

depth of the penetration of the rays is determined by the number of layers through which the rays penetrate. Thus if the rays penetrate through five layers the photo is a 5 X-ray picture.

#### AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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The fifty-first annual meeting of this organization was held in Pittsburg, Pa., during the week of June 28 to July 3, 1902. It will be recollected that last year the American Association was convened in Denver, Colo., and this year met in Pittsburg in accordance with the time-honored custom of alternating a Western meeting with one in the East.

The sessions of the meeting were begun with a gathering of the Council on June 28, presided over by President Charles S. Minot, who fills the chair of Histology and Embryology in the Harvard Medical School, when matters of routine business, especially those pertaining to the filling of vacancies occasioned by the absence of officers, were considered.

The opening session was held in the charming Music Hall of Carnegie Institute on Monday, June 30, at 10 o'clock, when Prof. Minot, after calling the meeting to order, introduced as the presiding officer of the session Prof. Asaph Hall, U. S. Navy, retired, distinguished among astronomers by his discoveries of the moons of Mars, who is now connected with the Harvard Astronomical Observatory. An eloquent address of welcome was made by Dr. W. J. Holland, director of the Carnegie Museum, representing the Hon. J. O. Brown and the Hon. J. R. Murphy, respectively, recorders of the cities of Pittsburg and Allegheny, which was followed by an address by Col. Samuel H. Church, secretary of the Board of Trustees of the Carnegie Institute, extending hospitalities of that institution as a meeting place to the members of the Association. Finally Col. George H. Anderson, secretary of the Chamber of Commerce, Pittsburg, welcomed the scientists on behalf of the business interests of the great manufacturing municipality of Pittsburg. To these various addresses, a brief but appropriate acknowledgment was made in behalf of the Association by President Hall.

The various Sections then convened for their organization as follows: A, Mathematics and Astronomy, under the presidency of Prof. George W. Hough, of the Northwestern University; B, Physics, under Prof. William S. Franklin, of the Lehigh University; C, Chemistry, Prof. Henry A. Weber, of the Ohio State University; D, Mechanical Science and Engineering, Prof. John J. Flather, of the University of Minnesota; E, Geology and Geography, under Joseph A. Holmes, State Geologist of North Carolina, in place of Orville A. Derby, of Sao Paulo, Brazil, who was unable to be present; F, Zoology, Dr. Edward L. Mark, Professor of Anatomy at Harvard University, in place of Prof. Charles C. Nutting, of the Iowa State University, who was absent; G, Botany, Dr. Charles E. Bessey, Professor of Botany at Nebraska University, in place of Douglas H. Campbell, Stanford University, who was unable to be present; H, Anthropology, Stewart Culin, of the University of Pennsylvania; I, Social and Economic Science, John Hyde, U. S. Department of Agriculture (in the absence of Carroll D. Wright, U. S. Commissioner of Labor); K, Physiology and Experimental Medicine, Dr. William H. Welch, of the Johns Hopkins University.

Sectional Committees were named, who then arranged the titles of the papers submitted to them for publication in the daily programme, after which they adjourned until the following day.

During the afternoon the retiring addresses of several of the Vice-Presidents were read. Among these was that before Section A, Mathematics and Astronomy, by Prof. James MacMahon, on "Some Recent Applications of the Function Theory to Physical Problems," which, owing to the absence of Prof. MacMahon, was presented by Prof. R. S. Woodward. The paper was a purely technical one, and therefore not suitable for a brief abstract. The address by Prof. D. B. Brace before the Section on Physics was on "Group-Velocity and the Wave-Velocity of Light." He traced the history of the measurement of the velocity of light from the time of Galileo to the present day, both by physical and astronomical methods. The highest accuracy at present attained was one part in 5,000. He showed that no method heretofore used in the laboratory had given the absolute velocity of light. He pointed out further that from astronomical observations light of all colors travels with the same velocity. He showed further that the observations by the American observers were superior to those of foreign observers, especially along the lines of electrodynamic experiments upon the velocity of light. Section D, on Mechanical Science and Engineering, listened to Prof. Henry S. Jacoby, who said that the application of scientific principles in the construction of bridges is to-day more complete than ever before, and that it applies to every detail of the work, from the manufacture of the material to the construction of

every member in the bridges, and that the application of science in the construction of bridges is appreciated by the great railroad magnates, who have met the advance heartily, and fully realize the economic advantages resulting therefrom. Prof. Jacoby showed the necessity of bridges of greater durability in every way than heretofore to accommodate the heavily-loaded trains now used. Mr. B. T. Galloway, director of the Office of Plant Industry of the U. S. Department of Agriculture, addressed the Section on Botany on the subject of "Applied Botany—Retrospective and Prospective." He referred to the changes in botanical work during the past twenty years and to the great advancement made in it in ten years just past. He approved strongly of the State experimental stations established in recent years as of great assistance to the botanist. He recommended a course of training in botany for coming generations. The time, he thought, was ripe for it. "We have been informed," he said, "in this section of the possibility in years to come of the wheat crop ceasing to be sufficient to supply the demand, and such a thing comes directly under applied botany, and botanists should devote themselves to finding a kind of wheat which will grow abundantly enough to insure a sufficient crop." The Section on Geology and Geography listened to Prof. Charles R. Van Hise, who spoke on the training and work of a geologist. His abundant experience, both in college and in the field, made it possible for him to treat this subject in a full and comprehensive manner. He defined geology, and spoke of the absolute necessity of being familiar with the fundamental principles of the "basal sciences," in order to make a success in geology as a profession. The basal sciences he explained as being physics, chemistry, astronomy, biology, and mineralogy. He insisted that geologists must spend part of each year in field work and the remaining part in office and laboratory working out their outdoor observations. President David Starr Jordan of the Leland Stanford University was not present, but forwarded his address, which was on the "History of Ichthyology." His great knowledge of this subject made it an exceedingly interesting one to those who are devoted to that branch of Zoology, but it is unfortunately not suited for satisfactory abstraction. The Section on Anthropology listened to Dr. J. Walter Fewkes, who spoke on "Prehistoric Porto Rico." This island, which he had but recently visited, he declared to be interesting from an anthropological point of view. Before the coming of Columbus there developed in this island a culture sufficiently self-centered to be characteristic. Here was found a race living in an insular environment exceptional on the western hemisphere. There was nowhere on the American continent, at the time of its discovery, a people less affected by contact with other cultures or more truly the reflection of climatic conditions. Although the race was the first seen by Europeans, by whom it has been known for the longest time, comparatively little accurate study has been given it by the anthropologist. A great amount of archaeological data yet remains hidden in the soil awaiting the spade of the explorer. Mr. John Hyde, statistician of the Department of Agriculture, delivered the address before the Section on Social and Economic Science. His subject was on "Some Statistical and Economic Aspects of Preventable Diseases," in the course of which he discussed the reduction of such diseases as small pox, diphtheria, yellow fever, and similar contagious complaints, giving statistics from the most authentic of recent authorities, showing the proportion of diminution of these diseases brought about in civilized communities by the introduction of sanitary improvements.

Beginning with Tuesday morning and continuing until the close of the meeting, the various Sections with the affiliated societies, which included the American Physical Society, the American Chemical Society, the Geographical Society of America, the Botanical Society of America, the American Anthropologic Association, and the American Folk-lore Society, met and discussed over three hundred and sixty papers, which is about one hundred and fifty more than were presented at the meeting held in Denver. It is not feasible in the short space at our command at this time to refer to any of these papers, even by title.

The great feature of the meeting was naturally the retiring address of the President. On this occasion President Minot chose as his theme "Consciousness in its Biological Aspects." In opening he referred to the meeting to be held in Washington during Convocation Week, and said for our next meeting we are to break with the long rule of summer gatherings, and assemble instead at New Year's time. To render this possible it was necessary to secure the co-operation of universities, colleges and technical schools to set aside the week of January 1 as "convocation week" for the meeting of learned societies. The plan, owing to the cordial and almost universal support given by the higher educational institutions, has been successfully carried through.

Then, passing directly to his subject, he began with

the statement that consciousness is at once the oldest problem of philosophy and the youngest problem of science. The time is not yet for giving a satisfactory definition of consciousness. Opinions concerning it are many and diverse, but we are all agreed that the fundamental question is, "Does or does not consciousness affect directly the course of events?" Is it a true cause? Thus we encounter at once the problem of free will.

Consciousness ought to be regarded as a biological phenomenon, which the biologist has to investigate in order to increase the number of veritable data concerning it. In that way, rather than by speculative thought, is the problem of consciousness to be solved, and it is because biologists are but beginning to study it that it may be said to be the newest problem of science. It is more important to seek additional positive knowledge than to hunt for ultimate interpretations. The biologist can very often tell why a given function is performed, but how the function exists he can tell very imperfectly. Consciousness is a particular example. The function of consciousness is to dislocate in time the reactions from the sensations. Consciousness is one of the fundamental functions of life, and yet has one of the smallest places in the realm of the biologist, although one of the greatest studies of the philosopher and psychologist. Years of patient labor must be passed through, but the result of the study will be great. Consciousness is to be viewed as a device to regulate the actions of the organisms so as to accomplish purposes which are useful to the organism. It has the power to change the form of energy, and is neither a form of energy nor a state of protoplasm. By this hypothesis there are two fundamentally different things in the universe—force and consciousness. Matter is not added because we have never had any evidence that matter exists. All our sensations are caused by force, and force alone.

As consciousness can initiate the change of the form of energy, it may be that without it the universe would come to absolute rest. Investigate consciousness by comparative observation. Correct, intelligent, exhaustive observation is our goal. When we reach it human science will be complete.

Three popular lectures complimentary to the citizens of Pittsburg were presented by members of the Association. The first of these lectures was by Dr. Leonard P. Kinnicutt, of the Worcester Polytechnic Institute, who spoke on "The Prevention of the Pollution of Streams by Modern Methods of Sewage Treatment." The second of these, given on Wednesday evening, July 2, was on "The Development of American Commerce—Past, Present and Prospective," by the Hon. O. P. Austin, Chief of the Bureau of Statistics of the Treasury Department. A third illustrated lecture entitled "The Recent Disaster in Martinique" was presented by Robert T. Hill, of the U. S. Geological Survey, on Thursday evening, July 3. Mr. Hill led an expedition to Martinique, sent out by the National Geographic Society, accounts of which have already appeared in the daily journals. These lectures were all enthusiastically received.

The Pittsburg meeting will rank as one of the most successful meetings ever held by the Association. The registration showed the presence of 436 members in attendance, which makes this meeting the twelfth in size of the fifty-two meetings previously held. It is the fourth in size of the meetings held during the last ten years. About sixty new members were elected during the meeting, and some eighty members advanced to the grade of fellows. A number of important measures concerning the future of the Association were considered, and amendments to the constitution were adopted, rendering the Council more permanent in its membership, and thus probably more efficient in its work, and also making the Sectional Committees so constituted as to render their greater efficiency a matter of practical certainty.

In accordance with the recommendation of the Council of last year, it was decided to hold the next meeting in Washington during Convocation Week, and for that event Ira Remsen, President of the Johns Hopkins University, was chosen President, and H. B. Ward, University of Nebraska, General Secretary, and some nineteen or twenty other officers were elected to supervise the different sections.

The New York Central & Hudson River Railway Company has awarded a contract for the equipment of its Putnam Division with the Hall system of automatic electro-gas block signals, which are to be operated on the normal danger plan. In this system the semaphore arms are held horizontally to indicate to the engineer danger ahead, or are drawn down by the pressure of carbonic acid gas in each signal post. The electrical equipment of the system consists in a valve which controls the flow of gas from the storage-tank to the cylinder. The valve is closed or opened by an electric current passing through the rails. The circuit is automatically completed by the train as it runs over the block ahead, and the approach of a train from behind.