function?' It was voted after debate that no discontinuous function exists.

At the time of his last illness plans had already been made for an anniversary dinner of the club, at which a loving cup was to have been presented to him as a token of the appreciation, felt by the members, of his quarter century of service as president.

No man could have been more closely identified with Harvard University than was James Mills Peirce. Born and educated in Cambridge, he spent there nearly every winter of his life. From the time of his entrance into Harvard College as a freshman in 1849 until the death of his father in 1880 he lived in the college yard as student, tutor and professor.

He was a man of most sweet and friendly disposition, kind to all with whom he came in contact, slow to anger, aroused only by injustice; a man of wide acquaintance and of many friends, most hospitable in his own home, fond of society and given to sociability. A lover of music and widely read in English literature, he was a man of the broadest intellectual interests.

What marked him most was a great faithfulness. He never faltered in his work, he never lost interest, indeed his enthusiasm grew greater from year to year. The welfare and the usefulness of the university were his dearest concern, and for their advancement was given the whole of a long and active life. He died, as we must suppose he would have chosen to die, working to the end.

J. K. Whittemore.

Harvard University.

Discussion and Correspondence.

Northern Limit of the Papaw Tree.

Some years ago I was surprised to receive from a correspondent, Mr. Kennyon, of McGregor, Ia., a specimen of the papaw tree found native in the vicinity of McGregor. Below McGregor on the Mississippi, between Dubuque and Specht's Ferry, quite a number of specimens of this plant were observed. Some years later, while botanizing in the vicinity of Clinton, Ia., the species was found in flower. I have never seen any fruit at any point near here, but feel warranted in saying that the plants are perfectly hardy and do bear fruit. In all of these cases the plants were found growing on the sides of limestone hills. It may be of interest also to note in this connection that the pecan also occurs on the Mississippi at Savannah, Ill., which is somewhat north of the latitude usually given for it. While it is true that the Indian may have been an agent in the dissemination of the seed of the papaw, it was probably also disseminated in other ways.

L. H. Pammel.

The Crayfish Industry.

In my recent article on 'The Future of the Crayfish Industry,' in Science, June 29, two errors appear on page 984. The value $420 in line fourteen should be $4,200 and the amount of 165,000 in line twenty-two should be 116,400, as *correctly* stated in the statistics of the Bureau of Fisheries.

E. A. Andrews.

Special Articles.

Emission of Electricity from the Radium Products.[1]

Hitherto, the rate of decay of the induced activity produced by radium, has not been studied by means of the charge carried away from the active body by the α and β rays.

The following is a brief report of the results of two series of experiments on the charge of electricity carried by these rays.

In the first series of experiments, a metal wire was made active by immersion in radium emanation; and immediately after removal from the emanation vessel, was placed inside a small hard rubber tube, with very thin walls. The outside of the tube was surrounded by

[1] An abstract of a paper read before a meeting of scientists, at the University of Colorado, on May 5, 1906.

mercury connected metallically to the earth; and the wire on the inside of the tube was connected to a quadrant electrometer. Under these conditions, positive electricity was discharged from the wire, for five or six minutes, and the electrometer indicated the accumulation of a negative charge. After the expiration of ten minutes, the electrometer indicated the accumulation of a positive charge, and the emission from the wire of negative electricity. This is in accord with the accepted views as to the charges carried by the α and β rays. Radium A radiates α rays only, and radium C, both α and β rays. Further, radium A disappears in ten minutes, so that the α rays, coming from radium A and radium C, passing through the rubber, caused a negative charge to appear on the wire for the first few minutes. After ten minutes radium A disappeared, and the positive charge appearing at that time was due to the β rays of radium C, the β rays passing through the rubber more easily than the α rays.

In the second series of experiments, a wire was made radioactive as before, and placed inside of and coaxial with a metal tube, the diameter of which was very slightly greater than that of the wire. The metal tube was made air-tight, and the air within it rapidly exhausted to a pressure of about one tenth of a millimeter of mercury. The wire being connected to the electrometer, and the tube to earth, the deflections of the electrometer indicated a continual accumulation of a positive charge from the very start. A series of careful measurements were made of the rate of discharge of negative electricity from the wire at different instants of time after the wire had been taken out of the emanation. These measurements showed plainly that the rate of discharge of negative electricity was not proportional to the ordinary ionization effect of the induced activity; that is, was not proportional to the quantity of radium A and C present on the wire. The curves, representing the decay of the rate of emission of electricity, are much steeper than those representing the rate of decay of the ionization currents, except for the first ten minutes. They agree, approximately, with the theoretical curves, given by Rutherford, representing the sum of the quantities of radium B and radium C on the wire. From this we may conclude that radium B, which hitherto has been considered non-radioactive, emits, approximately, as much negative electricity as does radium C.

If the tube and wire are placed in a magnetic field, so that the lines of force of the field are parallel to the axis of the tube, the rate of emission of electricity is considerably decreased. Further, an electromotive force of a few volts will stop a portion of the discharge of electricity. From these two experiments, it appears, using the usual formulas, that the ratio of the charge to the mass of the carriers of this negative electricity is, at least roughly, equal to that of the β rays. The experiments, however, give only the order of magnitude of this ratio. The velocity, too, of the carriers is very much smaller than that of the β rays, which explains the fact that the rays do not pass through the thin rubber tube, and do not produce a sufficient ionizing effect, to have been discovered by the ionization of gases. The small velocity indicates that the carriers are probably similar to those called by J. J. Thomson δ rays.

A much more detailed account of the experiments will be published as soon as the absolute quantity of electricity emitted by a given quantity of induced activity has been measured.

WILLIAM DUANE.

THE USE OF ASTRONOMICAL TELESCOPES IN DETERMINING THE SPEEDS OF MIGRATING BIRDS.

DURING the spring and fall of 1905 there was developed at the University of Illinois Observatory a method of determining the heights of migrating birds. Two observers watched the moon's disk at night through small telescopes placed some distance apart, and from the different paths seen projected against the moon from the two stations, it was possible to compute the height and direction of flight for each bird. These methods and results are given in papers by Messrs.