Naturae," and in that edition (1758) Linnaeus termed the creature in question *Volvox chaos,* later changing it to *Chaos protheus* in his twelfth edition. Thus the past nomenclature of Ameba seems to have been almost as protean as the creature itself. I suspect, however, that most of us will go on using the term Ameba or Amoeba, as our respective judgments may dictate. As to Paramecium, since the original spelling was with an *e* and not an *oe* or an *ae,* the correct form is obviously Paramecium.

M. F. GUYER

UNIVERSITY OF WISCONSIN

MORE OHIO MEDUSAE

IN my recent communication on an occurrence of fresh-water medusae at Akron, Ohio,[1] I made reference to the approximate number of such discoveries in the United States. Since I stated mine was the second such occurrence in Ohio, I must make this correction. I inadvertently overlooked others of recent dates.

In September, 1930, some medusae were found in Vermillion River, some in a quarry near Ashland, and in October, 1931, some in a quarry near Toledo, all localities in northern Ohio. These were reported in an abstract by Mr. Robert L. Baird, of Oberlin, Ohio.[2]

WALTER C. KRAATZ

UNIVERSITY OF AKRON

FARADAY'S DIARY

IN a recent review of Faraday's Diary (SCIENCE, Jan. 13) I pointed out that one of the most important experiments in electromagnetic induction, described in the First Series of Experimental Researches, noted as read on November 24, 1831, is entered in the Diary under date of December 26. I ventured to suggest that the date in the Diary must be wrong. After correspondence with Mr. Thomas Martin, the editor of the Diary, I am convinced that it was right. Mr. Martin permits me to say on his authority that considerable additions were made to the First and Second Series of the Experimental Researches in Electricity after the papers were read and before they were published.

No question of priority is involved, and I make this correction only for the sake of historical accuracy.

W. F. MAGIE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

RECENT DEVELOPMENTS IN GRAVITY APPARATUS

THE greatly increased interest taken in the use of geophysical methods in searching for buried geological structure, has resulted in an increased use of gravity apparatus for determining the value of g. For several decades the Von Sterneck invariable pendulum apparatus, or some modification of it, was used by geodesists for determining gravity. The observations were planned to meet the needs of physicists and chemists working in laboratories, and to enable geodesists to determine the figure of the earth or isostasists to study the distribution of densities throughout the earth's crust.

As gravity stations have become more closely spaced, it has been found that there is a definite relation between the gravity anomalies and the density of the rock close to the stations. This relationship is indicated in one way by large differences in anomalies for stations close together, of which there are several notable examples.

The Coast and Geodetic Survey, having had many calls for gravity surveys, assigned E. J. Brown, one of its field engineers, to the task of modernizing its pendulum apparatus, which had been in use since the early nineties. Brown finished his work about a year ago and the apparatus, named after him, has since been given a very severe test in the field, during which about seventy stations were established. The results have been in every way satisfactory. With the Brown apparatus one station a day can be observed, provided the distance between stations is not excessive, while with the old apparatus of the Coast Survey it was impossible to observe satisfactorily more than five stations per month.

The essential features of the Brown apparatus are:

(1) The receiver supports are about in the same horizontal plane as the knife edge on which the pendulum swings. This arrangement greatly reduces the flexure of the apparatus.

(2) The oscillations of the pendulum are made to actuate a photoelectric cell and the impulses are amplified until they operate the chronograph pen. With this arrangement the time signals sent from the Naval Observatory by radio can be compared directly on the chronograph sheet with the oscillations of the pendulum and a chronometer is not needed as an intermediary timepiece.

(3) Another very important feature of the Brown apparatus is that most of the auxiliary parts of the gravity equipment are installed permanently in an automobile truck. These parts include the chronograph, radio apparatus used for receiving the signals, switchboard, batteries, etc. The only important part

[1] SCIENCE, 77: 87, 1933.

[2] *Ohio Jour. Science*, 32: 323, 1932.

of the apparatus that needs to be taken out of the truck on arrival at a new station is the pendulum receiver.

(4) The pendulum receiver is designed in such a way that the pendulum can be clamped in a safe position without removing it, after observations have been made at a station. The receiver containing the clamped pendulum is then placed in an automobile truck and carried to the next station. At the new station the apparatus can be set up and the pendulum released and started in operation within a few minutes. A few electrical connections between the case and the apparatus installed in the truck and the erection of a short antenna completes the necessary arrangements. Ordinarily, the receiver remains evacuated during a whole season, and this helps to maintain a more uniform temperature of the pendulum.

There are several other novel features in the Brown apparatus, but they are of less importance than those mentioned. A brief account of the apparatus will be found in Transactions of the American Geophysical Union, dated June, 1932.

The Brown apparatus at the time of this writing is being used for a gravity survey in Cuba. It is expected that observations will be made at approximately seventy stations in that island, which were selected by the geologists of the Atlantic Refining Company of Cuba. The work is being done by the cooperation of that company, the Coast and Geodetic Survey, the Naval Observatory and Professor Richard M. Field, of Princeton University, chairman of the Committee on Geophysical and Geological Study of Oceanic Basins and their Margins of the American Geophysical Union.

Another new gravity apparatus, called the Lejay-Holweck Gravimeter, is receiving to-day a great deal of attention. This apparatus consists of a base on which is mounted a vertical frame that supports rigidly a short thin strip of elinvar extending vertically upward. Attached to the upper end of the elinvar strip is a bob of quartz whose coefficient of expansion is close to zero. The whole apparatus can be carried in a small box or case and is easily transported by hand.

The bob supported by the elinvar strip oscillates under the combined action of gravity and the elasticity of the strip. The mass of the bob is such that it is almost exactly balanced by the elastic force of the strip. By means of this arrangement the pendulum is given a very long period and in consequence is very sensitive to variations in the pull of gravity. This makes it unnecessary to have a very exact time control for measuring the periods of oscillation. It is stated that the apparatus is one hundred times more sensitive than the ordinary gravity pendulum and, therefore, an error in time may be tolerated that is one hundred times as great as that permissible with the usual pendulum apparatus.

In the *Comptes Rendus* of the Academy of Sciences of January 3, 1933, is a short article by Dr. Lejay telling of a gravity survey that had been made by him in the northwestern part of France. Forty determinations were made with the Lejay-Holweck apparatus in the two months of October and November, 1932. During two weeks of that period no observations were made. As an indication of the rapidity with which the observations were carried on, it is stated that on October 7, 1932, and again on October 11, observations were made at three stations. On each of several other days two stations were established. The average distance between the stations in this survey was about 40 kilometers. During the period, observations were made in Paris on three different dates and the range in the values of gravity at that station was only one part in a million. It is stated by Lejay that wherever he found it impracticable to find a stable support for his apparatus he preferred to secure what he considered a fairly accurate determination with an uncertainty of about two parts in a million of gravity rather than to delay the progress of his work. An accuracy of two parts in a million is really quite satisfactory for most purposes to which gravity data are applied. During the 7,000 kilometers traveled in an automobile during this gravity survey the pendulum did not change.

Lejay states that as a result of his campaign in northwest France one may be assured that it is possible for a single observer without any assistance and without great fatigue to complete one station per day, provided a means of rapid transportation is at the disposal of the observer.

It is understood that the computations for the topographic and isostatic reductions of the gravity stations in France will be made shortly. It will be of interest to learn the results, for until now there have been but few gravity stations in France for which the isostatic anomalies are available.

The Brown and the Lejay-Holweck types of apparatus are the only new ones known to the writer with which extensive and successful field work has been done. Other types of gravity apparatus are in the process of development. One is the apparatus of Fred E. Wright, of the Geophysical Laboratory of the Carnegie Institution of Washington, which is based on the use of horizontal helical springs to balance the pull of gravity on a weight at the end of a lever arm supported in a horizontal position by the torsion of the springs. Wright has developed his apparatus to the point where he was able to make some tests with it outside of the laboratory. No definite information is available as to the character of the results obtained during these tests.

An apparatus has been in the process of development at the office of the Geodetic Institute at Potsdam, Germany. This one has as its essential feature the balancing of a column of mercury against a fixed volume of gas. No definite reports of progress are available, but the writer has been led to believe from conversations and correspondence that the apparatus gives promise of being quite effective.

A new type of gravity apparatus has recently been developed in Norway. A description of the apparatus and of the methods employed in its use is contained in articles by K. Wold and G. Jelstrup, which appeared on pages 269 to 279 of *Gerlands Beiträge zur Geophysik,* No. 36, 1932.

It is well known that one or more of the petroleum companies of this country have been working on gravity apparatus and methods, but no information regarding them is in print. It is known, however, that a method has been employed whereby the oscillations of a pendulum kept swinging at a central field base station are transmitted by radio to surrounding stations at which they are compared directly with the oscillations of the field pendulums.[1] With such a method the required accuracy can be obtained by a short series of observations and any number of gravity parties can operate simultaneously in the field within a reasonable distance of the base. This method should be very effective in making an intensive gravity survey of a comparatively large area, but for the usual gravity work the expense of operating the base station with the transmitting apparatus would scarcely be justified.

It may be said without question that notable progress has been made recently in the improvement of gravity methods and apparatus, and it is very probable that even further advance will be made in the very near future. Gravity surveys will undoubtedly play an ever-increasing part in geophysical and geological studies designed to disclose buried structure, a matter of great importance in the search for petroleum, water and minerals. Anticlines, domes, synclines and masses of heavy rock or ore may be indicated by the values of gravity at stations located immediately above or very close to them.

WILLIAM BOWIE
U. S. COAST AND GEODETIC SURVEY

1 This method was suggested by C. A. Heiland in 1927 in a paper given before the Section of Geodesy of the American Geophysical Union. See Bulletin No. 61 of the National Research Council, pp. 66–71.

SPECIAL ARTICLES

NEW HARDY SEEDLESS GRAPES

A PROJECT[1] in breeding grapes which has for its aim the development of hardy seedless clons of merit has now given 28 seedlings that bear seedless or near-seedless fruits and that are hardy in the climate of central New York. One of these plants has already been reported,[2] but most of them fruited for the first time in 1932.

Seedless grapes of various types occasionally arise directly from seeded grapes, presumably either by mutation, by segregation or by some particular combination of complementary factors. Such plants usually bear viable pollen and hence they may be employed as pollen parents in crosses with seeded plants in the effort to take advantage of any hereditary values which seedlessness may possess in obtaining more seedless individuals among the offspring.

The new seedless grapes thus far obtained in this project are all the progeny of hardy seeded grapes crossed with the tender seedless varieties Sultanina, Rose Sultanina and Black Monukka. According to the investigations of Goodspeed,[3] Susa[4] and Pearson,[5] in these seedless grapes fruits are for the most part produced only after pollination and fertilization, and hence the parthenocarpy is stimulative rather than spontaneous.

Vines of the tender seedless grapes are grown in the courts between greenhouses at the New York Botanical Garden, where they frequently flower at the time when the pollen can be used on hardy grapes in bloom at Geneva. Rather large numbers of seeds (several thousand) were obtained in the crosses, but a large percentage of the F_1 died in the nursery or vineyard, evidently because of tenderness inherited from the vinifera parent. Of the seedlings that survived some have seeded fruits and some have seedless or near-seedless fruits.

The occurrence of seedless grapes in considerable numbers in the F_1 generation of these crosses is a matter of importance to the practical results of the breeding effort. The occurrence of both seeded and seedless individuals in this generation is a result of significance in considering the heredity of seedlessness. It appears that seedlessness of the type here concerned is not a simple character in inheritance and that in these crosses one or both parents are hetero-

1 By permission of the authorities of The New York Botanical Garden the writer has cooperated with the Department of Horticulture of the State Experiment Station at Geneva, N. Y., in this project.

2 A. B. Stout, "A New Hardy Seedless Grape," *Jour. Heredity,* 19: 316–323, 1928.

3 T. H. Goodspeed, Paper presented in Section G, 73rd meeting A. A. A. S., December 28, 1920.

4 T. Susa, "Sterility in Certain Grapes," Mem. Hort. Soc. N. Y. 3: 223–232, 1927.

5 Helen Pearson, "Parthenocarpy and Seedlessness in *Vitis vinifera,*" SCIENCE, 76: 594, 1932.