

# SCIENCE

FRIDAY, MAY 20, 1921

## THE ELECTRON THEORY OF MAGNETISM<sup>1</sup>

<i>The Electron Theory of Magnetism:</i> DR. S. J. BARNETT .....	465
<i>The American Association for the Advancement of Science:—</i>	
<i>Spring Meeting of the Executive Committee:</i> DR. BURTON E. LIVINGSTON.....	475
<i>Medals of the National Academy of Sciences:</i>	
DR. E. E. SLOSSON.....	478
<i>Third Award of the Daniel Giraud Elliot Medal:</i> DR. HENRY FAIRFIELD OSBORN....	480
<i>Scientific Events:—</i>	
<i>The United States Patent Office; The National Geographic Society; Exchange of Professors of Engineering between American and French Universities; Grants from the Bache Fund.....</i>	481
<i>Scientific Notes and News.....</i>	483
<i>University and Educational News.....</i>	484
<i>Discussion and Correspondence:—</i>	
<i>Effect of Dormant Lime Sulfur upon the Control of Apple Blotch:</i> DR. E. F. GUBA. <i>Crows and Starlings:</i> F. R. WELSH. <i>The Synchronal Flashing of Fireflies:</i> OTTO A. REINKING. <i>Franz Steindachner:</i> DR. H. W. WILEY .....	484
<i>Scientific Books:—</i>	
<i>Groth's Chemische Krystallographie:</i> PROFESSOR EDWARD H. KRAUS.....	486
<i>Special Articles:</i>	
<i>The Change in the Fat of Peanut-fed Rabbits:</i> S. T. DOWELL.....	487
<i>The American Society of Mammalogists....</i>	487

EVER since the time of Faraday it has been known that all varieties of matter can be grouped in three classes on the basis of magnetic behavior, ferromagnetic, paramagnetic and diamagnetic.

It would be far too much to claim that the electron theory has as yet given anything like a complete account of the phenomena witnessed in connection with these three types of magnetism; but it is the only theory proposed which has been in any way satisfactory and which appears to hold out any hope for the future.

In accordance with the plans of this symposium I shall restrict myself to a consideration of the more general aspects of the theory and its simplest applications. For the sake of logical completeness I shall have to refer to many matters well known. The extension of the theory and its application to more special and complex cases, in so far as they can be handled on this occasion, will be treated by my colleagues.

The first electrical theory of ferromagnetism was proposed by Ampère just about one hundred years ago. On the basis of his own experiments on the behavior of electric circuits and magnets, and on the assumption, already justified, that magnetism is a molecular and not a molar phenomenon, he concluded that the molecule of iron is the seat of a permanent electrical whirl and thus essentially a permanent magnet with its axis perpendicular to the whirl. When the iron is fully magnetized, all the whirls are oriented alike, and

<sup>1</sup> A paper read as a part of the symposium on recent progress in magnetism held at the joint meeting of the American Association for the Advancement of Science, Section B, and the American Physical Society, December, 1920. Revised, January, 1921.

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