information about the nervous system of the fly might be gained by recording the position of points inoculated by the spider and the point or points in the lantern at which the scintillations first appear, but the problem is one for a biologist rather than a physicist.

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THE FIRST ARTICLES ON GROUP THEORY PUBLISHED IN AMERICA

IN 1878 the first volume of the *American Journal of Mathematics* was published under the auspices of the Johns Hopkins University. This volume was edited by J. J. Sylvester (1814–1897) and contains two very short articles written by A. Cayley (1821–1895), who was then professor of mathematics at Cambridge University, England, and one of the most eminent mathematicians in the world. Each of these two articles covers less than three pages, and the former was largely embodied verbatim by its author in a longer article which appeared during the same year in the *Proceedings of the London Mathematical Society*. It contains the absurd statement that there are three groups of order 6, notwithstanding the fact that about twenty-four years earlier A. Cayley stated correctly that there are only two such groups, in the *Philosophical Magazine,* Volume 7, page 40 (1854).

The two articles by A. Cayley to which we called attention in the preceding paragraph seem to be the earliest articles on group theory published on the American Continent, but it is not true that the *American Journal of Mathematics* was the first mathematical journal founded on this continent, as stated by H. Weyl in his "The Classical Groups," page 27 (1939). The most conspicuous exception is *The Analyst,* founded at Des Moines, Iowa, in 1874, which appeared in ten volumes and was noted in the "Jahrbuch über die Fortschritte der Mathematik" for 1875 and later. It contains articles by G. W. Hill, S. Newcomb and other well-known mathematicians of that time and was the forerunner of the *Annals of Mathematics,* which is now published by the Princeton University Press.

The fact that no article on group theory was published in America before 1878 throws much light on the early history of mathematics in our country, since articles on this subject began to appear in Europe about one hundred years earlier and soon attracted considerable attention on the part of various European mathematicians living in different countries. This interest was greatly stimulated by the work of N. H. Abel (1802–1829) and E. Galois (1811–1832), both of whom died early but attracted much attention by their tragic lives and fundamental discoveries at an early age. The work of these men was published in Europe about fifty years before work along similar lines was published in America and the latter work had actually been done by a European mathematician and was only published in our country. It took about ten years more until such work was both accomplished and published in this country.

At present important advances made in Europe soon attract attention in America so that the slowness with which American mathematicians entered upon the study of group theory is in striking contrast with present conditions and throws light on the isolation of early American mathematicians. Their interests were for a long time practically confined to the writing of elementary text-books which were frequently based largely on the European text-books which had been in great favor but confined themselves to the treatment of elementary mathematical subjects. About half a dozen mathematical periodicals were published in America before the *American Journal of Mathematics* was established, and some of them had contributors who resided abroad, but the *American Journal of Mathematics* was the first to publish articles by eminent mathematicians residing abroad.

Just as in the case of the first article on group theory published in America the first text-book on this subject to be thus published was written by a mathematician residing in Europe. This text-book appeared in 1892 under the title "Theory of Substitutions" and was a translation of a work by E. Netto. This was about twenty-two years after a similar work had appeared in Europe under the title "Traité des substitutions," by C. Jordan. Enough may have been said to show how the backwardness of the early mathematics in America is reflected in the history of one advanced subject and to emphasize once more the rapid forward strides made by American mathematicians in recent years. The developments in group theory represent some of the most conspicuous advances, especially in the central and the western parts of our country.

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SCIENTIFIC BOOKS

AN ANECDOTAL HISTORY OF ELECTRICITY

Sparks, Lightning, Cosmic Rays. By DAYTON C. MILLER. ix + 192 pp., 183 illustrations. The Macmillan Company, 1939, $2.50.

THE author describes his book as an anecdotal history of electricity. It is based on the Christmas Week Lectures for young people by the Franklin Institute in December, 1937. Both the book and the lectures

form a natural tribute to the honor of Benjamin Franklin.

The material in the book in the main is objective and is chosen from the highlights of history. The settled accomplishments of the human race form easy stepping-stones for the lay reader to reach a fascinating picture of electricity as a part of the world. A museum of electricity outlined from this book would be a grand institution. Not only are abstruse and difficult mathematical derivations omitted, but there are also a minimum of mathematical relationships. Likewise worthy attempts to correlate electrical forces with gravitational forces are not considered.

The first part of the book is designated as "Sparks" or the "Beginnings of Electricity." The illustrations are numerous and in keeping with the writing. Particularly the illustration of "Queen Elizabeth watching Gilbert's Experiments" is appropriate to an anecdotal account. Perhaps the explanation of the electrophorus would have been improved if attention had been given to the fact that Volta devised it as a voltage multiplier which enabled him to establish the relative values of the different metals in the Volta series. Also the reproduction of the scene where Volta was showing the Voltaic Pile to Napoleon Bonaparte would fit. An artist's conception of Madame Galvani discovering the twitching of frog legs when an electrical discharge took place in her kitchen would dramatically mark the advent of the first galvanometer. In the reference to the "attracted disk electrometer" of William Snow Harris and later by Lord Kelvin one may make the valuable implication that the advance in the knowledge of electricity is contingent upon instruments of measurement.

The second part of the book is under the caption, "Lightning," in which simple experiments by Franklin and others lay solid foundation for the science of electricity. Franklin's inspiration for this science was incited at the age of forty when he saw some experiments by Dr. Spence. Within a year he had well stated the theory of positive and negative electricity. Within a few years he experimented in every practicable manner. His procedure was simple and direct, and his interpretation has stood well. He showed that lightning was an electric discharge, and he gave the world an electrostatic motor, the lightning rod, the electric chime and the basis for the "inverse square law" from the "ice pail experiment" as interpreted by Joseph Priestley. Besides the author presents the versatile Franklin as making contributions to bookprinting, flying machines, optics, eye-glasses, chemistry, geology, submarine boats, whirlwinds, stoves, street cleaning, musical instruments, aerial warfare, etc. In reading of Franklin's discussion of science before royalty and the greatest characters of the time, it would seem that as a salesman for science he is a model.

The author quotes Franklin's philosophic attitude, "nor is it of much importance to us to know the manner in which nature executes her laws. It is enough if we know the laws themselves. It is of real use to know that china (ware) left in the air unsupported will fall and break; but how it falls and why it breaks are matters of speculation. It is a pleasure indeed to know them, but we can preserve our china without it. Thus in the present case, to know this power of points (to discharge electricity) may possibly be of use to mankind, though we should never be able to explain it."

The reviewer would like to have seen reproductions of the early precursors of the Vande Graaff electrostatic generator such as were made by Sir William Thomson, Righi or Gray.

The third part of the book treats of modern electrical science up to and including cosmic rays. Maxwell's work is stated necessarily briefly, but the lay reader would hardly suspect him as the greatest intellect of all, whose work guided perhaps more research than any other man. Perhaps if Maxwell's electromagnetic model had been illustrated and explained, the reader might glimpse the great man's plight and vision. Nevertheless, this last part is an excellent short survey and should encourage many to learn more.

A commanding pageant, "Electricity," could be enacted in a three-hour period by selecting characters, apparatus and wording from Dr. Miller's book. Perhaps it would be bold for an ordinary reviewer to suggest that Dr. Miller could direct the staging of a film encompassing the outline and spirit of this book. By such works as these, other men may become inspired by science as Franklin was at forty.

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SPECIAL ARTICLES

AN ANALYSIS OF SKIN PIGMENT CHANGES AFTER EXPOSURE TO SUNLIGHT

WITH the use of the Hardy recording spectrophotometer and the methods set forth in an earlier paper,[1] we have been able to determine objectively the pigmentary changes in the skin after irradiation by sunlight. Here we demonstrate the events following a single one-hour exposure to the mid-day sun (in August, 1938).

[1] E. A. Edwards and S. Q. Duntley, *Am. Jour. Anat.*, 65: 1, 1939.