renewed attention to the limitations, from a physical standpoint, of the form of "interpolation formulæ" usually employed in the representation of natural phenomena.

16. Mr. H. W. Fisk considers the formula for latitude,

$$\phi = h - p \cos t + \tfrac{1}{2} p^2 \sin 1'' \sin^2 t \tan h,$$

from Chauvenet's I., § 176, and the formula for azimuth,

$$A = p \sin t \sec \phi + p^2 \cos \phi \tan \phi \sin t \cos t \sin 1'',$$

from Jordan, "Zeit und Orts-Bestimmung," p. 122. The first terms of these formulas are readily computed. The last terms, called correction terms, are arranged as a set of curves from which the value is quickly taken by inspection. The geographical limits within which this method may be used, as well as the expected accuracy under different conditions are discussed. Attention is given to the change in correction terms due to the progressive change in the value of p.

The general committee elected Professor E. W. Brown, Yale University, vice-president and chairman of the section. Professor G. A. Miller, University of Illinois, continues in office as secretary. The section elected Professor G. B. Halsted, councilor; Professor Winslow Upton, Ladd Observatory, as member of the sectional committee for five years.

G. A. Miller,
Secretary of Section
University of Illinois

Societies and Academies

The Washington Academy of Sciences

The fifty-first meeting of the Washington Academy of Sciences was held at Hubbard Memorial Hall, January 5, 1909. Dr. L. O. Howard presided.

Dr. E. B. Poulton, F.R.S., Hope professor of zoology in the University of Oxford, delivered an address on "Recent Researches on Mimicry and Seasonal Forms of Butterflies," of which he has kindly furnished the following abstract:

The lecturer explained the theory of mimicry proposed by H. W. Bates, showing in illustration some of the figures from the plates of the original monograph read before the Linnean Society of London, November 21, 1861. In these, as in most of Bates's examples, Pierine butterflies, presumed to be palatable to enemies, were seen mimicking the unpalatable Ithomiine (Heliconine) butterflies from the same localities. Succeeding illustrations exhibited oriental Pierine butterflies of the genus *Delias* acting as models instead of mimics, and beautifully resembled by moths of the subfamily Chalcosiinæ (Zygænidæ)—themselves admitted to belong to a group defended by its unpalatability. Such examples are of course inexplicable by the theory of Bates, but receive an interpretation on the hypothesis of Fritz Mueller, which supposes that the resemblance between distasteful forms has been gained in consequence of the saving of life effected by a lessened amount of experimental tasting by enemies. That the same Muellerian principle holds in other groups is seen in the numerous and varied distasteful forms which mimic the African Lycid beetles and by resemblances between well-defined wasps of different groups in the same locality.

The alternative between a Batesian and Muellerian interpretation may be approached from another point of view. In the case of a distasteful butterfly invading a new country we may enquire whether the indigenous species influenced by it are well concealed and presumably palatable, or conspicuous and presumably distasteful. The two large Danainæ of North America are especially interesting from this point of view. Formerly placed by Moore in two genera peculiar to the new world, *Anosia* and *Tasitia*, recent examination has shown that they are congeneric with each other and with the more dominant old world *Salatura* and *Limnas*. All four genera certainly sink to *Danaida*. The old world forms are more numerous and are far more extensively mimicked than those of the new. They, furthermore, enter into mimetic relations with other *Danainæ*. The American species of *Danaida*, on the other hand, are only mimicked by a single Nymphaline species in the north. They extend through South America beyond the southern tropic without entering into any relationship with the indigenous butterfly fauna, except the possible incipient mimicry of a form of *D. plexippus* by an *Actinote*, one of the Acræinæ. It may be inferred from these facts that *Danaida* is an old world Danaine genus which has reached the new world in comparatively recent times and has entered South America by way of North America.

The well-known mimic of *D. plexippus*, *Basilarchia* (*Limenitis*) *archippus* has been evolved from *B.* (*L.*) *arthemis*—with a pattern of the *Limenitis* type found through the temperate circumpolar belt. In the theory of the production of mimetic resemblance by climatic or other local influences the invading Danaine should have been influenced to produce a *Limenitis* pattern in the northern temperate zone. It should have been the mimic instead of the model. The black and white

pattern and conspicuous surface of the form (*B. arthemis*) which has been influenced supports strongly the Muellerian hypothesis. The mimic has in fact exchanged its original conspicuous pattern similar to that of the invading Danaine.

Danaida berenice of Florida is probably a later invader than *plexippus* and has modified into resemblance with itself the mimic already formed under the influence of this last-named Danaine. But the change is so recent that distant traces of the original mimicry of *plexippus* are easily seen in the *floridensis* (= *eros*) form of *archippus*.

Evidence in favor of the Muellerian hypothesis is also to be found in the complex group of mimetic butterflies which are ranged round the North American *Papilio* (*Pharmacophagus*) *philenor*. The female of *Papilio asterius*, a female form of *P. glaucus* (= *turnus*), and both male and female of *P. troilus* form primary mimics of *philenor*, but also appear to exhibit an evident secondary approach towards one another. *Basilarchia* (*Limenitis*) *astyanax*, considered by Haase as a mimic of *philenor*, is rather to be interpreted as a secondary mimic of the three mimetic swallow-tails. The female of *Argynnis* (*Semnopsyche*) *diana*, also thought by Haase to be a mimic of *philenor*, certainly resembles *B.* (*L.*) *astyanax*, as was clearly stated by Scudder. It is therefore a tertiary mimic. These complex resemblances to mimics and even to mimics of mimics rather than to the central model, are intelligible on the hypothesis of Fritz Mueller and not on that of H. W. Bates.

The concluding section of the address dealt with recent additions to our knowledge of the complex phenomena of mimicry in the females of the African *Papilio dardanus* (= *merope*), and with seasonal changes in African Nymphaline butterflies. A representation of a family of 28 individuals bred from the eggs laid by a *hippocoon* female of the South African *P. dardanus cenea* was thrown upon the screen. The family consisted of 14 non-mimetic males, 3 *hippocoon* females, like the parent, mimicking the Danaine *Amauris niavius dominicanus;* 3 *trophonius* females, mimicking *Danaida chrysippus;* and 8 *cenea* females, in part mimicking *Amauris albimaculata* and in part *Amauris echeria*. The recently described *flammoides* female form of the tropical subspecies of *dardanus*, extending from Nairobi westward to the Atlantic, was also represented. This is the only form which resembles a model other than a Danaine—the Acræine *Plancina foggei*. The evolution of the mimetic forms of *dardanus* from a non-mimetic female like that of the Abyssinian *P. antinorii* or the Madagascar *P. meriones* was shown to be readily intelligible through the intermediate form *trimeni* from the Kitnya escarpment.

In addition to the seasonal forms of the African species of *Precis—sesamus, antilope, actia, archesia* and *artaxia*, the recent evidence that similar changes may occur in the genus *Charaxes* was described and illustrated on the screen. A family of individuals bred from eggs laid by *Charaxes neanthes* contained one specimen of *C. zoolina*. This fact confirmed and placed beyond controversy the evidence that had long been accumulating that these are but forms of a single species.

This interesting and conclusive evidence has been obtained at Durban, Natal, by Mr. G. F. Leigh, who also bred the large family of *P. dardanus*, already referred to. The conclusions as to the seasonal forms of *Precis* are founded on the specimens bred by Mr. Guy A. K. Marshall at Salisbury, Mashonaland.

J. S. DILLER,
Recording Secretary

THE BOTANICAL SOCIETY OF WASHINGTON

THE 50th regular meeting of the society was held on November 21, 1908, Vice-president Thos. H. Kearney presiding. The following papers were read:

Plant Breeding in England and Sweden: Dr. ALBERT MANN.

Dr. Mann's paper, which was illustrated by a number of excellent lantern slides, treated chiefly of the methods of culture of barley, as observed by him during a recent trip to England and Sweden. In England he visited Mr. Beaven, of Warminster; Professor Biffen, of Cambridge, and John Garton, of Warrington. His observations showed that English barley culture is carried to much higher perfection than in the United States; that two-row barley, except in yield, is generally preferred; and that pedigree stock is the only source of permanent grain improvement. At Svalof, Sweden, an ingenious system of classification and original methods of breeding have produced remarkable results. The two chief ideas of Svalof, namely, the securing of new varieties by selection from old land races and the production of pure pedigree stock by growing such from a single mother plant were fully discussed and in general heartily commended. Information of minor importance was secured from Professor de Vries, of Amsterdam; Professor Johannsen, of Copenhagen; Professor von Tschermak, of Vienna,

and Professor Kraus, of Munich. The relative lack of information in the United States as to work done by European barley-growers was in strong contrast to the accurate data possessed by them in regard to work in this country. Mr. E. S. Beaven, of Warminster, not only knew definitely the quality and yield of all our American barleys, but he also had samples of every variety from every section of this country. This spirit of progressiveness is deserving of our attention. Mr. Beaven spoke highly of our California brewing barley, but he had a less favorable opinion of our other grades, especially of some now grown in the northwest.

The use of Timbe Barks by the Mexicans in the preparation of Alcoholic Drinks: W. E. Safford.

Timbe, or timbre, is a name applied to certain barks and roots offered for sale in the markets of San Luis Potosí and several other Mexican cities for use in the manufacture of pulque. They have a bitter astringent taste and evidently abound in tannic acid. On the Pacific coast of tropical Mexico the same name is applied to certain barks used in tanning leather. The identity of the principal timbes has not hitherto been established and the part they play in the manufacture of pulque has not been understood. Among the most important plants from which they are obtained are *Acacia filicioides*, the principal source of the San Luis Potosí supply, and a sumach, *Rhus pachyrrachis*. Other barks used for a similar purpose are those of *Calliandra grandiflora* and *Calliandra Houstoni*, the latter of which is also used extensively by the Mexicans as a cure for intermittent fever, under the name of pambotano. At first the sap of the agave from which pulque is made is sweet and clear. It is sold about the streets in this condition under the name of *agua-miel* (honey-water). It soon begins to ferment spontaneously and becomes milky and finally stringy, acquiring a putrid smell, if unchecked, from the fermentation caused by the lactic-acid bacteria contained in it. The timbe bark, after having been toasted and pounded, is added to the sap about four hours after the fermentation has begun. It has the effect of precipitating the greater portion of mucilaginous substances held in solution, undoubtedly owing to the action of the tannic acid in the bark upon the proteids, which, if let alone, would cause the liquid to putrify or turn sour. Its action, then, may be compared to that of hops in the manufacture of beer, which probably do not destroy the lactic bacteria, but cause the precipitation of albuminous material. In addition to this the timbe imparts a pleasant bitter taste to the drink.

W. E. Safford,
Corresponding Secretary

The Torrey Botanical Club

The meeting of November 25, 1908, was called to order at the museum building of the New York Botanical Garden at 3:40 P.M., with Dr. M. A. Howe in the chair. Fourteen persons were present. The minutes of the meeting of November 10 were read and approved.

The resignation of Dr. Valery Havard, dated November 8, 1908, was read. A motion was made and carried that the resignation of Dr. Havard be accepted and that his name be transferred to the list of corresponding members.

There was no announced scientific program for this meeting, but the following communications were made:

Dr. Britton showed fruits of the rare and local tree, *Prioria copaifera* Griseb., which he collected, in company with Mr. William Harris, at Bachelor's Hall, Jamaica, near where it was originally discovered sixty years ago by Nathaniel Wilson, who sent it to Grisebach. *Prioria* is one of the largest trees of Jamaica, sometimes attaining a height of ninety feet, and is a member of the senna family. So far as is known, this tree is found only on two estates in Jamaica, and grows at an elevation of from five to six hundred feet. This species is characterized by having a one-seeded legume, which is indehiscent. The genus *Prioria* is reported to be represented also in the Republic of Panama.

Dr. Murrill displayed photographs and colored drawings of several of the larger local fungi. He also explained reproduction of colored drawings by the four-color process. This process seems to be the most satisfactory for representing fungi in colors.

Mr. Nash exhibited a living plant of *Dendrobium Cœlogyne*, a rare orchid from Burma, which has just flowered in the conservatories of the New York Botanical Garden. Specimens of *Cœlogyne* and of other species of *Dendrobium* were also shown to illustrate the characters of these two genera. While the flowers of *Dendrobium Cœlogyne* resemble those of a *Dendrobium*, the habit is that of a *Cœlogyne*.

Percy Wilson,
Secretary