

the Fox Movietone Company. Several of the designated members responded, and their pictures are already being shown in different cities. Arrangements of this kind may well become an important feature of the work of the association news service in future.

THE GENERAL SESSIONS AT NEW YORK

The association was unusually fortunate this year in the arrangement of its general sessions, a very important task to which President Osborn had given much personal attention for many months. Each of the evening general sessions was planned to represent some particular field of science, but the addresses were so presented, all by men of the highest eminence, as to be of great interest and value to workers in other fields and to educated people generally. The general sessions constitute a very important part of the program of the annual meeting, for they offer excellent opportunities by which those engaged in any branch of science work may become better acquainted with important phases of the progress that is being made in other branches. The general sessions aid the spread of knowledge and appreciation across the marks and boundaries that tend so strongly, in these days of increasingly pronounced specialization, to discourage the cultivation of the broader aspects of scientific thought and to retard a much-needed interchange of ideas between the several groups of men and women of science. The general sessions at New York were freely open to all who wished to attend, to the general public as well as to specialists in science work, and without regard to membership in the association. The following brief reports of these sessions are based on the General Program and on material kindly furnished by Mr. Watson Davis, of Science Service.

On Thursday afternoon occurred a symposium on "The Centenary of the Glacial Theory," given in the auditorium of the American Museum of Natural History, under the joint auspices of Section E—Geology and Geography—and the Geological Society of America. Arrangements for this important symposium had been made by President Osborn and Dr. Chester A. Reeds, local representative of the Geological Society of America. The papers dealt with the development of the glacial theory since it was first advanced by Charpentier and Agassiz a century ago. Important new glaciation maps were displayed and discussed. Other new world maps, on the Lambert and tilted Mollweide projections, were described. Five twenty-minute papers were presented, with an interim of ten minutes for discussion following each paper, by H. F. Osborn, C. A. Reeds, E. Antevs, R. A. Daly and W. H. Hobbs. The symposium closed with an address on "Glaciation in the Northern Hemisphere," by Professor Frank Leverett, of the University of Michigan, chairman of Section E.

Another general session on Thursday afternoon was devoted to an illustrated lecture by Dr. C. E. Kenneth Mees, of the Eastman Kodak Company, on "The Kodacolor Process of Color Photography." This very interesting session was held at the McMillin Theater, 116th Street and Broadway. Dr. Mees is an eminent research leader in the chemistry and physics of photography. Educated at University College, London, under Sir William Ramsay, his doctor's thesis was on the theory of the photographic process, and he soon became a specialist in the theory and manufacture of panchromatic plates and light filters for the photography of colored objects and color photography. Since 1912 he has been engaged in directing research in the Eastman Kodak Company. The process of color photography known as "Kodacolor" is one of the latest developments in amateur cinematography. This is an additive process depending upon the use of three color filters in the objective and of a film on which microscopic lenses are embossed, these lenses forming images of the three filters upon the color-sensitive emulsion. Natural objects are reproduced on the film cut into small sections, each section corresponding to one of the three primary colors. When the film is projected in an apparatus equipped in the same way, with filter on the lens, the light passing through the individual sections is recombined on the screen to generate a picture in color. The process is characterized by convenience and simplicity and is capable of giving excellent results. The lecture was illustrated by lantern slides and the projection of "Kodacolor" pictures.

On Thursday evening, at the American Museum of Natural History, was held the general session marking the official opening of the fifth New York meeting of the association. The session was opened by Dean George B. Pegram, of Columbia University, general chairman of the New York committees on arrangements, who was followed by the Honorable Arthur J. W. Hilly, acting corporation counsel of the City of New York. Mr. Hilly, representing Mayor James J. Walker, spoke on behalf of the city in extending a cordial welcome to the American Association and all men and women of science. President Henry Fairfield Osborn responded for the association, thanking the city and its people for the fine spirit of hospitality shown toward this meeting. The president then introduced the main speaker of the evening, Dr. Charles P. Berkey, professor of geology in Columbia University, president of the New York Academy of Science and secretary of the American Geological Society. Dr. Berkey is chief geologist of the Central Asiatic Expeditions, sponsored by the American Museum of Natural History, and his lecture dealt with some of the results of those expeditions. His title was "Recent Discoveries in the Ancient History of Mongolia."

He showed the classification of the geologic formations and structures for several thousand miles of new country and discussed the interpretation of these in terms of a relatively comprehensive geologic history of Central Asia. The history leads through several very ancient systems affected by intense metamorphism and deformation, and further complicated by long-continued batholithic invasion on a magnificent scale. These events were followed by renewed sedimentation, repeated folding, and at least two great erosion intervals, the last of which reduced the then mountainous region to a peneplain. The subsequent geologic record is preserved in thin patches of continental sediments lodged within the down-warped portions of the great interior depression now forming the Gobi basin. Buried in the sediments are found a great variety of vertebrate fossils that have made the Gobi region one of the finest collecting grounds known. The very last chapter has to do with prehistoric man. Abundant traces of successive human cultures have been found imbedded in the uppermost strata, which were deposited under a changing climatic environment of great significance in correlation. Bronze and stone age men lived in Asia, and their drawings, tools and weapons, estimated to be 40,000 to 200,000 years old, have been found. But "man had been man for ages and had a fairly advanced civilization when the oldest human traces so far found were made in Mongolia." Dr. Berkey's address was a remarkable example of clear and interesting presentation.

The general reception, given by the trustees of the American Museum to the members of the association and the associated societies, followed Dr. Berkey's lecture. The receiving line was in the Hall of the Age of Man, and the reception halls also included the Hall of the Age of Mammals, the Hall of Jewels, Geology Hall and Dinosaur Hall. There was music by the Eddie Davis Orchestra and refreshments were served.

There were four general sessions on Friday afternoon. Professor Herbert Hall Turner, Savilian professor of astronomy at Oxford University, official representative of the British Association for the Advancement of Science at this fifth New York meeting of the American Association, spoke on "The Scientific Retrospect," at the American Museum of Natural History. The lecturer gave an interesting series of sidelights on men of science from Kepler to Einstein, illustrated with lantern slides showing instructive old apparatus. Professor Turner is the dean of British astronomers and he is one of the most distinguished of the astronomers who specialize in precise measurement. Of his many notable contributions to science the most far-reaching is his procedure for the rapid and accurate reduction of astronomical

photographs without the use of complicated formulae. Indeed, the Turner methods of reduction have been the principal factor in giving to photographic measurement the important position that it now holds in astronomy. Professor Turner has also made important investigations on variable stars, on the periodicity of earthquakes, and in other lines, all of which show his unusual skill in the application of sound mathematics to obtain requisite results with a minimum of labor.

At 2 o'clock on Friday afternoon was held a symposium of invited papers on "The Economic Status of Scientific Men and Women," under the auspices of the Committee of One Hundred on Scientific Research, of which Dr. Rodney H. True, of the University of Pennsylvania, is secretary. The symposium dealt with *getting* and *spending* by college and university men and women, with special regard to the relation of income to research effectiveness. The following questions suggest some phases of this important problem: What relation does salary adequacy bear to the enlistment of the best young men and women in college and university work? Are the potential leaders drafted for other work commanding higher incomes? What do college and university people receive in comparison with other groups of trained men and women? How do academic families spend their incomes and do the incomes cover the needs? Are present salaries sufficient to purchase free time and freedom needed for research effectiveness? Is research stimulated by prompt and adequate publication? If so, are the present facilities equal to this demand? If not, should additional facilities be provided, or must publications be further condensed or discouraged? This session was opened by President Osborn, who presided. Besides the remarks of Professor Osborn there were papers on: "Budgets of Academic Families," by Professor Benjamin R. Andrews, of Teachers College, Columbia University; "Salaries and Supplementary Earnings of College Teachers," by Frank P. Bachman, director of the General Education Board, and "The Salary Scale of Trained Men," by Dr. Rodney H. True, of the University of Pennsylvania. An interesting and profitable discussion followed. It is expected that the papers presented at this general session will be published later.

At four o'clock on Friday afternoon, at the Horace Mann School, Dr. C. A. Kofoid, of the University of California, showed the famous Canti motion pictures of cell division and other cytological phenomena, including some aspects of the action of radium on living tissue. These motion pictures were prepared under the direction of Dr. Reginald Canti, of the British Imperial Cancer Institute, and Professor Strange-ways, of Cambridge University. They deal mainly

with the periosteum of the chick and with Jensen's rat sarcoma. The process of mitosis is dramatically depicted, including the emergence and division of the chromosomes and the formation of the daughter cells. The action of radium emanation upon both normal and malignant cells is well illustrated, as are also amoeboid movement, the behavior of phagocytes and the movements of mitochondria.

The showing of the Cinti films was followed by a showing of a new and very valuable series of motion pictures depicting the early stages of the development of the rabbit's egg, prepared by the department of embryology of the Carnegie Institution of Washington. Both of these showings aroused much favorable comment.

In the Casa Italiana, Columbia University, on Friday afternoon at four o'clock, was given the sixth annual Josiah Willard Gibbs Lecture, under the joint auspices of the American Mathematical Society and the American Association. This important address was presented by Professor G. H. Hardy, Savilian professor of geometry at Oxford University, on "An Introduction to the Theory of Numbers." Professor Hardy is one of the greatest of mathematicians and his lecture was very important in its field. It was well attended.

The Friday evening general session was devoted to the presentation of the seventh annual Sigma Xi lecture, under the joint auspices of the Society of the Sigma Xi and the American Association, the lecturer being Dr. Arthur H. Compton, of the University of Chicago, who received the Nobel Prize in physics for 1927. Dr. Compton's subject was "What is Light?" After demonstrations of various types of electromagnetic radiation, including radio waves, heat rays, light, ultra-violet x-rays and gamma rays, he described the experiments (mainly those involving interference) that show the wave characteristics of light. He then proceeded to a discussion of the experiments that have shown the corpuscular character of x-rays. Finally, attention was turned to the fact that this duality, by which light has both wave and corpuscular aspects, is also applicable to electrons. The corpuscular character of electrons has long been known, but their wave characteristics are only now being made evident. "It is only to satisfy our sense of continuity that we assume that an electron or proton has a real existence between the occasions at which it acts on other particles." While moving from one place to another light appears to spread out as waves, but when producing any physical effect it would materialize into discrete particles.

Following this general session a reception was held in Education Hall of the American Museum of Natural History. The exhibition halls of the museum

were open for inspection by members of the association and refreshments were served.

On Saturday afternoon there was a general session at 4:30, in the duplex assembly room of the American Museum of Natural History, at which Professor Franz Boas, eminent anthropologist, of Columbia University, delivered a fascinating lecture on "Migrations of Asiatic Races and Cultures to North America." Dr. Boas is the most competent person in the world to discuss the peopling of America from Asia. He concluded that the Mongoloid races very early migrated in a number of waves into the American continent and were gradually driven southward by the inclemency of the Arctic climate. Later on, when the climate became more temperate, man settled again in the more northern districts of both continents and there was migration in both directions. The outposts of the eastern wave may have been the Eskimo, while the western wave moved across Bering Strait and back into Siberia, where its peoples subsequently amalgamated with the Old World tribes, which also migrated northward when Siberia became again habitable.

The general session of Saturday evening was devoted to an important lecture on "New Tendencies in Biologic Theory," by Dr. William Morton Wheeler, dean of the Bussey Institution, Harvard University. This session was held at the American Museum of Natural History and was followed by a reception, with refreshments, in the Darwin Hall, the Reptile Hall and the new Hall of Fishes. Professor Wheeler said that the meeting ground for the two opposing schools of thought in biology (the mechanists and the historicists, as he termed them) seems to lie in "holism," "emergent evolution," "organicism" and "organismalism." From this intermediate point of view a plant or animal is seen not as a mere mechanism, nor yet as something driven by a pseudo-supernatural force from within, but as something in itself, developing its qualities from the combination of the elements that make it up—qualities that these elements do not appear to possess in the separated state.

The general session on Monday evening, also held at the American Museum of Natural History, was devoted to the address of the retiring president of the association, Dr. Arthur A. Noyes, director of the Gates Chemical Laboratory of the California Institute of Technology. Dr. Noyes has been called the father of American physical chemistry and the most successful American teacher of chemistry. His great influence on teaching methods is felt in every American chemical classroom. He described the development of our knowledge of the chemical elements, passing briefly over its earlier stages but discussing more fully the remarkable recent advances that have re-

sulted from the discoveries of modern physics. He showed, with the aid of lantern illustrations, some of the recent discoveries relating to the structure of the atom, contrasting the view-point of thirty years ago (when the atom was considered to be a rigid sphere) with the present highly developed knowledge of various kinds of radiations, which have shown the atom to be a type of solar system with a central (sun-like) nucleus built up out of hydrogen-nuclei and electrons with other (planetary) electrons circulating around it. He dwelt on the chemical aspects of the subject, since these have received less attention than the physical ones, showing what the new knowledge of the structure of atoms has contributed to chemical science and indicating what this new knowledge may mean for the future development of chemistry. Dr. Noyes's stimulating and informative address has been published in *SCIENCE* for January 11.

Another very enjoyable and profitable reception, with refreshments, followed the Monday evening general session, in Education Hall, the Morgan Memorial Hall and other halls of the American Museum of Natural History.

The final and closing general session of the fifth New York meeting was held at the American Museum of Natural History on Tuesday evening, followed by the last of the series of receptions for which the association is so greatly indebted to the American Museum. President Osborn made some happily chosen remarks on the successful accomplishment of this, the greatest of the association meetings, and he was followed by Dean George B. Pegram, Dr. J. McKeen Cattell and Dr. Burton E. Livingston, who also spoke briefly on the fine outcome of this meeting. The address of the evening was given by Dr. Harlow Shapley, director of the Harvard College Observatory and Paine professor of astronomy in Harvard University, who was introduced by Professor H. H. Turner, official representative of the British Association at this meeting.

Dr. Shapley's address was on "The Galaxy of Galaxies—New Developments in the Study of the Super-Organizations Outside the Milky Way." He is a leader in American astronomical investigation. His principal researches have dealt with photometry and spectroscopy, especially in connection with investigations of the so-called spiral nebulae, which are now known to be extra-galactic universes. He has greatly advanced our knowledge of these extra-galactic systems and has recently done outstanding work in locating the center of our own Milky Way system. The address dealt with our rapidly increasing knowledge of the external galaxies, those very remote systems that seem to resemble our own galaxy in many ways, being considered now as each made up of millions of stars. Among the external galaxies

are included the typical spiral nebulae. Others are like the two Magellanic clouds, which are visible from southern countries to the unaided eye, being more irregular. Dr. Shapley himself has demonstrated that the Magellanic clouds are definitely outside our own universe. Our own galaxy appears to have a diameter from ten to twenty times as great as that of any of the others with which we are acquainted, with the exception of the Andromeda nebula, which may be a fifth as large as our system. In the oceans of space, our galaxy is like a continent, whereas the hundreds of thousands of extra-galactic nebulae may be called "island universes," as Herschel and others termed them a hundred years ago. But these "islands" are not isolated. They are organized into higher systems, into galaxies of galaxies, which are enormously larger than our own galaxy. Analysis has shown that the Coma-Virgo group of galaxies is itself composed of between two hundred and three hundred galaxies. Lying in the same general direction, though much more remote, are at least three other clouds of galaxies, indicating a scattering of such systems through space as far as we can fathom.

"In analyzing the Coma-Virgo region we hit upon the major discovery of all our work—the apparent proof that intergalactic space is effectively transparent. This gives us the assurance that the distances we are measuring are correct and that veils of meteoric dust and of electrons can not obscure the light of remote systems and lead us to false conclusions concerning their distances. This permits us to say that the remotest galaxies we study are more than a hundred million light years distant; that the great Coma-Virgo galaxy of galaxies is ten million light years away and extends throughout two million light years of space; and that the individual systems in this organization have diameters of from five thousand to twenty thousand light years. Our own galaxy probably much exceeds two hundred thousand light years in diameter. It is possible that an enormous galaxy such as ours may have resulted from the condensation or amalgamation of many smaller galaxies, as from the concentration into one system of a hundred or so of the members of a super-system such as that in Coma-Virgo."

ENTERTAINMENT AND SUNDAY FEATURES

This New York meeting was exceptional in its entertainment features. Afternoon tea was served daily in the Philosophy Hall of Columbia University, at the general science exhibition in University Hall, Columbia University, and in the Grace Dodge Room of Teachers College. Tea was served Saturday afternoon at the Museums of the Peaceful Arts. As has been mentioned, a reception followed each of the five

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