field only in electromagnetic waves, whereas no such association is invoked in the case of magnetic fields about currents and magnets. An electromotive force is induced by magnetic flux cutting a wire; but in a transformer, the changing magnetic flux within the core is assumed, in some mysterious manner, to perform that invaluable function without cutting the wires. Something is wrong in the exposition of the subject when it does not even attempt to give a direct explanation of the electromotive force induced in a wire cutting magnetic flux. Mathematical equations giving quantitative relationships without rational concepts do not and can never fully satisfy. These facts, together with the great loss of time involved, I believe, rather than recent physical discoveries which could be injected into the old structure if necessary, are the chief reasons for the imminent complete downfall of the historical method.

The logical presentation here outlined attempts to completely coordinate the well-established major phenomena in electricity and magnetism and explains them in terms of only the two most basic observations on electric and magnetic forces. This presentation assumes the elemental charge and its electric field to be inseparable; in fact, the charge and the field are treated as aspects of one and the same physical entity. Superposed elemental fields, therefore, in freely interpenetrating, retain their individual identities. An uncharged body then is surrounded by the individual electric fields of all its electrons and protons. For the purpose of analysis it is convenient to consider the resultant proton and electron fields separately. An electric charge, whether at rest or in motion, in these superposed electron and proton fields is acted on by no effective force. However, when the electron field is in motion in conjunction with its associated uniform electron flow, although a charge at rest still feels no force, a charge in motion, and due to that motion alone, is acted on by a definite (magnetic) force. This is considered the basic observation on magnetic forces. A magnetic field, therefore, is definitely pictured as a quality of a moving electric field, which quality is possessed by virtue of the field motion. The electric charges with their fields and this observation on magnetic forces are the two basic phenomena in terms of which the major phenomena of electricity and magnetism are definitely explained. The concept of the magnetic line of force is derived from the known directions of the magnetic forces acting between moving electrons in a magnetic loop and a wire carrying a current. The known directions of the magnetic forces and the determined directions of the magnetic fields about wires carrying currents give the law for electromagnetic reaction.

Under such a treatment, for example, each electron of a wire moving in a magnetic field has its individual magnetic field. The direction and magnitude of the force acting on the electron are known and the e.m.f. generated in the circuit explained in terms of physical concepts.

Electromagnetic induction, due to a changing intensity of a current, is explained by assuming the electric field to have inertia. The negative field about the wire is distorted by the acceleration, and a component of this distorted portion, being at right angles to the opposing proton field, is not neutralized. A cylindrical effective electric field is formed in this manner about the wire. The distorted portion which contains this field moves outward with the velocity of light and in its path gives to the yet stationary part of the negative field the velocity of the accelerating electrons. Between the distorted portion and the wire, therefore, the electron field is in motion and has the quality which we call the magnetic field about the wire. The distorted portion itself is the electromagnetic pulse, which accounts for induction and electromagnetic waves.

In order to account for the intensity of the magnetic field about a coil of wire, it is necessary to assume the elemental fields to move as expected with their lines of force always parallel to themselves. This must also be the assumption in order to show that $H = \frac{[vF]}{c}$.

The assumption of the elemental electric field, having inertia, as basic, and the attributing of the magnetic field definitely to a quality of the electric field in motion, in conjunction with the concept of superposed fields and the conservation of energy, enables all the major phenomena in electricity and magnetism to be clearly coordinated in a satisfying, logical manner.

OBITUARY

OUTRAM BANGS

OUTRAM BANGS, curator of birds at the Museum of Comparative Zoology, Cambridge, Massachusetts, and one of the foremost ornithologists of the day, died at his summer home at Wareham, Massachusetts, on September 22, 1932, after an illness of two weeks.

Bangs was born in Watertown, Massachusetts, on January 12, 1863, the son of Edward and Annie Outram (Hodgkinson) Bangs. He attended Noble's School in Boston and later Harvard University,

graduating from the Lawrence Scientific School in 1884.

From earliest youth he displayed a great love of nature, which led him out into the woods and fields on all occasions; he had learned to shoot and to prepare specimens by the time that he was twelve years old, and the amassing of a collection of birds thus began long before entering college. After graduation, a brief experience in a business office convinced him that he would be much happier following his natural bent. Fortunately, he was not obliged to work for a livelihood, so he was free to devote his entire time to systematic zoology. He immediately plunged into the field of mammalogy, and remained thus engrossed until the latter years of the last century. He collected mammals extensively in New England, the Maritime Provinces, Georgia and Florida; employed collectors in Labrador, Newfoundland and in the southern states, thus acquiring a collection of some 10,000 skins and skulls, including the 100 or more types of the forms of the eastern land mammals that he had described. Between 1894 and 1899 he published about 70 papers in the field of systematic zoology, 55 of which were on mammals and the remainder on birds.

In 1898 he sent a collector to the Santa Marta region of Colombia, principally to collect mammals, but the few birds that were also sent back so aroused his enthusiasm that he gradually withdrew from the field of mammalogy and began to devote himself more and more to ornithology. In addition to building up his collection of North American birds, he or his friend, John E. Thayer, sent collectors to Panama, the Pearl Islands and Gorgona Island, Honduras, and the West Indies, as well as purchasing collections from various parts of Mexico, Costa Rica, Colombia, Surinam and Brazil.

In 1899, the Bangs collection of mammals was purchased for the Museum of Comparative Zoology, and at the same time Mr. Bangs was appointed assistant in mammalogy; in 1904, his title was changed to assistant in charge of mammals; in 1911, it was again changed to curator of mammals; in 1919, he became curator of mammals and birds; and, in 1924, he was finally successful in his efforts to be relieved of further responsibility for the mammal collection and became curator of birds.

In 1908 his splendid collection of birds, numbering about 24,000 skins, was presented to the museum. By this time he had definitely abandoned mammalogy, and while still nominally in charge of the mammal collection devoted himself exclusively to birds. His success in raising the small and inadequate bird collection he found on coming to Cambridge to a well-balanced collection of birds of the world, ranking among the three largest in this country, was in itself an achievement to be proud of, but when it is recalled that for many years he worked almost entirely without assistance, and single-handed kept the collection so beautifully arranged and systematically labelled that any specimen was instantly available, one becomes even more impressed with his genius and ability. Besides his routine and curatorial work, he felt a certain obligation to ornithologists throughout the world promptly to report on and to publish the results of the many important collections as they came in. His bibliography is a long one, consisting of several hundred titles, some of them papers of considerable length; in addition to describing about 100 forms of mammals, he is also the authority alone or jointly of nearly 400 species of birds.

Bangs's forceful and genuine personality was a large contributing factor to his success in building up the museum's collection; visitors and friends alike were impressed by his interest and enthusiasm, and on more than one occasion persons who sought his advice on hunting trips to foreign parts ended by taking a taxidermist with them in response to Bangs's persuasive powers. Always an active, vigorous man, it is strange that he never went on any extended collecting trips himself. With the exception of his field work in the South while engaged in the study of mammals, he made but one short visit to Jamaica in 1906, and this was cut short by an attack of dengue fever. He was, however, an inveterate hunter and fisherman, and until the onset of the first attack of a circulatory trouble, four years before the one that led to his death, he spent much time wading the icy trout streams of New England during the spring, and tramping the woods after partridges and woodcock in October and November.

By temperament he was philosophical and calm; changes he accepted without complaining; never hurried nor stampeded, he could sit down to a problem and think it out carefully and dispassionately and, aided by his inherent common sense, arrive at the logical answer. Anything savoring of ostentation was entirely foreign to his disposition; he never sought recognition, in fact went out of his way to avoid it; for this reason his professional honors are fewer than those of many a man of far less ability. He was awarded an honorary A.M. from his alma mater in 1918; he was a Foreign Member of the British Ornithologists Union and a Corresponding Member of the Deutsche Ornithologische Gesellschaft. He was a Fellow of the American Ornithologists Union, and a member of the Boston Society of Natural History, Nuttall Ornithological Club, Cooper Ornithological Club, New England Zoological Club,

Washington Academy of Sciences, Biological Society of Washington and the American Society of Mammalogists.

JAMES LEE PETERS

RECENT DEATHS

JOHN RIPLEY FREEMAN, consulting hydraulic engineer, of Providence, Rhode Island, died on October 6, aged seventy-seven years. Dr. Freeman was a member of the National Academy of Sciences and had been president of the American Societies of Civil and Mechanical Engineers.

ROBERT LEE FARIS, hydrographer and geodetic engineer, assistant director of the U. S. Coast and Geodetic Survey, died on October 5 at the age of sixty-four years.

DR. CYPRIEN O'DILLON MAILLOUX, of New York, consulting engineer, formerly editor of the *Electrical World,* died on October 5 at the age of seventy-one years. Dr Mailloux had been president of the American Institute of Electrical Engineers.

MONROE BENJAMIN SNYDER, who had served for many years on the faculty of Central High School, Philadelphia, and later had been engaged at the Franklin Institute in scientific research in physics, chemistry and astronomy, died on September 27. He was in his eighty-fifth year.

ADOLPH LOMB, vice-president of the Bausch and Lomb Optical Company and a son of the late Henry Lomb, cofounder of the firm, died on September 30. He was sixty-six years old.

MRS. MARCIA WOODARD ATWATER, widow of Professor W. O. Atwater, formerly professor of chemistry at Wesleyan University and head of the nutrition investigations of the United States Department of Agriculture, died on September 24 in Middletown, Connecticut, at the age of eighty-one years. She is survived by her daughter, Helen Woodard Atwater, editor of the *Journal of Home Economics,* and her son, Charles Woodard Atwater, of the law firm of Atwater and Clarke, New York City.

THE death is announced of Dr. William Stirling, Fullerian professor of physiology at the Royal Institution, London, at the age of eighty-one years. Dr. Stirling was formerly professor of physiology at Edinburgh.

PROFESSOR MAX WOLF, director of the Königstuhl Observatory at Heidelberg, died on October 3. He was sixty-nine years old.

SCIENTIFIC EVENTS

AMALGAMATION OF THE BRITISH PHYSICAL AND OPTICAL SOCIETIES

A PLAN for the amalgamation of the Physical Society of London and the Optical Society has been drawn up and unanimously recommended by a committee representative of the two societies. The combined societies will be named the Physical Society.

Nature says that it must be understood that the scheme is, as it states, an amalgamation—a fusion of the societies concerned. "In making a balanced estimate of the advantages accruing from such a fusion, it must be remembered that the circumstances in which the Optical Society was founded are scarcely germane to the present situation. However specialized its aims may have been in the earliest years of its existence, the Optical Society, as a glance at its *Transactions* will show, has developed into a general scientific body with an outlook scarcely to be distinguished from that of the Physical Society of London."

The article in *Nature* continues:

In some quarters a fear has been expressed that the fusion of the two societies will leave workers in applied optics without a forum in which to express their views. Nothing could be farther from the truth. Optical science is no longer confined to a narrow sphere of influence but has become the handmaid of all sciences, and optical instruments are now tools of industry. The amalgamation now completed is a visible sign of the union, to their mutual benefit, of the most representative body of producers of optical methods and instruments with the body which represents the largest and most important group of users of such methods and instruments. Under the auspices of the new Physical Society, the Guthrie lecture and the Thomas Young oration will be delivered as heretofore; papers on optical subjects have been a prominent feature in the *Proceedings of the Physical Society of London,* and their number will be materially increased under the new régime; arrangements for special lectures on topics of optical interest have been made, and the session now opening will be inaugurated by a lecture by Dr. J. W. French on "The Manufacture of Optical Glass"; and the probability of an increased output of papers is provided for by an increase of one part per annum in the number of published parts of the *Proceedings.*

THE EMPLOYMENT OF CHEMISTS

AT the Denver meeting of the American Chemical Society, the following statement was adopted as the sense of the council:

As it became manifest that the United States was involved in an economic depression which since has left no country untouched, the American Chemical Society increased its efforts on behalf of chemists not only in the