diagnosis and treatment of surgical cases. Modern surgeons do not think of considering a diagnosis of tissue as final until a competent pathologist has passed on it, and the injustice the surgeon would do his patient if he failed to take advantage of such consultation would not only be a reflection on his own judgment but might result in a judgment against him in civil court. The diagnosis of tissues obtained at operation, and the diagnosis of tissues obtained at necropsy, have furnished the entering wedge, which, hammered in by the bacteriologists and chemists, is gradually pushing into the yet unsolvable question of cancer. This is probably the laboratory man's greatest problem to-day, and the solving of it must, by the very nature of the disease, be undertaken by him.

As an adjunct to the field of medicine, the laboratory has not only aided in diagnosis, prognosis and treatment, but has been so important that one may say without fear of contradiction that modern medicine could not have developed without it. A great deal of value in the laboratory has been missed by the clinician, who has looked on it as the place where some remote person is able to perform "tests" with a positive or negative result. If the clinician will view the laboratory as a place where one may detect and measure the degree of certain varying reactions of the body to stimuli, the true worth of the so-called "tests" will become more apparent. The importance of the clinical pathologist is not so much that he makes diagnoses, although he often does, but that he gathers facts which, when fitted into the general picture, help to portray the true condition.

But one could go on indefinitely in listing the importance, indeed the absolute necessity, of clinical pathology to modern medicine. One could point out the brilliant results which have been achieved in hematology, where we are beginning to see more clearly than ever before the nature of obscure diseases, unfathomable to any but the keenest observers who have devoted their whole energies to such studies in the laboratory. One could stress the necessity of numerous checks on operating room procedures made by skilled bacteriologists or the importance of identification of various bacteria and animal parasites that make their homes in our bodies. Even the elemental fact of the presence of leukocytosis or albuminuria can not be learned unless the laboratory is employed, and if it is not in the hands of a skilled pathologist, what havoc can be wrought!

But there is a greater contribution that the laboratory has made to modern medicine than the wholly practically things I have mentioned. It is the stimulus it has given to explore the unknown, to reach out beyond whatever was known at the time. It is the imagination, grounded in specific, fundamental knowledge, which clinical pathology has given to medicine, that has been its greatest gift. This stimulus has not been confined to the practitioner alone, but has affected the thousands of students passing through the universities, who, catching a spark of fire from the altar of pathology, have gone out inspired to observe more closely and to record for mankind. The laboratory has furnished superior opportunities not only to study the relation of the unknown to the individual patient but to the general sciences which underlie every phase of medical science.

It is with the hope and knowledge that this stimulus to discover the unknown will be preserved and nourished here in New Orleans, that this building was erected and that it is being dedicated in accordance with the conviction of Jean Cruveilhier that a physician without a knowledge of pathology could, indeed, be ever so skilful in practice, but, although he might see many patients, he would see no diseases.

THE TREATMENT OF ELECTRICITY FROM A LOGICAL RATHER THAN HISTORICAL STANDPOINT[1]

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THE historical method of presenting the subject of electricity has some advantages, in that the subject is expounded in the order in which it evolved. Each new field of the subject has its own mystery, in the unfolding of which there is a certain natural logic. The history connected with each field increases the cultural value of the course and adds interest through its human touch. It is, therefore, not the historical order as such that causes the dissatisfaction with the presentation of the subject but rather the facts that the different fields are not properly coordinated and that each set of phenomena is separately described and not explained in terms of basic phenomena which underlie the whole subject. There are even apparent contradictions: a magnetic field is ordinarily considered to be inseparably associated with an electric

[1] A paper read before the American Association of Physics Teachers, New Orleans, on December 31, 1931.

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,