$$\begin{vmatrix} 4 & 1 & 0 & 0 & 0 & \dots \\ 1 & 4 & 1 & 0 & 0 & \dots \\ 0 & 1 & 4 & 1 & 0 & \dots \\ 0 & 0 & 1 & 4 & 1 & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \end{vmatrix}$$

of order $n-1$. We will represent it by Δ_{n-1}. The solution of the system of equations for any unknown, say M_r, will be a fraction with Δ_{n-1} for the denominator. The numerator of the fraction will be a determinant of order $n-1$ with the same elements as Δ_{n-1} except that each element in the $r-1$th column is 1. By expanding Δ_{n-1} it is easy to see that the general formula

$$\Delta_n = 4\Delta_{n-1} - \Delta_{n-2}$$

holds. Since $\Delta_1 = 4$ and Δ_0 may be defined as 1, any Δ may be computed.

For computing the determinant in the numerator we let D_n represent a determinant of the nth order which has the same elements as Δ_n except that each element of the first column is 1. Expanding D_n, it is found that

$$D_n = \Delta_{n-1} - D_{n-1}.$$

D_0 is to be defined as 0. Now expanding the numerator of the fraction representing M_r in terms of minors of the upper $r-2$ rows, we find

$$M_r = \frac{\Delta_{r-2}D_{n-r+1} - D_{r-2}\Delta_{n-r}}{\Delta_{n-1}},$$

and multiplying this result by $-wl^2/2$ we have the general expression given at the beginning of this article. In computing a table from this formula it is of course not necessary to compute all the Ms, for the bending moments at supports equidistant from the ends are equal, that is,

$$M_r = M_{n-r+2}.$$

Arthur R. Crathorne
University of Illinois

SOCIETIES AND ACADEMIES

THE BOTANICAL SOCIETY OF WASHINGTON

The sixtieth regular meeting of the society was held at the Ebbitt House, February 19, 1910, at eight o'clock P.M.; President Wm. A. Taylor presided. The following papers were read:

Sprout Leaves of Western Willows: C. R. Ball, U. S. Bureau of Plant Industry.

A knowledge of the range of variation in the leaves of willows is important because a large proportion of the herbarium material must be determined from foliage specimens only. This is due to the precocious flowering of many species and the quick disappearance of the staminate aments from all, thus leaving fully half the plants in this diœcious genus with only the leaves as determining features. The pistillate aments also are gone from plants of the diœcious species before most collectors reach the field. The leaves of the so-called water sprouts are interesting because of their wide departure from the normal, especially in size and to some extent in form also.

A series of collections shows that the proportion of breadth to length found in the normal leaves is maintained in sprout leaves from the same individual in several species of the sections Pentandræ, Longifoliæ and Cordatæ from the western United States. A variation of form was found in a specimen of *S. scouleriana* (section Capreæ) from Arizona, in which the normal leaves are obovate, but those of this sprout were broadly ovate. The paper was illustrated by numerous specimens.

Bull-horn Acacias in Botanical Literature, with a Description of two new Species: W. E. Safford, U. S. Bureau of Plant Industry.

There has been much confusion as to the identity of certain acacias of Mexico and Central America having large inflated horn-like stipular thorns, which are usually inhabited by ants. Linnæus placed all which had been described previously to the publication of his "Species Plantarum," under a single species *Mimosa cornigera.* Schlechtendal and Chamisso recognized the fact that the supposed synonyms cited by Linnæus included more than one species. These authors described two species found in the collections of Schiede from the state of Vera Cruz, Mexico, which they named *A. spadicigera* and *A. sphærocephala.* They leave it in doubt whether either of these species is the *Arbor cornigera,* figured and described by Hernandez (ed. Rom., p. 86, 1656), which in all probability is identical with the first plant cited by Linnæus, under his description of *Mimosa cornigera.*

In the National Herbarium are specimens of a bull-horn acacia from the type region of Hernandez's plant, collected by Dr. Edward Palmer. There are also at least two others quite distinct from any species hitherto described, one of them from Guatemala, with the inflorescence in spherical heads and with very long slender dehiscent pods; the other from the state of Chiapas, southern Mexico, with spadix-like inflorescence and

stout dehiscent pods. *Acacia cornigera* L. differs from both of these in having inflated indehiscent pods terminating in a spine-like beak, as well as in the character of its inflorescence and of the extrafloral nectaries on its leaves.

Acacia cookii sp. nov. Flowers in spherical heads on long stout peduncles clustered in the axils of large slender thorns resembling the prongs of a fork which usually straddle the stem; leaves large, with many pairs of pinnæ and many elongated nectar glands borne on the upper side of the grooved rachis; pods linear, 30 cm. or more in length, slightly curved, dehiscent. Based on specimens collected by Mr. O. F. Cook at Secanquim, Alta Verapaz, Guatemala (in alcohol), and by Mr. G. P. Goll, at the Finca Trece Aguas, in the same region, March 8, 1907 (No. 102).

Acacia collinsii sp. nov. Flowers in spadix-like spikes, usually in clusters of four or five, the oldest spike usually sessile or nearly so, the rest on long stout peduncles; bractlets of the inflorescence peltate circular, covering the unopened flowers, but concealed after anthesis; leaves with several round bead-like nectar-glands at the base of the petiole and a single gland on the rachis at the base of each pair of pinnæ; thorns stout, U-shaped; one of the arms usually perforated by ants, as in the case of other "bull-horn" acacias; pods stout, thick, short, straight or slightly curved, dehiscent, filled with yellow sweetish aril in which the seeds are imbedded. This species is based on specimens collected by Mr. Guy N. Collins between Chicoasen and San Fernandino, in the state of Chiapas, southern Mexico, January 14, 1907 (No. 180). A species resembling *Acacia hindsii*, but differing from that species in the form of its thorns, the thickness of its peduncles, and the form and stoutness of its pods.

The Categories of Variation: W. J. SPILLMAN, U. S. Bureau of Plant Industry.

Recent work indicates that the variations with which Darwin dealt may be separated into several categories which have different relations to evolutionary change. The work of Nilsson, Johannsen and Jennings seems to have demonstrated that there is a class of variations, due wholly to environment, that are not hereditary and on which selection is without effect. These variations are coming more and more to be called "fluctuations."

It is also pretty well established that when an organism is removed from its old environment to an entirely new one it may undergo rather marked changes, apparently as the result of changed environment. The meager information at hand indicates that several individuals having exactly the same inheritance undergo the same change when transplanted to a new environment and that the change is permanent under the new environment. Some recent investigations indicate that in cases of this kind, when the organism is transferred back to its old environment, it changes back to its old form. Much more investigation is needed before this type of variation, which is sometimes called "new-place effect," can be properly catalogued.

A third type of variation is that due to recombination of Mendelian characters. These recombinations frequently result in the production of new forms which are stable and must therefore be looked upon as one means of progressive evolution.

Apparently a fourth type of variation is that discovered by de Vries in *Œnothera*. The investigations of Gates and Miss Lutz point to the assumption that the variations studied by de Vries are due to the loss, gain or exchange of chromosomes in mitosis.

There are probably many other types of variation which have not yet been recognized. On *a priori* grounds it would appear almost certain that changes in the chemical composition of the germ plasm or in the relative amounts of substances present in the germ plasm are of fundamental importance in evolution, and that in the main evolutionary progress is due to them. These changes may take place in any part of the germ cell which has a determining influence on development. It was suggested that when such a change occurs in the composition of a chromosome the new form resulting would give Mendelian phenomena when crossed with the old form, but if the change occurs in cytoplasm Mendelian phenomena would be lacking, and there is some evidence that this is the case. A case in point is that of albomarginate leaves studied by Baur. The behavior of the cross is such as to indicate that the albomarginate character is cytoplasmic, and the inheritance of this character is non-Mendelian.

W. W. STOCKBERGER,
Corresponding Secretary

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

AT the 445th regular meeting, held March 29, 1910, the first paper of the evening was on "The White-dog Feast of the Iroquois," by Mr. J. N. B. Hewitt.

The white-dog sacrifice of the Iroquois is a

congeries of independent rites, ritually interrelated at this ceremony, designed to renew through the orenda or immanent magic power of these rites the life powers of living beings, the fauna and flora of nature, which are ebbing away to their extinction by the adversative action of the powers of the winter god. The embodiment of all life is Teharonhiawagon, or the "Master of Life." One of the functions of a tutelary is to reveal in a dream what is needful for the restoration of the life force of its possessor. The tutelary of Teharonhiawagon reveals to him in a dream that a victim, primarily a human being but symbolized by a dog in modern times, with an offering of native tobacco, would restore the life forces which he embodies, and with a performance of all the sacred rites of the people at this time for the purpose of disenchanting all his aids and expressions—the bodies and beings in nature. These rites therefore seek to compel the return of the sun, the elder brother of man, to the north from his apparent departure southward. The rites performed at this new year ceremony are the rekindling of new fires on the hearths of the lodges, the disenchantment of individuals by passing through the phratrial fires lighted in honor of Teharonhiawagon in the assembly-hall, the rechanting of the challenge songs of individual tutelaries to rejuvenate them, the "divining of dreams" for the restoration of the health of individuals, and for the purpose of ascertaining the revealed tutelaries of persons and children who have no tutelaries, the sacrifice of a victim to restore the health of Teharonhiawagon, and finally the performance of the four ceremonies of the tribe, the latter consuming the better part of four days in their performance. Such is in brief the ceremony of the Iroquois Onnonhwaroia, or new-year festival.

The second paper was presented by the president of the society, Dr. J. Walter Fewkes, on "The Return of the Hopi Sky-god."

The Hopi, said the president, shared with many other tribes of North American Indians, the idea of an annual return in spring time of a sky-god to revivify the earth. This conception, which is wide-spread among the pueblos, accounts in part for the belief in a future advent of Montezuma, or a fair-god, and explains certain ceremonial representations prominent in sun worship. It is so deeply rooted in Hopi myths that we find the return of the sky-god dramatized by a personation of this being accompanied by elaborate rites. From the composite nature of the Hopi ritual, dramatizations of this advent are duplicated, varying somewhat in detail, although remaining the same in general intent.

The sky-god is regarded by these Indians as the god of life, who by magic power annually rejuvenates the earth, thus making possible the germination and growth of crops which furnish the food supply of the Hopi. Some variants of this drama are performed at Walpi in late winter; others in early spring. One of the several presentations, mentioned by Dr. Fewkes, was the personation of the sky-god which occurs about Easter in a complex drama called the Powamu. The main object of this ceremony is to discharm or disenchant the earth which throughout the winter is supposed to have been controlled by a malevolent being. In this ceremony the sky-god, under the name of the returning one, is supposed to lead his followers, the clan ancients, or Kachinas to the pueblo, fructifying the earth and thus bringing back the planting and much-desired harvest time. Clad in prescribed paraphernalia, the personator of the sky-god, wearing the mask of the sun, enters the pueblo at sunrise from the east, and proceeding to every sacred room and clan house, receives the prayers of the owners of the dwellings, for abundant crops, giving in return, as symbols of a favorable reply, sprouting corn and beans. As he does so he marks each doorway with sacred meal and bowing to the rising sun, beckons to his imaginary followers to bring blessings to the people—blessing always being abundant crops and copious rains.

Certain clans now living in a pueblo near Walpi called Sichumovi, whose ancestors claim to have originally come from Zuñi, celebrate the return of their sky-god with slight variations, but with the same intent. The symbolism which distinguished the personators of the sky-god and his followers in this pueblo was brought by clans from Zuñi several years ago. Other clans that according to legends migrated to Walpi from southern Arizona perform a characteristic dramatization of the return of their sky-god, the advent of which occurs at the time of the winter solstice. Here the personator of the sky-god represents a mythic bird, whose realistic return is dramatized in the kiva or sacred room. At sunrise on the following morning, accompanied by two corn maidens, the sky-god, no longer a bird personator, distributed seed corn to representatives of the clans of the pueblos.

The ceremonies accompanying the return of the sky-god at the winter solstice are many and com-

plicated. Some of these are designed to disenchant the earth, while others draw to the pueblo the gods of germination. The prayers are said to the plumed serpent, represented by an archaic effigy, to fertilize the earth. A personation of the sky-god carrying the effigy of the plumed serpent, emblematic of lightning, forms one act of the great theatrical ceremony in the month of March; this act is performed at night in the kivas in the presence of the whole population of Walpi and neighboring villages, and represents the return of the sky-god, and the renewal of life on the earth made dormant by the sorcery of evil-minded gods.

I. M. CASANOWICZ,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 468th regular meeting of the society was held March 19, 1910, in the main hall of George Washington University, with President T. S. Palmer in the chair and a good attendance of members. Sixteen new members were elected.

Under the heading brief notes and exhibition of specimens Professor W. J. Spillman exhibited specimens of hoofs and foot bones of the solid-hoofed, or mule-footed, hog, a breed now well established but by no means new, since it was known 2,000 years ago.

H. W. Clark reported that he had observed numerous birds and insects feeding on sap that had oozed from a wounded spot on a red-oak tree. Among the birds were the humming bird, woodpeckers and flycatchers.

The following communications were presented:

The Birds of Midway Island: PAUL BARTSCH.

This paper was illustrated with photographs and specimens to show the use of the McIntosh reflectoscope.

The International Fisheries Regulations: BARTON W. EVERMANN.

The paper by Dr. Bartsch was discussed by President Palmer and others; that of Dr. Evermann was also discussed by the president.

THE 469th regular meeting of the society was held April 2, 1910, in the west hall of George Washington University, with President Palmer in the chair.

Under the heading brief notes, Dr. C. Dwight Marsh reported the receipt of some interesting copepods from Dr. V. L. Shelford, of Chicago University. Among them was the species *Diatomus Righardi*, obtained from northern Lake Michigan.

President Palmer reported that Professor John B. Watson, of Johns Hopkins University, would act as warden of the Tortugas Bird Reservation during the present season, and under the auspices of the Carnegie Institution would continue his investigations of the homing instincts of the noddy and sooty terns. These birds, carefully marked, will be carried farther north on the Atlantic coast and inland than in former experiments and also to the north and west sides of the Gulf of Mexico with a view to determining the length of time in which they find their way back to the nesting grounds.

The following communication was presented:

A Hasty Visit to some Foreign Zoological Gardens (illustrated with slides): A. B. BAKER.

Mr. Baker's recent visit to Nairobi, Africa, to bring home the animals presented to the National Zoological Park by Mr. W. N. McMillan, afforded an opportunity to visit some of the foreign zoological gardens. Brief visits were made to those at Manchester, London, Antwerp, Rotterdam, Amsterdam, Berlin, Halle, Frankfort, Hamburg, Leipzig, Breslau and Vienna in Europe and to the Gizeh gardens in Egypt. A description of the grounds and buildings was given. The illustrations were mainly from ordinary picture post cards, thrown on the screen by a reflectoscope.

D. E. LANTZ,
Recording Secretary

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

THE thirty-seventh meeting was held at the Physiological Laboratory of the New York University and Bellevue Hospital Medical College on Wednesday, February 16, 1910, at 8:15 P.M., with President Lee in the chair.

Members Present: Atkinson, Auer, Banzhaf, Cole, R. I., Flexner, Gies, Hiss, Jackson, Joseph, Lee, Levin, Lusk, Mandel, A. R., MacCallum, McClendon, Meltzer, Morgan, Morse, Opie, Park, Rous, Shaklee, Stockard, Van Slyke, Wallace, Weil.

Officers elected: President—Dr. T. H. Morgan; *Vice-president*—Dr. W. J. Gies; *Secretary*—Dr. E. L. Opie; *Treasurer*—Dr. Graham Lusk.

New members elected: Dr. J. V. Cooke, Dr. A. R. Dochez, Professor J. B. Leathes.

Scientific Program

"A New Method for Determining the Activity of Ferments and Antiferments," R. Weil and S. Feldstein.

"Resistance to the Growth of Cancer Induced in Rats by Injection of Autolyzed Rat Tissue," Isaac Levin.

"Parenteral Protein Assimilation," P. A. Levene and G. M. Meyer.

"The Inhibitory Effect of Magnesium upon Indirect and Direct Irritability of Frog Muscle and the Antagonistic Action of Sodium and Calcium upon this Effect," Don R. Joseph and S. J. Meltzer.

"On the Vaso-motor Nerves of the Stomach," R. Burton-Opitz.

"The Change in the Venous Blood-flow on Administration of Amyl Nitrate," R. Burton-Opitz and H. F. Wolf.

"The Fate of Embryo Grafted into the Mother," Peyton Rous.

"The Behavior of Implanted Mixtures of Tumor and Embryo," Peyton Rous.

"Vaughan's Split Products and Unbroken Protein," Edwin J. Banzhaf and Edna Steinhardt.

"Notes on Sensitization with Tuberculin to Tubercular Rabbit's Serum," J. P. Atkinson and C. B. Fitzpatrick.

"Remote Results of the Replantation of the Kidneys," A. Carrel.

"Temporary Diversion of the Blood from the Left Ventricle to the Descending Aorta," A. Carrel.

"Remote Result of the Replantation of the Spleen," A. Carrel.

"The Mechanism of the Depressor Action of Dog's Urine with Remarks on the Antagonistic Action of Adrenalin," R. M. Pearce and A. B. Eisenbrey.

"On the Elimination of Bacteria from the Blood through the Wall of the Intestine," Alfred F. Hess.

Eugene L. Opie,
Secretary

THE AMERICAN CHEMICAL SOCIETY
RHODE ISLAND SECTION

A special public meeting of the section was held in Rhode Island Hall, Brown University, on the evening of March 4, 1910, at 8 o'clock.

Professor Charles E. Munroe, dean of the graduate department of George Washington University, Washington, D. C., and consulting expert for the United States government at the Pittsburg Testing Station, Pittsburg, Pa., gave a stereopticon lecture on the subject "The Testing of Explosives for Use in Coal Mines, with special reference to the Prevention of Mine Disasters."

The lecturer first called attention to the enormous increase in the production of coal in the United States and then, in the discussion of the casualties attending coal mining, pointed out that whether the comparison was made on the basis of output or on the basis of the number of men employed, the loss of life was greater in the United States than in European countries. In 1907, under the auspices of the United States Geological Survey, an investigation was begun at the George Washington University to determine the reason for the difference. It was found, he said, that a reason lay in either the improper use of explosives or the use of improper explosives. While the university's investigation was being carried on, a series of serious disasters occurred at the Monongah mines, West Virginia, the Darr and Naomi mines in Pennsylvania and the Yolande mine in Alabama, in which 623 men were killed. These mine horrors aroused public opinion to such an extent that a suitable appropriation was made for an experimental inquiry into the nature of the explosives offered for use. A well-equipped testing station was opened on the arsenal grounds at Pittsburg, Pa., and since that time testing of explosives has been carried on with a view to determining which is most suitable for use in coal mines. After testing these explosives to determine the power and sensitiveness of each, in comparison with a certain grade of dynamite, which is taken as a standard, charges of known weight are fired, by detonation, from a very strong gun, into a mixture of natural gas, such as occurs in coal mines, and air, or natural gas, coal dust and air, or simply a mixture of coal dust and air, which mixtures are confined in a long cylindrical gallery made of boiler plate, to ascertain whether or not the charge of explosive when fired will cause the explosion of the mixture in the gallery. The gallery represents a gallery in the mine, and the hole in the gun represents the bore-hole in the coal in the mine. A limit charge of explosive is fixed upon, and if this quantity of explosive causes an explosion in the gallery, the explosive is rejected, but if it does not cause an explosion, the explosive is styled a permissible explosive, and is recommended for use. Since the establishment of the testing station at Pittsburg, 171 different explosive substances have been tested, and of these 51 have been put upon the list of permissible explosives.

Albert W. Claflin,
Secretary

Providence, R. I.