pineapple. At the end of 24 hours both parasites were completely digested, while controls incubated in heat-inactivated pineapple juice and in saline solution were very lively and active.

The results obtained indicate that the juice possesses enzymatic activity similar in nature to that of some Ficus latexes, and therefore there is some scientific basis for its use as an anthelmintic.

The much wider availability and cheapness of fresh pineapple juice suggest it as a more practical source of non-toxic, ficin-like anthelmintic.

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QUOTATIONS

THE VOICE OF SCIENCE

ONCE more the burden of war is laid upon us. Once more, as in 1914, the cynical disregard of Germany for the rights of small nations has constrained the British people to take up arms in the cause of justice and fair dealing in international relations. The challenge of the German Reich has been accepted reluctantly, and with no illusions as to the nature of the glories of modern warfare, only after every effort to secure a peaceful but equitable settlement of the differences between Germany and Poland has failed. It has been accepted with full realization of the gravity of every implication of the decision. But in turning to war as the last resort, the British people has acted with a unanimity such as never before in its history, and with a grim determination that no effort shall be spared in the endeavor to ensure that the cause which it holds just shall prevail.

From 1914–18, the Allies opposed dynastic ambitions in the interests of the freedom of peoples. No longer were the people to be the pawns of the political intrigues of their rulers. The world, it was said, was to be made safe for democracy—words that now have a mocking ring. In 1939, the canker has sunk deeper. It is not merely political liberty that is at stake, though that too is jeopardized. It is the spirit of man.

In no previous war has science played so great a part as that which will be demanded of it in the struggle that is at hand. For a time, while the issue hangs in the balance, it is the duty of the man of science to lay aside his just misgivings whether the greatest force of the human intellect should thus be harnessed to the forces of destruction. For the moment, the interests of pure science as an intellectual pursuit and discipline must remain in abeyance. The energies, the abilities and the knowledge of each and every individual with scientific training must be directed without remission to the service of the Allied cause. Nevertheless, the end to be attained, and the end which science should hold ceaselessly before the eyes of the Allied peoples, is not destruction, but a constructive ideal—to ensure in the future such conditions as will make possible the advancement of all the peoples of the world without discrimination, according to the status and the traditions of each, in the light shed by reason and scientific knowledge. To keep alive the aims of science in furthering the pursuit of truth in the universe and the relation of that truth to the developments of man's nature, without regard to tribal and racial distinctions, should be, indeed, must be, the ultimate function of the scientific thinker, whatever may be his more immediate preoccupations.

As to the form in which that ideal will find embodiment, at the moment, in the turmoil of initial operations, it is too soon to attempt a forecast; but that it is no idealist's dream is certain. The failure of the League of Nations as a political organization has cast discredit in the popular mind on such forms of international cooperation. Possibly the League of Nations came before its time, and this has obscured in the popular verdict the enormous value of its scientific work in the study of social and economic problems, and the progress which has followed, where the practical application of the solutions suggested has not conflicted with the trends of nationalist development. To extend the fields in which such cooperation between peoples may be applied is the task of the future, when the time comes, as it surely will, for reconstruction.—*Nature.*

SCIENTIFIC BOOKS

ELECTROMAGNETICS

Electromagnetics; a Discussion of Fundamentals. By ALFRED O'RAHILLY. xii + 884 pp. Longmans Green and Co., 1938. 42/- net.

ANY one who has attempted to write a logical presentation of electromagnetics is quite aware of the difficulties and so should welcome this essay in constructive criticism published by the Cork University Press.

A good amplified presentation is given of the usual mathematical analysis and the existence of different views is shown by numerous quotations from the writ-

ings of prominent authors. In some cases the views of a writer are only partially expressed in the sentence quoted, and it is not clear what part the quotation is intended to play in the discussion. In some other cases the quotation serves as a definition; as, for instance, when a physical theory is defined, after Duhem, as a system of mathematical propositions deduced from a small number of principles whose object is to represent a group of experimental laws as simply, completely and exactly as possible. Such a definition makes constructive criticism a natural part of theoretical physics, for every presentation of a theory must be examined to ascertain how far the desired perfection has been obtained. Duhem's "sole test of a physical theory" is mentioned and reiterated in the following quotation from Dirac's "Principles of Quantum Mechanics," p. 7. "The only object of theoretical physics is to calculate results that can be compared with experiment; and it is quite unnecessary that any description of the whole course of the phenomena should be given." This statement, taken alone, seems too restrictive unless there is an intention to distinguish between theoretical physics and mathematical physics. The chief aim of the mathematician is to find out how to make calculations and to construct a language of symbols which will make it possible to think clearly about physical phenomena and to formulate the conventions under which the comparisons with experiments are to be made. The way to make calculations is often far from evident; it is important, moreover, to be able to choose an expeditious way and to be able to judge whether it is worth while to make the calculations. Mathematicians are glad to welcome any device or means of representation that may help them in their difficulties.

In an attempt to clarify the situation produced by the use of the word aether in at least three different senses the author recommends the use of the word schesis to denote the framework of reference used in the formulation of the electromagnetic equations. The absolute velocities occurring in these equations are then described as schesic velocities. With this proposition the reviewer is wholly in sympathy. The term absolute seems too drastic for the velocities in the scheme of representation that has been found most convenient. It should be emphasized also that relative velocity can only be defined when a scheme of representation has been chosen.

The reviewer would go further and recommend that the word aether should now be restricted to the sense in which it has become associated with the ideas of Heraclitus, who regarded everything as being in a state of flux and compared matter with a flame which burns or transforms the aether. As Heraclitus emphasizes the idea of force and the present author endeavors to found electromagnetics on the force formula between two moving electrons he may be regarded as a follower of Heraclitus who has an open mind with regard to the exact law of force, since he discusses the law of Ritz as well as that of Liénard and shows that Ritz's law accounts for some phenomena quite well.

Some writers may, of course, prefer to still associate the word aether with the "indeterminate" of Anaximander or the starry firmament. Thus Livens says in a portion of the passage quoted on page 630. "What happens in the space between (space is that something which can be occupied by matter) we do not and can not know."

The idea of space seems, however, to be inseparably connected with some scheme of representation. Any one familiar with the theory of geometrical transformations knows that two points which are contiguous in one representation may be separated in another. It is unlikely that there is an exact one to one correspondence between the descriptions of the universe obtained in different laboratories when, according to one description, there is an acceleration of one laboratory relative to the other. In actual life correspondences are seldom exact over a great range. The mathematical estimate of the closeness of fit of a correspondence may well play a part in an attempt to define pleasure and pain, good and evil.

The idea of empty space is just as difficult as that of an indeterminate aether. A distance between two points can only be measured by placing a yardstick or other measuring device in the "vacant region," in one sense, then, the interval has no existence until the yardstick is in place.

The fundamental electromagnetic equations do not require time to be associated permanently with each point of the framework arbitrarily chosen for a scheme of representing location. The equations merely state that when *a* time has been associated with each point according to some continuous law, then two flux relations hold. The equations do not even involve the velocity of light. This enters only when an attempt is made by the introduction of constitutive relations between the four electromagnetic vectors to account for observed physical phenomena.

A theoretical physicist is sometimes satisfied with a physical theory when calculated results agree with experiment. In some cases, however, the calculated results depend only on the characteristics of the partial differential equations used in the theory and may be the same in innumerable other theories in which the partial differential equations have the same characteristics. The mathematician can not then be satisfied by a simple agreement with experiment. He must scrutinize a theory carefully to ascertain what features of the theory are really confirmed by experiment.

The book under review contains discussions of many matters. Relativity and other recent theories are discussed. The ideas of Einstein and Maxwell are criticized. The author has little respect for authority, and this alone may entice readers to buy the book. The idea of localized energy is regarded as useless except in the case of radiation and the idea of stress in a medium is regarded as not helpful. The idea of contact action is just as difficult to comprehend as that of action at a distance.

H. BATEMAN

THE PHILOSOPHY OF PHYSICS

On Understanding Physics. By W. H. WATSON. Cambridge University Press, 1938.

THIS book is one more indication that interest in what has been variously termed the philosophy of physics or the logic of physics continues unabated. Sooner or later every physicist succumbs to the temptation to probe more deeply into the foundations of physical theories in the attempt to associate more meaning with what he is doing. The ultimate advantage of this procedure is not that it settles anything but that it does place certain problems in a clearer light. In some measure it also affords physicists an opportunity to clarify their philosophical tastes.

The author of the present volume believes that philosophy has great value in clarifying physical problems, but he also makes clear his opinion that the only kind of philosophy valuable for this purpose is that confined to the study of the logic of language. This sort of philosophizing has recently received much attention through the work of Wittgenstein and also the so-called Vienna circle of logical positivists. The author acknowledges his debt to Wittgenstein for the original stimulus to the present work. The first two chapters of the book are largely devoted to an expression and defense of the view-point that "the function of philosophy . . . is to clear up an understanding of the use of symbolism" and that psychology has little or nothing to do with the logic of physics.

The rest of the volume consists of four not completely integrated essays embodying the application of the author's ideas to various physical theories. There is indeed a common thread running throughout the discussion, namely, the emphasis that in its description of experience physics employs various methods of representation depending on the problem in hand. Unfortunately since the author does not make precisely clear what he means by a "method of representation," the reader will be forced to place his own interpretation on the treatment. The reviewer has the impression that *any* physical theory is an attempted representation of nature. On this view the author appears to be trying to say that whenever we have constructed a physical theory, in every application of the theory we must be careful to preserve consistency with the definitions and postulates of the theory and not try to mix in ideas from another and different theory. It is unlikely that physicists will disagree with this view.

In an interesting chapter on the "Nature of Mechanism" the author makes a few trenchant remarks about causality and points out that the wide-spread belief that quantum theory has abandoned causality is based on a misconception of the physicists' interpretation of this concept. It should perhaps be emphasized that to the author mechanism means simply the determinateness of physical theories, *i.e.*, the fact that theories make *precise predictions* from their postulates. It is not confined to mechanical or dynamical theories as commonly understood.

The last two chapters contain discussions of the concepts of substance and motion and certain aspects of the use of symbolism in mechanics and electricity. Most of the applications here are to classical physics.

The book as a whole is by no means easy reading. The reviewer feels that a closer integration of the various chapters would have enabled the reader better to grasp the gist of the author's admittedly carefully considered opinions and analysis of fundamental questions in the logic of physics.

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MEADOW AND PASTURE INSECTS

Meadow and Pasture Insects. By HERBERT OSBORN. pp. i + viii, 1 + 288, 100 text illustrations. The Educators Press, Columbus, Ohio, 1939.

THE meadow and pasture lands of the country are an important part of the agricultural area of the country. They comprised in the West in 1909 over 80 per cent. of the area and about 60 per cent. of the value of all crops in that part of the country.

This volume presents the first comprehensive account of the part insects play in reducing forage crops, especially grasses. There have been a number of excellent publications upon some of the more injurious species affecting these crops. It has remained for the author to bring together the results of his studies of grass-infesting species extending over a period of more than fifty years. He has been led to conclude that a reduction of nearly 50 per cent. in the forage after land has been in grass three or four years is largely due to insect levies. This is certainly of much practical importance to all owners of grazing land and all owners of live stock, particularly since the author discusses conditions which favor the multiplication of these pests and outlines practical methods for reducing losses of this character.

The ecologist will find much of interest in the volume in the extended discussion of the ecology of the meadow.