here.

The main strength of the book is quite naturally the discussion of biological energy transformations, this being the author's field of greatest experience. The outline of biosynthetic mechanisms, in some ways, does not come off as well. For example, a synthesis of sucrose from glucose 1-phosphate and fructose is mentioned as being exergonic; in fact, it is an endergonic reaction, and the biosynthetic path for sucrose is, rather, through uridine diphosphoglucose (UDGP) + fructose, which is exergonic [L. F. Leloir, in *Proc. Plenary Sessions*, 6th Intern. Congr. Biochem. **33**, 15 (1964)]. Subsequently, UDPG is presented in the synthesis of glucosidic bonds in glycogen, and the rather large "waste" of energy in this synthesis is emphasized. Elsewhere in the book, however, there may be a little too much fascination and marveling about the perfection of bio-mechanisms at a time when, in some fields, we are discovering that man-made devices are frequently superior.

One would have liked to see a few more references to pertinent literature. Although the author included a partial quotation of the famous introduction by Lewis and Randall to their *Thermodynamics* (McGraw-Hill, 1923), the name of G. N. Lewis does not

appear in these pages. This is particularly deplorable to those who consider Lewis a pioneer in the application of thermodynamics to biochemical problems, and who grew up using, as he proposed, the ΔF rather than the ΔG for change in free energy. The use in this book of ΔG , in view of the almost exclusive use of ΔF in biological literature, should at least have been introduced as an alternative to ΔF rather than without further explanation.

Finally a word on the reference to negative entropy as a measure of information. Here I should like to quote from MacKay (in *Man and His Future*, p. 154): "One could say that whereas physics looks for explanations in terms of the *dependence of force upon force*, the science of communication constructs its "causal chains" out of the *dependence of form upon form*, . . . regardless of where the necessary energy came from." I think that, at the moment, there is a great deal of loose talk which glosses over this fundamental difference.

My minor reservations are not meant to detract from the great usefulness of this book as an introduction to biological energy transformations. The large number of well-designed illustrations will be quite helpful to the newcomer's understanding of essential features, on which the book rightly concentrates.

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Cytogenetics

Human Chromosome Methodology.

Jorge J. Yunis, Ed. Academic Press, New York, 1965. xiv + 258 pp. Illus. \$8.50.

A new era in cytogenetics was instituted in 1956 when Tjio and Levan published the report that human cells contain 46 chromosomes. Since that time events have moved with almost explosive rapidity, and the large accumulation of literature describes results of great importance to both fundamental biology and medicine. The coincident rise in interest in the practical aspects of this phase of genetics has resulted in the publication of a large number of monographs and reviews on the subject.

This book, however, does in part fill a need unmet by most other re-

views. It provides authoritative and up-to-date essays which describe techniques for studying the sex chromatin body and the human chromosomes, techniques that have been successfully utilized in well-established and experienced laboratories. The contributors, all authorities in the field, have necessarily favored their own methodologies, occasionally to the neglect of others that are equally effective.

The chapter on the sex chromatin is thoroughly and lucidly handled. Murray Barr quite properly stresses the necessity of not trying to interpret specimens of inferior quality. The use of such specimens is undoubtedly the major cause of incorrect reading of chromatin preparations. I would not agree with Barr's statement that "no other form of the test is as applicable to newborn surveys as buccal smears," for, in my opinion, the amniotic membrane technique is indeed preferable, particularly for surveys on large populations. I wish that Barr had made it clear that there is no reason to assume an intrinsic difference in the sex chromatin of normal newborns.

Mellman's chapter on the culture of peripheral leukocytes, Harnden and Brunton's chapter on culture of skin cells, and Schmid's on autoradiography are practical and competent descriptions of various techniques used in fields that abound in modifications.

Two outstanding discussions are the comments by Tjio and Whang on direct bone marrow preparations, and that by Ohno on the direct handling of germ cells. These techniques, both of which are of increasing importance to the cytogeneticist, are succinctly described and well illustrated. Similarly, the chapters on microscopy and photography fill a real need for those who are attempting high resolution microscopy for the first time.

Patau's paper emphasizes his views about the uncertainties that still remain in the identification of the human chromosomes. Despite its many imperfections, however, it is worth reiterating that the "Denver system" is still the best method by which scientists can communicate their chromosomal findings.

The final chapter, "Human chromosomes in disease" by Yunis, contains much information, but a paucity of constructive generalization that might be helpful to the audience for which it was intended.

In summary, this monograph should prove extremely useful to the tyro in

cytogenetics; this is particularly true of the first eight chapters which adhere to the aim of the book—that is, to discuss methodology. I commend to readers the last paragraph of T. C. Hsu's introduction in which there is a reminder that mastering techniques alone does not make one a competent cytogeneticist. This reminder is particularly important for medical groups who wish to start a laboratory in cytogenetics.

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Combustion Institute Symposia

Tenth Symposium (International) on Combustion (Cambridge, England), August 1964. Organized by the Combustion Institute, Pittsburgh, Pa., 1965. xxviii + 1488 pp. Illus. \$35.

The prestige and scientific importance of the biennial international symposia organized by the Combustion Institute are now so well established that nearly every active worker in the field, from every part of the world, is anxious to present his latest experimental or theoretical results at these meetings. It follows, therefore, that all those who have more than a passing interest in this field should have the proceedings of the symposia close at hand.

The proceedings of the Tenth Symposium (International) on Combustion meets the high standards set by its predecessors and in some ways exceeds them. One hundred and thirty papers from ten countries, together with the comments made on each paper, have been assembled in this one volume; the papers are in good to excellent English and with singularly few apparent errors. More important, the quality of the work presented is in most cases extremely high. I venture the opinion that it would be impossible to find an equal number of consecutive pages of any scientific journal containing such a high proportion of new data, important experiments, critical analysis, and theoretical advancement.

The broad divisions of subject matter include flame chemistry, kinetics of reactions related to combustion, electrical properties of flames, detonation, flame spectroscopy, fire research, aerodynamics in combustion, and solid pro-

pellant burning. But these broad classes hardly suffice to indicate the great variety of topics considered—topics ranging from the augmenting of flames with electric discharges to the rate of growth of soot, or from the generation of pressure waves by accelerating flames to the identification of negative flame-ions. A few topics, which were well covered in the ninth symposium, are intentionally omitted here; these are modeling of combustion processes, reactions and phase changes in supersonic flow, and reciprocating engine combustion.

For the first time, the Combustion Institute has acted as its own publisher; the result is gratifying, not only in the book itself but also in that the elapsed time between symposium and publication is the shortest within recent memory. Another innovation, one that is worth the price of the volume, is the inclusion of cumulative author and subject indices for the first ten symposia.

This volume and the several preceding it constitute a refutation of the thesis that no worthwhile thing can come from a committee; scores of people, all listed in the introductory section, labored to make the symposium a success. Perhaps special recognition should be given to Raymond Friedman, who headed the large group that selected the papers presented from the much larger number of papers that were submitted, and to Walter G. Berl for the work of his committee in editing and publishing this very worthwhile volume.

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Acridology

The African Genera of Acridoidea.

V. M. Dirsh. Published for the Anti-Locust Research Centre by Cambridge University Press, New York, 1965. xiv + 579 pp. Illus. \$37.50.

Since its establishment in 1945 the Anti-Locust Research Centre (London) has consistently sponsored basic systematic research on grasshoppers, in addition to much work on bionomics and applied aspects. Work on the grasshoppers of Africa has been conspicuous, probably because of the rich and poorly known fauna of that continent, the involvement of several species of