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spin and statistical behavior of particles naturally led him to investigate the dynamics of the meson. The meson is now a generally accepted particle in nuclear physics. Of a more dubious character seems an invention of Pauli's, the most elusive of all elementary particles, which he dubbed neutrino, and others call Paulino. It is a particle without charge and mass, which nevertheless seems to be indispensable if the laws of conservation of energy and angular momentum are to be safeguarded. Here are question marks for the future.

My brief account is far from complete. I have not mentioned Pauli's two great articles on quantum theory, written for the Handbuch der Physik in 1925 and 1933. Enormous, but difficult to assess, is the influence Pauli has exerted by correspondence and discussion. In view of the discontinuous leaps by which theoretical physics develops, the stream of his scientific production has been remarkably steady. Indeed, when I compare the theoretical physicist with the mathematician I find that the former has a much harder lot. If the mathematician cannot solve a problem, he modifies it until he can solve it; no impenetrable reality limits the freedom of his imagination. So he is liable to succumb to Peer Gynt's temptation: "Go around," said the crooked." Not so the physicist. He has to face the hard facts of nature. The problem of the atom must be solved straightforwardly; otherwise, no further progress is possible. Therefore, theoretical physics has affluent periods when, after persistent efforts, a new stage of theoretical interpretation has been reached, as was the case, for instance, in 1925; then there is all of a sudden plenty of highly satisfactory work for the theorist. But this alternates with stagnant periods where nothing else seems possible than to wait patiently for the slow accumulation of new facts by the experimentalists—facts which refuse to fall into any recognizable theoretical pattern. I have the greatest admiration for the courage and ingenuity with which Pauli has met this intriguing situation.

Another tension tells on the theoretical physicist—that between pure science and applications. He is a theorist and thereby committed to the contemplative life and its ideals. As Dilthey once said, "das vom Eigenleben unabhängige Glück des Sehens" is one of the most primitive and basic blessings of our existence. True, the physicist's contemplation is not a purely passive attitude—it is creative construction, but construction in symbols, resembling the creative work of the musician. On the other hand, science, since it discloses reality, is applicable to reality. Thus it is called upon to serve for the benefit and malefice of mankind. Its technical applications are used to make man's life more comfortable and more miserable, to build and to destroy. To what extent shall and can the theorist take responsibility for the practical consequences of his discoveries? What a beautiful theoretical edifice is quantum physics—and what a terrible thing is the atomic bomb! When they helped to develop the latter, did the physicists do nothing but their duty as citizens of a country engaged in total war, or did they prostitute their science? I think the experience of the last years has shown that there is little danger that the call of national duty will not be heeded by the scientists when the life of the nation is at stake, but that there is great danger indeed that in the fight for the basic values of our existence we may lose these values themselves; that the relentless pursuit of science—strange antimony!—may imperil its very foundations in man's life. Pauli has all his life been deeply interested in philosophy. The wisdom of the Chinese sages seems to have a special appeal for him. No wonder that his sympathies are with those who are not willing to sacrifice the spiritual for the secular, and who are not willing to accept efficiency as the ultimate criterion.

Scanning Science—

New honors are being bestowed upon the discoverers of argon. First came the Barnard gold medal of Columbia College, then the $10,000 Hodgkins prize, then the prize of 50,000 franes from the French Institute and now it is announced that Lord Rayleigh and Professor Ramsay have been made Knights of the Legion of Honor, by order of the French Government.

—14 February 1896
The Transmission of *Litomosoides Carinii*, Filariid Parasite of the Cotton Rat, by the Tropical Rat Mite, *Liponyssus bacoti*

ROGER W. WILLIAMS and HAROLD W. BROWN

The authors recently reported (2) the development of *Litomosoides carinii*, filariid parasite of the cotton rat, *Sigmodon hispidus*, from the microfilarial to the infective stage in the tropical rat mite, *Liponyssus bacoti*. We now have experimental evidence that the tropical rat mite serves as a vector of this filariid.

Four albino rats, 30 days old, were used in the experiment. Two of these rats were placed in individual wire-mesh cages, each cage being placed in a separate box beside a similar cage containing an infected cotton rat. A colony of mites were developed on each of the two cotton rats in their respective boxes prior to the introduction of the albino rats. The position of the two cages in each of the two boxes was periodically interchanged so that the mites could more readily have access to the albino rats after having fed on the infected cotton rats. The other two albino rats, which were used as control animals, were placed together in a wire-mesh cage. This cage was placed in a box, which harbored no mites, beside a similar cage containing a cotton rat heavily infected with *L. carinii*. The position of the cages containing the control rats and the infected cotton rat were also interchanged periodically. All three boxes, the two with the mites and the one without mites, were kept in the same room.

The two albino rats subjected to contact with the mites were autopsied 42 and 44 days after being placed in the mite colonies with the infected cotton rats. The rat autopsied after 42 days contained seven *L. carinii* worms in the pleural cavity ranging in length from 1.165 to 12 mm., while the second rat contained two worms, one 9 mm. and the other 42 mm. in length. The control rats were negative when autopsied after 44 days.

The length of the infective stage within the mites was found to be from 800 to 1,000 μ. It is interesting to note that the smallest worm found in the pleural cavity of the infected albino rat was only 165 μ longer than the largest form found within the mites. This indicates that either the parasite reaches the pleural cavity soon after gaining entrance to the rat or that growth is very slow until the pleural cavity is reached. It is also of interest that a length of 42 mm. could be attained in 44 days or less.

In a similar experiment a cotton rat and an albino rat, which had been experimentally infected by the mite vector, exhibited microfilariae in their blood 80 days after exposure to infected mites. Epidemiological evidence indicated by naturally infected rats points to the possibility that rats may be infected and exhibit microfilariae as early as 50 to 60 days after exposure to infection.

Chandler (1) reported that at the Rice Institute an albino rat which had been housed with cotton rats infected with this filariid parasite was also found to be infected with this worm. The mode of infection was unknown.

Now that it is possible to infect rats readily in the laboratory, new fields of filariasis investigation are open. Immunological and prophylactic drug studies can be conducted, and age resistance of worms to various chemotherapeutic agents can be studied.

References

Scanning Science—

The Eighth Annual Report of the Trustees of the Marine Biological Laboratory at Woods Hole has just been issued, and shows that the summer of 1895 was the most successful in the history of the Laboratory. At different times during the summer there were 63 investigators present, 42 of whom occupied special research rooms. At present 25 colleges subscribe for investigator's rooms, besides five societies, including the American Association for the Advancement of Science and the American Society of Naturalists.

—13 March 1896
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cent'' includes the confusing statement: "The number 1 is 100%.''
As used, this statement is correct before the decimal point is shifted, but not afterward.

The discussion of slide-rule errors in the chapter on that subject could be improved to bring out more fully the limitations of the commonly used slide rule. The statement that "slide-rule answers are accurate but not exact" is hardly sufficient. In fact, the authors would have done well if they had included a brief chapter, written in their interesting style, on the usually dry subject of measurement, tolerances, precision, accuracy, and limits-of-error. Such terms as "exact" and "accurate" mean little in engineering unless carefully defined. No mention is made of calculating machines as used for mathematical work in which slide-rule errors would be too large to tolerate.

The abbreviations of terms do not in some cases follow the recommended practice of the American Institute of Electrical Engineers—for example, a-c should be used instead of a.c.

The errors and inconsistencies appear to be few indeed for a first edition, and both books are likely to be popular with many eager students.

I. MELVILLE STEIN
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Infrared and Raman spectra of polyatomic molecules.

This comprehensive treatise constitutes the second of a series on molecular spectra by a competent writer and will be cordially welcomed by all who have a serious interest in this field. It is, however, primarily a book for the specialists, and for its enjoyment a reasonable previous knowledge of the subject is a prerequisite. The extent of the material covered and the adequacy with which it has been treated may be judged by the 978 literature references and the complete subject index of 65 pages, which greatly enhance the value of the book as a reference.

The organization of the book is very logical, though possibly at the expense of introducing certain pedagogical difficulties, since the phenomena to be explained and their interest and relation to other knowledge do not become fully evident until the later chapters. In the Introduction a discussion of the symmetry properties of molecules is immediately presented, greatly facilitating the later discussion. Chapters I and II, which deal with Rotation and Rotation Spectra, and Vibrations and Vibrational Energy Levels, respectively, are primarily a theoretical discussion of the arrangement of the energy levels of molecules, of their degeneracy, and of their symmetry properties. The treatment is very complete, and, as in other sections of the book, alternative approaches to a given subject are often presented. In many cases proofs are not given, which occasionally seems unfortunate. For the reader who is not interested in theory for its own sake it may appear that undue

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