DR. WALTER B. CANNON, George Higginson professor of physiology at Harvard University and president of the American Association for the Advancement of Science, spoke on "Serendipity" or "An Accidental Sagacity" at the second annual meeting of the Wellesley Chapter of Sigma Xi on April 28.

DR. ALBERT D. MEAD, professor of biology, emeritus, will give the Graduate School Convocation address at Brown University on June 17. His subject will be "The Species Complex."

THE Association for Research in Human Heredity meets at the New York Academy of Medicine on May 5 at 8:30 P.M. Dr. Alan Gregg, of the Rockefeller Foundation, is chairman. The speakers and their subjects are Dr. Nolan D. C. Lewis, the New York State Psychiatric Institute, "Evaluation of Present Research on the Genetics of Mental Disease," and Dr. Leslie T. Webster, the Rockefeller Institute for Medical Research, "The Role of Inborn Resistance in Infectious Disease."

A MEDICAL center, built at a cost of $1,000,000, on Mt. Scopus, Jerusalem, will be dedicated on May 9. Funds for the building were provided by the American Jewish Physicians' Committee and by Hadassah, the Women's Zionist Organization of America.

THE new observatory at the University of Glasgow was opened on April 18 by Sir Arthur Eddington, Plumian professor of astronomy at the University of Cambridge and director of the Cambridge Observatory. Sir Arthur was introduced by Sir Hector Hetherington, principal and vice-chancellor of the university, who said that it was the third observatory of the department of astronomy. It would be used not so much for observation as for instruction and the training of students in the use of astronomical instruments. The new observatory consists of a laboratory, an astronomy room, a dome for the 7-inch refractor and a house for the transit instrument. Before the opening ceremony Sir Arthur lectured on "The Expansion of the Universe."

DISCUSSION

THE FIRST EXPERIMENT IN PLANT PHYSIOLOGY

ACCORDING to texts in general botany and plant physiology and to a representative series of books on the history of biology and the history of botany, the first experiment in plant physiology was performed by Van Helmont in the seventeenth century, the familiar and oft-cited five-year test, during which a five-pound willow shoot grew to a weight of one hundred and sixty-nine pounds, while its supporting soil, starting at two hundred pounds, lost only two ounces. That Van Helmont was first to perform this experiment is so generally accepted that a divergent opinion was a matter of special interest. According to Charles Singer ("From Magic to Science," 1928), credit for this experiment really belongs to a man of two centuries before Van Helmont, Nicholas Krebbs (1401–1464), usually set down as Cusanus or Cardinal Nicholas de Cusa (Cues or Kues). Singer writes: "He records a careful experiment of a growing plant—afterwards pirated by the seventeenth century writer, Van Helmont (1577–1644)—proving that it absorbs something of weight from the air. This is the first biological experiment of modern times, and incidentally the first formal proof that air has weight."

As a matter of interest and record, translations of the statements of Cusanus and of Van Helmont are reproduced below for comparison. The Van Helmont excerpt was made by E. J. Russell, as quoted in *Plant Physiology* (1929). The Cusanus translation comes from an English edition of a small part of his writings published in 1650, six years after Van Helmont's death, and bearing the following title page:

The Idiot, in four books. The first and second of Wisddome. The third of the Minde. The fourth of statick Experiment. or experiments of ballance. By the famous and learned C. Cusanus. London. Printed for William Leake, and are to be sold at the signe of the Crowne in Fleet-Street, between the two Temple Gates, 1650.

From Van Helmont:

I took an earthen vessel in which I put 200 pounds of soil dried in an oven, then I moistened with rain water and pressed hard into it a shoot of willow weighing five pounds. After exactly five years the tree that had grown up weighed 169 pounds and about three ounces. But the vessel had never received anything but rain water or distilled water to moisten the soil when this was necessary, and it remained full of soil, which was still tightly packed, and, lest any dust from outside should get into the soil, it was covered with a sheet of iron coated with tin but perforated with many holes. I did not take the weight of the leaves that fell in the autumn. In the end I dried the soil once more and got the same two hundred pounds that I started with, less two ounces. Therefore the 164 pounds of wood, bark, and root arose from the water alone.

From Cusanus:

Orator. "There is a saying, that no pure element is to be given, how is this proved by the Ballance?"

Idiot. "If a man should put an hundred weight of earth into a great pot, and then take some Herbs, and Seeds, & weigh them, and then plant or sow them in that

pot, and then should let them grow there so long, untill he had successively by little and little, gotten an hundred weight of them, hee would finde the earth but very little diminished, when he came to weight it againe: by which he might gather, that all the aforesaid herbs, had their weight from the water. Therefore the waters being ingrossed (or impregnated) in the earth, attracted a terrestreity, and by the operation of the Sunne, upon the Herb were condensed (or were condensed into an Herb.) If these Herbs bee then burn't to ashes, mayest thou not guesse by the diversity of the weights of all: How much earth thou foundest more than the hundred weight, and then conclude that the water brought all that? For the Elements are convertible one into another by parts, as we finde by a glass put into the snow, where we shall see the aire condensed into Water and flowing in the glass. So wee finde by experience, that some water is turned into stones, as some is into Ice; and there is in some fountaines a hardening and petrifying vertue, which turns the things that are put into them, into stone. For so say they, there is a certain water found in *Hungary,* which through the power of the vitriall which is in it, turneth Iron into Copper; for by such powers and vertues, it is manifest that the waters are not purely elementary, but elementated. And it were pleasant to have the weights of all these waters, of such divers vertues, that by the diversity of their weights in aire & oyle, one might come the nearer to the conjectures of their vertues.''

Whether Cusanus actually performed one or more specific experiments with plants of the type indicated probably can not be certainly determined. It is obvious, however, that he had a true concept of experimental method long before any one else is known to have put it to trial, so far as botany is concerned. That he probably did actually perform many tests with balances seems indicated by the circumstantiality of the phraseology. This opinion seems further confirmed by the fact that this plant experiment was not merely alone; the text contains others so factually correct that they practically eliminate the possibility that his citation of them may have been due to *a priori* reasoning. Two others are given below for their evidence of Cusanus's objective and inductive point of view.

Orator. ''Might not the breath of a man be so weighed?''

Idiot. ''There is one weight of the same man, when he draws in or holds his breath, another when he breathes it out; one weight of a man whilest he lives, another when he is dead; And so in all living things. And therefore it were good to have these differences noted, in divers living things, and divers men, and divers ages of men, that so by conjecture, a man might ascend to the weight of the vitall spirits.'' . . .

Orator. ''How may the strength of a man be known by this means?''

Idiot. ''Make a paire of scales even, then let a man lay hold of one of them, and in the other put as much weight as he can by the utmost of his strength pluck up from the ground till the balance be even: (which will be found more true (say I) if he have a rest to stay one or both his feet against) then take the weight of that which he hath pulled up, and deducting the weight of the man himself, all the remainder of the weight is portioned to his strength.''

When all the circumstances are considered, the question of credit for the first experiment in plant physiology seems to be resolvable about as follows: The works of Cusanus were extant and perhaps fairly well known in the seventeenth century, but his chief reputation then, as to-day, came from his contributions in the field of cosmology and philosophy, known from his influence on Giordano Bruno. In his experimentation, he had been so far ahead of his time that little attention had been paid to such matters of precision. By the seventeenth century, however, the intellectual soil had been cultivated further. Harvey had demonstrated the circulation of the blood. Francis Bacon had strongly advocated the use of the inductive method, and in his Sylva Sylvarum (1627) had described "ten centuries" of experiments, including not a few in plant physiology. Some of these are given in general terms, like the Cusanus account above, but others are as circumstantial as the Van Helmont experiment, and some even include carefully stipulated controls. Botanists will find in this Bacon work the forerunners of a variety of plant experiments. Since Sylva Sylvarum, published posthumously, antedated Van Helmont apparently by twenty-four years, it would appear that the question of priority for the first experiment in plant physiology lies between three men, rather than between two, with Van Helmont probably third in the series.

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METHOD OF ENTRANCE OF CERTAIN FISH INTO AN ESTUARY

THE factors responsible for the migration of fish into an estuary are not as yet fully understood. Various theories, some of them incorporating an "instinctive" behavior, have been put forward to explain certain phases of these migrations, but scientific investigation tends to discredit such theories, and places instead great importance on the influence of certain purely environmental factors.[1,2,3,4]

The mouth of the five-mile long tidal part of the Margaree River in Nova Scotia is of such a nature that it offers an excellent opportunity for studying the passage of certain fish into and out of the estuary. The common estuarine fish of this river is the stickleback, *Gasterosteus aculeatus,* and large numbers are

[1] A. G. Huntsman, SCIENCE, 85: 313–314, 1937.
[2] E. B. Powers, *Publ. Puget Sound Biol. Sta.,* 3: 1–22, 1921.
[3] V. E. Shelford and E. B. Powers, *Biol. Bull.,* 28: 315–334, 1915.
[4] H. B. Ward, *Ann. Mag. Nat. Hist.,* 10: 6, 18–36, 1930.