research which gives the field a kind of unity and which fully justifies this interesting monograph by one of the leading "explorers" of our day. Because of the variety of observations which are now carried on below one hundred degrees absolute it has been impossible in a small book to do more than pick out and describe briefly a few of the more striking examples in each line of work. As stated in the preface: "Though this book may be of some use to the specialist, we have had in mind as prospective readers rather physicists specializing in other fields . . ." For this purpose the material is admirably selected.

The book is divided into four parts, the first and longest being entitled "Phase Equilibrium" and dealing with the history and recent developments in liquefaction, measurements of low temperatures and phase diagram studies. The early work of Pictet, Dewar and Linde is graphically described with many quotations from original letters and papers. Unfortunately, the date of Kammerlingh Onnes' death is given as 1924 instead of 1926. The second part deals with the "Solid State," x-ray methods, thermal energy, the "Third Law of Thermodynamics." The third part covers "Orbit and Spin," the production of temperatures of the order of one hundredth of a degree by the Giauque method. The fourth part, "The 'Free' Electron," deals with superconductivity. There is an excellent bibliography covering the literature up to May, 1937.

The work described undoubtedly constitutes one of the most exciting chapters in modern science and the authors have presented the material in a vigorous and interesting manner. As a reference book, it could have been made much more valuable by the more careful labelling of equations and figures with units.

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SOUND WAVES, THEIR SHAPE AND SPEED

Sound Waves, Their Shape and Speed. By DAYTON C. MILLER. The Macmillan Company. 1937.

PROFESSOR MILLER in this small book gives us an account of certain work which he has done some time ago and never before fully reported. The first research here treated included the development of his phonodeik, the instrument with which he obtained by purely mechanical means most satisfactory photographic records of the form of sound waves. The second major item deals with a series of experiments in which apparatus somewhat like the phonodeik was used to measure the velocity of sound from high-power guns, the form of their sound-waves, and the pressures produced by them at various distances. In addition, there is an important chapter on spark-photography of sound waves, and of bullets in flight, and one on the velocity of sound in air.

The account which Professor Miller gives of these studies is a model of clarity, and the research itself is a model of thoroughness and scientific accuracy. Every student of physics should read this book for the interest in the subject-matter and for the example it sets in proper research methods and in the presentation of results.

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SPECIAL ARTICLES

EXPERIMENTAL INTERSEXUALITY: THE PRODUCTION OF FEMINIZED MALE RATS BY ANTENATAL TREATMENT WITH ESTROGENS[1]

THE production of masculinized female rats by antenatal administration of androgens has been reported.[2,3,4] Until very recently attempts to produce feminized male rats by the antenatal administration of estrogenic substances (estrone, estradiol and estradiol benzoate) have been unsuccessful. Dosages that would conceivably cause feminization of the genetic male fetuses, when administered to pregnant rats, caused resorptions of the pregnancies. However, one full-term litter which showed slight changes in sexual development was obtained. The mother of this litter had been given 0.8 mg estradiol in divided doses from the thirteenth day to the twentieth day of pregnancy. Two new-born males of this litter were serially sectioned, and it was noted that there had been definite inhibition of development of the prostatic diverticula and of the seminal vesicles.

A generous amount of estradiol dipropionate has been made available to us through the courtesy of Dr. Ernst Oppenheimer, of Ciba Pharmaceutical Products, Inc. This compound is very slowly absorbed and consequently has a very prolonged estrogenic effect. Thirty-two pregnant rats have been injected with this compound, usually in single doses of 0.375 mg to 4.0 mg on the thirteenth, fourteenth or fifteenth day of pregnancy. Nineteen of these animals have carried to term and 24 males have been obtained from these litters. Fourteen of these males, the mothers of which had received 2.0 to 4.0 mg of estradiol dipropionate, had grossly visible nipples at birth and were hypospadiac. Normally nipples are not present in the males rats of our colony. Normal new-born males

[1] This work has been supported in part by a grant from the Josiah Macy, Jr., Foundation.

[2] R. R. Greene and A. C. Ivy, SCIENCE, 86: 200, 1937.

[3] R. R. Greene, M. W. Burrill and A. C. Ivy, *Proc. Soc. Exp. Biol. and Med.*, 38: 1, 1938.

[4] R. R. Greene, M. W. Burrill and A. C. Ivy, SCIENCE, 87: 396, 1938.