three students, who all went to work vigorously. Last year I hired several assistants, and when I returned from France I had to put my hand in my pocket. That is I borrowed money at six per cent. This method of high finance may do for high trajectories, but it can not continue forever. I hear much of the National Research Council, but I do not see any money. I am an elderly man, and have experienced three disillusionments connected with the names of great millionaires. "Timeo Danaos et dona ferentes"—I fear organizations even when they offer me money—much more when they don't! Last year I gave a paper at the American Philosophical Society on the work of our ballistic institute, but I have never had the time to have it published.

I did not get to the front in the war—not till last summer. I had no uniform, and few helpers. So I got no glory, but some debts. A propos of Professor Wilson's letter about the University of Strasbourg, I should like to say that I visited it last year, and was shown all over it, and that the French are making it first class. Professor Pierre Weiss is going to have the best facilities in the world for the study of magnetism. I made about two hundred and fifty lantern slides of the places visited by our mission, and have been giving lectures on it ever since. Strasbourg figures largely in them.

ARTHUR GORDON WEBSTER

SCIENTIFIC BOOKS

KNOWLTON'S CATALOGUE OF FOSSIL PLANTS[1]

IN 1898 Dr. Knowlton published "A Catalogue of the Cretaceous and Tertiary Plants of North America." We now have from the same pen a work with the very similar title of "A Catalogue of the Mesozoic and Cenozoic Plants of North America." This is a far more comprehensive work than the former, or than its title indicates. To say that it about doubles the number of known species is but a slight indication of the way in which it mirrors the progress that paleobotany has made in America in the past twenty years, for while very many significant new forms are added, many others that existed in name only have disappeared from the literature. Botanical determinations in many cases have been placed on a firmer footing during the interval and geological occurrences are now given with much greater precision, in fact, in so far as the progress of stratigraphic and areal geology is concerned with plant-bearing units, the present work may be said to show the progress made in stratigraphy during the past two decades.

Only those who know the drudgery of such compilations can appreciate the vast labor that has gone into the making of this book. The author has been one of the most influential factors in the progress of paleobotany in this country during the present generation and that he should have found the time to place this epitome of its present status before the public is a cause for sincere congratulation, not alone to him but to all who may have occasion to refer to the work. Fellow geologists will probably not need to have its merits or usefulness called to their attention, but botanists are not so likely to scan the lists of publications of the U. S. Geological Survey.

There is a stratigraphic table, a bibliography, followed by the body of the catalogue arranged alphabetically. In this part references are given to the original description of each genus, type species are indicated and under each species the synonymy, principal citations and geological and geographical distribution are given. Following the body of the catalogue, the included genera are given in their biological arrangement. This is followed by floral lists for each of the North American Mesozoic and Cenozoic plant bearing formations—a most useful feature of wide interest.

EDWARD W. BERRY

[1] Bulletin U. S. Geological Survey, No. 696, 815 pp., 1919 (1920).

NOTES ON METEOROLOGY

THE WEST INDIAN HURRICANE OF SEPTEMBER, 1919

This hurricane, which seems to have been the largest that has occurred in the Gulf of Mexico since the U. S. Weather service was

established, has been the subject of much study. A rather full account of the storm and its effects is given in the *Monthly Weather Review* by Dr. H. C. Frankenfield, and others in the regions affected.[6] Appearing in the Bahamas on September 6, the hurricane passed through Florida Straits on the 9th, 10th, was lost in the Gulf of Mexico from the 11th to 13th, went ashore on the south Texas coast on the 14th and broke up in the southern Rockies. A surviving portion may have formed the germ for the cyclone with heavy rains[7] which passed from northern New Mexico to the Great Lakes from the 17th to 19th.

Although people in Key West had ample warning, and did everything possible to protect shipping and buildings, the losses sustained were estimated at $2,000,000. The Weather Bureau official in charge, Mr. H. B. Boyer says:

> Hurricane warnings were immediately displayed [on receipt of telegram from Washington at 1:05 P.M. September 8] and the information disseminated by every available means. The response to this warning was immediate and there followed a period of great activity, especially as regards shipping. Vessels were moved to safer anchorage or better secured, and all weak places in residences and buildings of all descriptions were strengthened as much as possible by nailing and battening doors, windows, roof hatches, etc. In the terrific gusts that prevailed during the height of the storm stanch brick structures had walls blown out and large vessels, firmly secured, were torn from their fastenings or moorings and blown on the banks. . . . Winds of gale force and over lasted continuously from about 7 A.M. on the 9th to about 9:30 P.M. the 10th.

The center of the storm passed about 30 or 40 miles south of Key West. The rainfall was estimated at over 13 inches. The Weather Bureau stationed at Sand Key, several miles nearer the path of the center was all but washed away, the island, and all outstanding and superstructures having been carried away or blown down by waves or winds. As the center passed over the Dry Tortugas the pressure fell to 27.36 inches[8] (as observed on the tank steamer *Fred W. Weller*), and the wind about the center was estimated at 125 mi./hr.

> With one or two unimportant exceptions no reports were received from the Gulf of Mexico after the morning of the 10th until after the storm had passed into Texas, which was during the day of the 14th. It was, therefore, absolutely impossible to forecast the intensity and progress of the storm, and the coast stations far from the center of the storm afforded but meager information. (Forecaster.)

As one newspaper put it, "The Weather Bureau suffered from its own efficiency," by holding vessels in port. Of the 10 vessels reported lost or missing, one with 488 people, and the other 25 reported damaged,[9] none had left port in spite of warnings, which were issued at Florida ports September 8 and other Gulf ports September 10. Later, such few logs as were received from vessels caught in the Gulf by the storm indicate that for a time the hurricane was curving toward the Louisiana coast, as surmised by the forecaster, and that it then renewed its course westward, apparently because of a rise in atmospheric pressure in its path, due to the approach of a high pressure area.

Although strong winds and a flood tide occurred at Galveston, Weather Bureau warnings saved three million bushels of grain and many cattle. The damage at Galveston was estimated at $60,000, and that in the vicinity at about $200,000 more.

At Corpus Christi and vicinity the weather on the 13th, the day before the storm was op-

[6] September, 1919, Vol. 47, pp. 664–673, 639–641, 6 figs., 11 charts.

[7] Very heavy downpours locally on the valley of the Solomon River in Kansas, September 17 and 18, caused a sharp rise in that river to 33.6 feet at Beloit—15 feet above flood-stage on the 20th. *Ibid.*, p. 674.

[8] Some other very low barometer readings in other tropical cyclones have been: 27.06 in., Habana, Cuba, October 11, 1846; 26.85 in., Morne Rouge, Martinique, August 18 or 19, 1891; 24.76 in., Vohemare, Madagascar, February 3, 1899; and 26.16 in., S.S. *Arethusa*, lat. 13° 35′ N., long. 134° 30′ E., December 16, 1900.

[9] *N. Y. Maritime Register*, September and October issues.

pressive in spite of a steady north wind and unusual, close-sticking swarms of flies were bothersome. On the Gulf coast the hurricane tide began to rise about noon on the 13th and the sea became very choppy. During the late afternoon a dark line widening into a band in the eastern sky was to be seen slowly rising. The story of 284 lives lost and $20,000,000 property damage at Corpus Christi and vicinity, as reported soon after the storm does not need to be repeated here. The extremely high tide, "15 feet," covered the low ground and allowed the great waves to demolish 900 houses, and numerous substantial commercial establishments.

A map shows that the heaviest rainfall, September 14–17, in Texas was 12 inches, and in New Mexico, nearly 10 inches. More seems to have fallen in the mountains of northern Mexico, for a great flood rise suddenly on the Rio Grande, at Eagle Pass the rise being 27.2 feet in the 24 hours ending at 7 A.M., the 17th. For about 100 miles above the mouth of the river it is said to have widened to 40 or 50 miles. In connection with the hurricane at least two tornadoes occurred—one at Goulds, Florida, and the other near Hobbs, in southeastern New Mexico.

Mr. R. H. Weightman made a study of the wind conditions over the United States, Central America and the West Indies preceding and during the hurricane, using cloud observations, pilot balloon and kite data for the winds aloft. There was a deep (6 km. or more) circulation of easterly or northeasterly winds throughout the southern states as the center of the cyclone approached and passed several hundred miles to the south.[10]

CHARLES F. BROOKS

WASHINGTON, D. C.

SPECIAL ARTICLES

TECHNIQUE OF OPERATING ON CHICK EMBRYOS

DURING the past five years, a number of workers in the department of anatomy at the University of Missouri have studied problems which involved operations on chick embryos. Since, for many of these studies, it was necessary that the chicks should continue to live and develop to a late stage of embryonic life or to the time of hatching, it was most desirable to develop a satisfactory technique. This has apparently been accomplished and it therefore seems worth while to record these methods briefly for the benefit of other workers in experimental embryology.

Operations are carried out under the binocular microscope, enclosed in a warm box, heated by electric light bulbs. Light is furnished by a desk arc light. A flask containing dilute copper sulphate serves to concentrate, cool, and properly color the light.

The egg is taken from the incubator and candled. By this means the location of the embryo and the extent of the air chamber may be seen and these are marked with pencil on the egg shell. The egg is then placed in a dish containing water, warmed to 38°–40° C., and deep enough so that the air chamber is completely immersed. The egg may be held in place in the water by tucking gauze around it. Mr. E. C. Albritton has devised a simple and ingenious wire frame for this purpose which fits over the edge of the dish, with an inner suspended portion into which the egg fits, the egg being held in the desired position by rubber bands. He also devised a simple steam-heating apparatus for keeping the water warm which obviated the necessity of using a warm box.

The portion of the egg containing the embryo, which is exposed to the air, is swabbed with alcohol and allowed to dry. A small opening is then made in the egg shell by means of a needle or sharp pointed knife. The shell fragments are picked away with forceps, care being taken not to tear the shell membrane beneath. An opening 7 mm. in diameter is sufficiently large for most operations. A drop or two of sterile Ringer's solution is then dropped in the opening, after which the shell membrane may be stripped off with ease.

[10] *Monthly Weather Rev.*, October, 1919, Vol. 47, pp. 717–720, 11 figs.