MR. ARTHUR JACKSON ELLIS, geologist in the Water Resources Branch of the U. S. Geological Survey, died on July 22, 1920.

THE death of Charles N. Forbes, for twelve years curator of botany on the staff of the Bishop Museum, occurred on August 8.

DR. GEORGE MOREWOOD LEFFERTS, a retired specialist in throat diseases, emeritus professor of the College of Physicians and Surgeons, Columbia University, where he was a member of the faculty from 1874 to 1904, died on September 21 at the age of seventy-four years.

KARL HERMANN STRUVE, director of the Berlin-Babelsberg Observatory, and professor of astronomy in the Berlin University, died on August 12.

WE learn from *The Observatory* of the death of Mrs. Frametta Wilson, who was one of the five women pioneers admitted as fellows of the Royal Astronomical Society in 1916, and was later elected a member of the council. Mrs. Wilson had been awarded the "Edward C. Pickering Astronomical Fellowship for Women" for the college year 1920–21 had been assigned by the Harvard College Observatory.

DR. J. PIERRE MORAT, formerly professor of physiology at the Lyons medical faculty, has died at the age of seventy-five years.

THE British Thomson-Houston Company has decided to establish two scholarships, one of which will be allotted to Cambridge. It proposes to select from the engineering graduates of that university who have worked with the firm for not less than six months a scholar who will be sent to their American associates, the General Electric Company. The company proposes to allow for the student's expenses for one year an equivalent of $1,800 dollars. After a year's study in America he will be expected to return to the British company.

COLUMBIA UNIVERSITY, beginning with the autumn term, will offer in cooperation with Rutgers College and the State University of New Jersey a regular four years' course in agriculture leading to the degree of bachelor of science. The first two years will be given chiefly at Columbia and the second two years at Rutgers. The student who completes the course will receive his degree from Rutgers College. The requirements for admission are the same as those for Columbia College. Students are urged to spend at least a year on a well organized farm before entering Columbia. Working on farms during summer vacations approximates satisfactory farm experience.

UNIVERSITY AND EDUCATIONAL NEWS

THE first section of the new engineering shops which are being constructed at Camp Randall for the College of Engineering of the University of Wisconsin will be ready for occupancy about the first of the second semester. This building is the first step towards moving some of the engineering work to Camp Randall and it will relieve the overcrowded conditions resulting from the heavy enrollment in the College of Engineering since the close of the war.

DR. WILLIBALD WENIGER, formerly head of the department of physics, who left six years ago to engage in research work at the Nela Research laboratory of the National Electric Lamp Division of the General Electric Company, Cleveland, Ohio, has returned to his former position in the Oregon Agricultural College. At this institution Dr. Floyd E. Rowland, assistant professor of chemistry in the University of Kansas, has been appointed head of the department of chemical engineering, and Dr. Nathan Fasten, of the University of Washington, has been appointed associate professor of zoology. Dr. S. M. Zeller, assistant professor of plant pathology has been promoted to be associate professor in charge of orchard disease investigation.

DR. PHILIP HADLEY, formerly professor of bacteriology at the Rhode Island State College and biologist at the Agricultural Experiment Station, has received appointment on the faculty of the department of bacteriology and hygiene, school of medicine, University of Michigan.

Dr. Vernon K. Krieble, assistant professor of chemistry at McGill University, succeeds Dr. R. C. Riggs as Scoville professor of chemistry at Trinity College, Hartford, Conn.

DISCUSSION AND CORRESPONDENCE

ELECTRICITY AND GRAVITATION

The action of gravitation on light is generally regarded as a continuous process but if we consider a ray of light as the limit of a chain of rectilinear rays for each of which the velocity has its upper limit value c, we can regard the gravitational action on the ray as built up of a succession of impulses, each of which changes the direction of the ray. To obtain a definite picture of this action, let us imagine the æther to be built up of electrical doublets travelling along straight lines with velocity c and sometimes colliding with one another. A collision in which the doublets break up and their constituents secure new partners leads to a temporary manifestation of free electric charge. For simplicity we shall suppose that this type of collision takes place only at points where matter is present and that such collisions occur continually so that the manifestation of free electric charge is permanent[1] and approximately steady. At a point not occupied by matter a collision may be supposed to result simply in a change in the direction of motion of the doublets. It is possible, however, that collisions are all of the first type. The elementary type of electromagnetic field is one in which a doublet breaks up into positive and negative constituents which fly away in different directions with the velocity c. The field of an electric charge moving with a velocity less than c can apparently be built up from such elementary fields by superposition and so the assumption of the fundamental character of the elementary field seems legitimate.

From the elementary fields it is possible to build up a type of field in which the electric charge associated with an electric pole fluctuates owing to the fact that the constituents of a doublet are in the neighbourhood of the pole at slightly different times. We shall assume that the electric action between two poles depends on the instantaneous values of the charges and shall endeavor to estimate the effect of the fluctuations. Let us assume that the total number of doublets which break up at an electric pole per unit time is proportional to the mass associated with the pole. This number will also be supposed to be the number of doublets which are created from the constituents of those which break up. Among the doublets which arrive at the second pole B there may be some that have come from A. Let us suppose in the first place that there is no gravitational shielding, then it seems reasonable to assume that the percentage of B's doublets which have come directly from A is proportional to the number which leave A and so is per unit time, proportional to the mass of A. The number of doublets which pass directly from A to B per unit time is thus proportional to the product of the masses of A and B. The doublets themselves will be supposed to be so small that the emission of the different doublets and the arrival of others may all be regarded as independent events. At an instant of time t when a doublet from A is arriving at B the charge on B may be then regarded as equal to $e' + f(t)$ when the charge on A at the earlier time $t - (AB/c)$ was $e - f(t)$. The function $f(t)$ is supposed to have a mean value equal to zero so that e and e' may be regarded as the mean charges associated with A and B respectively. The above expressions for the charges are supposed to hold only for the very short periods of time when the particular doublet under consideration is in the neighborhoods of B and A, at other times the values of the charges are governed by the presence of other doublets.

The mean value of the electric force between A and B over a small period of time, which is

[1] We imagine one component of a doublet to be momentarily separated from its fellow, when another doubtlet comes along the lonely charge secures a new mate and leaves another charge all alone, this charge behaves in a similar manner when it encounters another doublet and so on. In what follows we really consider collisions between doublets and free electric charges.