Book Reviews

Can Man Be Modified? Jean Rostand. Translated from the French by Jonathan Griffin. Basic Books, New York, 1959. 105 pp. $3.

"Have not the biologists the right to a little conceit, when they add up what they have achieved in the space of a mere half century?" asks Rostand, as he proceeds to catalog many of these achievements and predict future ones: parthenogenesis, sex control, chemical control of personality, artificial insemination, preservation of choice human sperm for long periods of time, modification of brain function, and so forth. The picture is familiar: it is *Brave New World* again.

It has been more than a quarter of a century since Aldous Huxley made his synthesis of implications. The evidence of his success is the extent to which subsequent writers in the same field have found it impossible to go beyond what he said. They may praise him or damn him, but they cannot, apparently, be very original. Some plagiarize *Brave New World* unconsciously, supposing they are saying something new. Others, more perceptive, generously acknowledge their debt, as Rostand does. A critic might protest against the repetition of ideas, but this reaction is probably wrong. Truth in human affairs has a sort of "half-life"—of ten years, say?—and it is necessary to revive truth periodically, to recharge its source, so to speak. The generations of mankind succeed one another rapidly, and the continuance of society requires endless repetitions, however painful they may be to the critic of long memory. He will just have to suffer.

Rostand is intransigently optimistic about the changes made possible by science and technology. Why, he asks, should we fear such developments as those that give us more leisure? "This is really like being afraid that a wife may become too beautiful, and I agree with Raymond Queneau . . . that 'the people who whine about naughty robots and inhuman machinery have never proved anything except their own lack of imagination and fear of liberty.'" With respect to the biological frontier, Rostand is delighted to report: "The fertilising needle enters into morals, it is provided for and paid for under social insurance, and already one receives pieces of pasteboard with such inscriptions as: 'Mlle X has the pleasure of announcing the birth of her daughter [or son] by artificial insemination.'" This appears to be a statement of French fact rather than a prediction. It came as a surprise to me; I have not yet received any such formal announcement (but would be most delighted to see one).

Can Man Be Modified is a gracefully written book, with a bit of the *épatez les bourgeois* spirit in it that the French, from long experience, can manage so well. Yet it is basically serious, as Rostand insists, near the end: "We who are called 'scientists'—and it is a name we do not refuse, for there are less honourable ones—are not as grossly and naively insensitive as people are apt to believe. The fact that we persist in regarding man as part of nature does not make us have less respect for him or incline us to treat him without ceremony. I will even go so far as to say that perhaps respect for mankind should be even greater in those who believe only in man, —in those who, stripped of every illusion about transcendence, can only see in man an animal unlike any other, with no obligation except towards itself, with no law to obey except its own and with no values to revere except those of its own making."

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Theory of Relativity. W. Pauli. Translated from the German by Gerald Field. With supplementary notes by the author. Pergamon, New York, 1958. xiv + 241 pp. $6.

This book presents a comprehensive and critical discussion of both the special and the general theory of relativity. The discussion first appeared in 1921, in German, as an extensive contribution to volume 5 of *Encyklopädie der Mathematischen Wissenschaften*. Because of its excellence, and in view of the great interest in the relativity theory at that time, Sommerfeld arranged for its immediate publication in separate book form. Now, thanks to Gerald Field's translation and to Pergamon Press, we are privileged to welcome Pauli's article, extended by him with extensive notes on developments between 1921 and 1956, into the English literature.

The many virtues of Pauli's discussion were eloquently proclaimed by the creator of the relativity theory, Albert Einstein, writing (in German) in *Naturwissenschaften* [**10**, 184 (1922)]: "It would be difficult for anyone who studies this mature and beautifully constructed work to believe that the author is a man of 21 years. One doesn't know what to admire most, the psychological appreciation for the development of ideas, the sureness of the mathematical deduction, the deep physical insight, the faculty for a clearly arranged systematic presentation, the knowledge of the literature, the factual completeness, or the sureness of criticism."

Part 1 (20 pages) contains a critical and thorough analysis of the empirical basis, and of important tests, of the special theory.

Part 2 (50 pages) is devoted to a complete and general discussion of the mathematical tools of the special and the general theory. Variational theorems, the theory of invariants, parallel displacement, and covariant differentiation in affinely connected, as well as Riemannian, spaces are a few of the topics covered. This part is of especial value to the serious student of the general theory.

Part 3 (71 pages) presents an exhaustive exposition of formal developments, including action principles, and of physical applications of the special theory to mechanics, electrodynamics, and thermodynamics.

Part 4 (42 pages) is concerned with the general theory. It presents a full discussion of the basic ideas of the equivalence principle and of general covariance and considers applications of the theory to special problems. In this part one first realizes how long ago this book was written. It is only in the supplementary notes that one finds a discussion of Friedmann's solution (1922) to the field equations for a world with a time-dependent metric and of the significance of this work for the cosmological problem, following the discovery of the red shift by Hubble. Also, the extensive work of Einstein, Infeld, and their collaborators in obtaining the law of motion of a particle from the field equations, with no additional assumptions, is only briefly referred to and discussed.

Part 5 (22 pages) is devoted to attempts to formulate an electromagnetic theory of mass within the framework of the special theory and to Weyl's attempt to incorporate electromagnetism in the world geometry, along with gravitation. Other, more recent, attempts to arrive at a unified field theory, by Einstein and by Kaluza and Klein, are discussed and

analyzed in the supplementary notes.

This book achieves a very broad coverage of subject matter in a limited space by confining formal developments to the main points, without presenting detailed proofs. In concluding his review of the original edition, Einstein recommended Pauli's treatment to "everyone working creatively in the field of relativity as well as to everyone who wants an authoritative orientation in fundamental questions."

Another of Pauli's legacies to modern physics is his equally highly esteemed article on "The general principles of wave mechanics," in the *Handbuch der Physik* [(Springer, Berlin, 1958), vol. 5, part 1]. It would be of at least equal value to the large community of monolingual American physicists if this, too, were to find its way into English.

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Aircraft and Missile Propulsion. vol. 1, *Thermodynamics of Fluid Flow and Applications to Propulsion Engines.* 538 pp. Illus. $11.50. vol. 2, *The Gas Turbine Power Plant, Turboprop, Turbojet, Ramjet, and Rocket Engines.* 636 pp. Illus. $13. M. J. Zucrow. Wiley, New York; Chapman and Hall, London, 1958.

These two volumes represent a considerable step forward from the author's earlier book, *The Principles of Jet Propulsion and Gas Turbines* (Wiley, New York, 1948). Zucrow, a noted expert in jet propulsion and a teacher of many years' standing, has recognized that the practices of jet propulsion have moved forward in the past decade and require a more comprehensive treatment. This he has provided.

He has included rocket propulsion in these volumes, correctly categorizing it as a branch of jet propulsion. That rocket propulsion belongs in this category has not always been well understood by other authors, some of whom have tended to separate air-breathing and rocket jet propulsion.

Volume 1 consists of five chapters, of which the first is a review of fundamental principles. This is one of the more valuable chapters, since it allows the reader to go back and "brush up" on fundamental principles without referring to other volumes. Indeed, laudable as the inclusion of this chapter is, one wishes the author had made it even longer, to include, perhaps, more definitions—in particular of words such as *entropy*—and more background on compression and expansion processes in gases.

One of the very important problems facing the jet engine (and rocket engine) designer is that of heat transfer. Again, a separate chapter on the principles and practices of heat transfer would have been desirable. Indeed, since so much has been written on ballistic equations for space flight, and since other good treatises are available on solid-propellant rocket design, one wishes that the two chapters on ballistics and space flight in volume 2 could have been replaced by one very good chapter on the advanced principles of fluid mechanics and heat transfer.

Nevertheless, the author has vigorously and thoroughly covered (volume 1, chapters 2–5) the general characteristics of propulsion systems, the thermodynamics of compressible fluid flow (inclusion in this chapter of some of the theory and principles of shock tube phenomena would have been interesting), gas flow through nozzles, and flow through diffusers. In these later chapters, a more thorough treatment of rocket and jet-engine nozzle design would have been helpful. Some controversy and some empiricism are manifest in the rocket industry today in connection with the design of the exhaust nozzle. Some designers favor straight cones and other so-called "Prandtl" nozzles. It is true that Zucrow had no thought of catering to the designer (and this is proper), but at least a discussion of the gas flow phenomena in curved nozzles and of the related theory would have been helpful.

In volume 1 Zucrow has included many tables which contribute greatly to an understanding of the theory that he presents. I found his charts of isentropic compressible flow and his tables of conversion factors for dynamic viscosity most helpful.

There is, of necessity, some duplication of material in volumes 1 and 2, but the latter concentrates more on the practical problems of jet engines, covering gas turbine power plant cycles and analysis of ideal cycles (chapter 6); analysis of gas turbine power plants and the turbopropeller engine (chapter 7); and the turbojet engine (chapter 8). These three chapters are easily the most useful I have found in the literature, and section 9 (of chapter 9), on the turbojet engine, which deals with flight performance at the design point, is remarkable for its conciseness and thoroughness.

In chapter 9 the author devotes about 60 pages to the ramjet. This important power plant, somewhat neglected in the literature, warrants all the description and analysis possible. Indeed, the chapter might have been rounded out a bit with a review of actual problems met in the last few years and discussion of the application of ramjets in the field of missile propulsion. There are some interesting variants of the ramjet and turbojet engines called turborockets and ramrockets. It is true that the author concentrates on fundamental principles as much as possible, but a description, at least, of these power plants would have been desirable. Perhaps this will be included in volume 3.

Perhaps the largest single instance of increase in text material over the earlier book on jet propulsion occurs in chapter 10, "Rocket jet propulsion." Some of the nomenclature and standard expressions—for example, "specific impulse"—reflect the author's earlier work and show that standardization of symbols and terms in the field of rocket propulsion has not yet been achieved. I had to refer continuously to the principal notation at the beginning of the chapter (this notation covers more than two pages and is somewhat labored) in order to understand the equations or at least the terms the author has used in this chapter. The last section of the chapter, on questions of space travel and the multistage rocket, covers only eight pages and might as well have been left out, since, as was stated before, there are more voluminous books available on these subjects. Similarly, the author, in trying to cover as wide a field as possible, has included (section 8, chapter 10) a review of interior ballistics of solid-propellant rocket motors. While this material is useful, it might have been better used for, say, a thoroughly theoretical treatment of rocket combustion, particularly in one of the author's pet fields, combustion instability.

Six tables on enthalpies, rocket propellant properties, and equilibrium constants complete this volume.

In general, despite the minor shortcomings I have noted, these two volumes are a most useful addition to the library of the engineer and designer who wants to get a good understanding of jet propulsion principles without having to refer to a vast number of treatises on the subject.

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Hydrogéologie. Introduction à l'étude des eaus destinées à l'alimentation humaine et à l'industrie. P. Fourmarier. Masson, Paris; Vaillant-Carmanne, Liége, Belgium, ed. 2, 1958. 294 pp. Illus. Paper, F. 3000.

This book is the second edition of a well-known textbook of hydrogeology (or ground-water geology) which was published originally in 1939. Although the present edition contains only ten pages more than the previous edition, an expansion of about 20 percent has been accommodated by use of smaller