

1904 for research in terrestrial magnetism and allied phenomena, was faced at the outset with the lack of sufficient accurate data on which to base its researches. Various governments had done much in the way of operating magnetic observatories and conducting magnetic surveys in their respective territories, but there were many countries where the governments had not been able or willing to have the needed observations made and the data for the oceans were meager and unreliable.

Thanks to the energetic and efficient world magnetic survey operations of the Department of Terrestrial Magnetism, the needed data have now been supplied for practically all the land and water areas between latitude 60° north and 50° south. One of the immediate practical results of this work has been the furnishing of accurate information regarding the compass variation over the ocean areas, of great benefit to the navigator.

Volumes I, II and IV of the researches of the Department of Terrestrial Magnetism contained the results of observations made on land between 1905 and 1920 and Volume III was devoted to the results of observations at sea between 1907 and 1916. Volume V, recently issued, contains the results of magnetic and electric observations made aboard the *Carnegie* between 1915 and 1921 and reports of several special investigations. The cruises during that period covered over nine thousand two hundred miles and extended into the Atlantic, Pacific, Indian and Southern oceans. A cruise of special interest was the circumnavigation of the Antarctic Continent in 1915 and 1916. The tracks of previous cruises were crossed at many points, thus furnishing information regarding the change of the earth's magnetism with lapse of time. The ocean magnetic survey has now reached the point where this class of observations is the most important one and it is gratifying to know that there is prospect of the resumption of the operation of the *Carnegie* for that and other purposes in the near future.

With the accumulation of observations in terrestrial magnetism and atmospheric electricity, not only from the work of the Carnegie Institution, but from that of the various governments, it has been found possible to study the correlations of the various magnetic and atmospheric electric elements with each other and with solar and other phenomena. The correlations appear to be fundamental to adequate explanation of these observed phenomena.

Volume V contains also a discussion of navigation of aircraft by astronomical methods, which is one of the difficult problems, especially in the Arctic. It also contains a description of the compass variometer, an instrument which fills a long-existing need for the investigation of local magnetic disturbances, hidden magnetic objects and materials and for registering intensity variations with accuracy under field conditions.

N. H. HECK

Sermons of a Chemist. By EDWIN E. SLOSSON, author of "Creative Chemistry," etc., director of Science Service, Washington, D. C. New York, Harcourt, Brace & Co.

DR. SLOSSON has been long known and honored as a clever, straightforward journalist, with a liking for accuracy, and the saving grace, where such is needed, of humor. He has been still longer if not better known as a chemist, and as interested in the human side of all problems he now comes before us as a preacher. For there are no facts in chemistry or anywhere else in the world that do not somehow have human bearings. It is not well to leave these all to the clergy, for even a truth must be seen from several different aspects, and new truths not yet moss-grown or even seasoned constantly sweep into our line of vision. It is no use for us to resist them. Whether we like them or not, if spurious they will soon fade away—if genuine they are here forever. If so it is well for us to know what they signify. And as a guide in this quest, we can ask nothing better than this whimsical, jovial, scholarly and sympathetic chemist.

This volume is made up of twenty-two discourses, actually delivered and all related on the one hand to science, on the other to the spiritual side of scientific knowledge. These range widely from "The Greatest Miracle of the Bible," the creation of man from the dust of the earth (that is from carbon, oxygen, hydrogen, nitrogen, lime and the rest of the ingredients, which pass into and through his body, never to stay) to the "Seven Sons of Satan," which torment and divert the even current of man's life.

The fine humor, overlying a ripe common sense, makes every chapter excellent and profitable reading. Often a new way of putting a new idea suddenly makes it self-evident. Thus:

Science is based not on verified facts but on verifiable facts. If some antiquarian should unearth a death-bed confession of Joseph Priestley, stating that he had never discovered oxygen, and that his paper claiming that discovery was a hoax, most chemists would not care enough about it to read it. Priestley may have been a fraud for all we know, but oxygen is a reality, as we know.

I may quote a few more passages:

Jehovah appears from the first as a decent God, although bloody, while Zeus had a past he could not live down. To ascribe wings to God was a primitive inspiration. To ascribe morals to God was not thought of for a thousand years later. . . . God is not affected by what we think of Him. He is not annihilated when we forget him.

We all specialize in the virtues, devoting ourselves to such as suit our purposes. Some of us favor the lower end of the moral spectrum and display the red badge of courage. Others cultivate the more delicate vibrations of the blue end, purity, constancy and truth. Most of

us are prismatic and changeable, flashing forth one color and sometimes another, perhaps in the course of a lifetime displaying them all, but never all at once and equally in all directions.

The true object of education is the cultivation of the faculty of prevision. If you young people have been properly educated, you have had your heads turned. . . . Providence means seeing ahead. . . . You should be able to distinguish between a rising statesman and a false alarm.

Nations are always conquered from the inside. So long as we are normally strong, we shall be strong in every other way. . . . Those who perpetrate injustice, those who appeal to violence, those who stir up class hatred are the men whom we as a nation have to dread and against whom we have to protect ourselves. Liberty and independence, law and order, are not preserved by written constitutions and statutes, not by police and armies, not by wealth and success, but by the morality of the people. . . . Americanism is one of the fine arts, the finest of all the fine arts, the art of getting along peaceably with all kinds and conditions of men. We Americans have had more experience with the practice of this art than other nations, and it is not undue boasting to say that we have acquired a certain proficiency in it.

If all sermons were so graciously composed and so full of meat as those of Dr. Slosson, the churches would not worry over empty pews.

DAVID STARR JORDAN

STANFORD UNIVERSITY

SPECIAL ARTICLES

ASEXUAL REPRODUCTION WITHOUT LOSS OF VITALITY IN MALARIAL ORGANISMS

THE life-cycle of *Plasmodium praecox*, the protozoan parasite of bird malaria, is similar to that of the plasmodia of the human malarias. Asexual reproduction (schizogony) occurs in the vertebrate host, a bird, and sexual reproduction (sporogony) in the invertebrate host, a mosquito. The infective stages of the parasite, known as sporozoites, when inoculated by the mosquito into the blood of the bird, attack red blood corpuscles into which they penetrate. They grow within the corpuscles at the expense of the surrounding protoplasm until they almost completely fill them. Then the nucleus divides into from ten to twenty daughter nuclei, each of which, with a small amount of cytoplasm, is cut off as a minute merozoite. The average number of merozoites formed by each parasite is about fifteen (L. G. Taliaferro, 1925).¹ These merozoites escape into the blood

stream when the corpuscle breaks down and some of them succeed in parasitizing new cells, thus starting another asexual cycle. Not all the merozoites undergo asexual reproduction; a few of them grow into sexual cells known as gametocytes. The gametocytes, however, do not pass through the stages of maturation, fertilization, etc., as long as they remain in the body of the bird; but if they are sucked into the stomach of the proper species of mosquito, they continue their development, and, after fertilization has taken place, produce by sporogony large numbers of sporozoites. Sexual reproduction thus takes place only in the mosquito and asexual reproduction only in the bird.

Bird malaria has been encountered in the common English sparrow on several occasions in this country; Whitmore in the month of August, 1913, secured parasites from a sparrow in New York which he inoculated successfully into canary birds. In 1918 I obtained infected birds from him and the strain has been maintained in canaries in my laboratory ever since. In 1924 Hartman obtained another strain from a sparrow in Baltimore; this strain has also been maintained since then in canaries.

The transfer of the infection from one bird to another is very simple. A small amount of blood from a vein in the wing or leg is sucked up into a syringe containing normal saline or sodium citrate solution and is then injected into the breast muscle or peritoneal cavity of a fresh bird; a few days later parasites can be found in the blood of the newly inoculated bird.

L. G. Taliaferro (1925)¹ has proved by plotting the mean size of parasites at frequent intervals that the asexual cycle of the strain of *Plasmodium praecox* from New York is thirty hours in length and of that from Baltimore twenty-four hours long. This periodicity occurs not only during the acute attack but also during the latent and relapse periods that usually follow. The normal course of an infection with bird malaria includes (1) a prepatent period between the time of inoculation and that of the appearance of parasites in the blood; (2) an acute period during which the parasite number increases very rapidly, finally reaching a peak, and then decreases until no parasites can be found in the blood by ordinary technical methods; (3) a latent period during which parasites are present in the blood but can be demonstrated only by prolonged and patient search; and (4) a period of relapse, either spontaneous or induced, when the parasites increase until they are again abundant in the blood. The period of relapse is followed by another latent period; and there may be several periods of latency and relapse.

¹ Taliaferro, L. G., 1925, "Infection and Resistance in Bird Malaria, with Special Reference to Periodicity and Rate of Reproduction of the Parasite," *Amer. Journ. Hyg.*, 5: 742-789.