Time of the Total Solar Eclipse of August 30, 1905," by O. H. Tittmann.

"Preliminary Note on an 'International Magnetic Standard,'" by L. A. Bauer.

"The Life and Work of Maurits Snellen," by E. van Everdingen.

"Die Magnetische Observatorien des Preussischen Meteorologischen Instituts," by Adolf Schmidt.

"Mean Values of the Magnetic Elements at Observatories," compiled by J. A. Fleming.

Letters to Editor: "Principal Magnetic Storms recorded at the Cheltenham Magnetic Observatory," by O. H. Tittmann; "Concerning Publication 'Caractère magnétique de chaque jour,'" by E. van Everdingen.

SOCIETIES AND ACADEMIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

THE 645th meeting was held February 15, 1908, President Bauer presiding.

Professor Simon Newcomb read a paper upon "The Climate of Mars."

The establishment of Stefan's law of radiation, as proportional at ordinary temperatures, to the fourth power of the absolute temperature, makes possible an estimate of the temperature of an opaque planet more reliable than was possible formerly. Christiansen, Poynting and Lowell have applied the law to estimate the temperature of Mars. The speaker stated that the method in which these investigators had made their results to depend upon the albedo of the planet, and the absorbent power of its atmosphere did not seem to him well adapted to the case. He based his own conclusions upon Kirchhoff's law of the equality between radiating and reflecting power of matter for each separate wave-length of heat, which law is, itself, a corollary from the second law of thermodynamics. Making abstraction of an atmosphere, there is a certain normal temperature of a planet which would be independent of this albedo, except when the latter was different for different parts of the spectrum. The effect of this difference is probably small. Assuming Mars to reflect the lower rays of the spectrum more strongly than the higher ones, there would be somewhat higher temperature than the normal one. The effect of an atmosphere like ours would be to make the planet rather warmer than the normal. This effect would be produced in two ways, one of which is the effect of absorption by the sun's heat which mix up the lower strata with the higher one. This results in the earth being warmer than it would be in the absence of an atmosphere. Since Mars has only an extremely thin atmosphere, the effect in raising its temperature is much less than in the case of the earth.

As the result of his estimates it was said that, in general, the surface of Mars must be in general below the freezing point of water except in the equatorial zone. It does not seem possible that the polar regions can ever rise to the temperature of melting ice. Before approaching this temperature the radiation, as given by Stefan's law, would exceed the heat absorbed from the solar radiation so that a fall of temperature should be the result. The disappearance of the white polar caps is easily accounted for through evaporation of ice at the lowest temperatures, especially under so small an atmospheric pressure as prevails on Mars.

The second paper of the evening was presented by Dr. C. G. Abbot, of the Smithsonian Astrophysical Observatory, upon "The Variability of the Sun."

If two observers at opposite sides of the earth, and greatly different altitudes, should both determine the intensity of solar radiation at mean solar distance by a process sound in theory, and both should decide independently that the average value of the "solar-constant" is 2.10 calories per square centimeter per minute, but that on March 1 of a certain year it was 2.20 while on March 1 of the following year it was but 2.00—then it is probable that interest and support would be forthcoming to push the task of "solar-constant" determination steadily and perseveringly enough to determine the extent and character of the sun's variation.

The evidence of solar variation thus far attained is not so strong as this, but is strong enough to warrant a persevering study of the subject. Measurements on Mount Wilson in

California by the Smithsonian Astrophysical Observatory indicate that in the two periods June–October, inclusive of 1905 and 1906 there were variations of the "solar constant" between 1.95 and 2.14 calories. Some of these apparent variations were of short duration, as ten days for example, others of several months.

All the determinations, 130 in number, are by the method of high and low sun measurement with homogeneous rays. The probable error of a single good determination (and nearly all were excellent) is about one per cent. But it is urged that the method though apparently sound in theory may in fact fail to estimate properly the transparency of the air. Supporting evidence of the soundness of the work is as follows:

The mean value of the "solar-constant" observed on Mt. Wilson in 1905–6 is 2.03. The mean value observed in Washington 1902–6 is 2.06. There is one mile difference in altitude, 3,000 miles in longitude, and in the one case the average maximum solar intensity at the earth's surface is about 1.60, and in the other only 1.20. This close agreement outside the atmosphere seems strongly confirmatory of the accuracy of the means of estimating the transparency of the air.

On seven days in 1905 and 1906 practically simultaneous measurements were made at Washington and Mt. Wilson. The Washington results were systematically a little higher, about 3 per cent. in fact. Allowing for this small systematic difference the remaining average deviation is only 1.5 per cent.

Considering Mt. Wilson work again, there is no relation either direct or inverse which holds consistently between the variations of the "solar-constant" and the variable elements of the air, such as its transparency at different wave-lengths and its humidity. The fluctuations of the "solar constant" observed are not hap-hazard in character, but several days or weeks of observation lead gradually up to a maximum or down to a minimum.

If it were in fact true that "solar-constant" measurements on Mt. Wilson are competent to indicate variations of 1 per cent. in solar radiation the real change of several per cent. due to the elipticity of the earth's orbit ought to be plainly shown. This is the case in both 1905 and 1906.

Confirmation from the earth's temperature. With the aid of numerous measurements made on Mt. Wilson of the reflection of clouds at different angles and of the brightness and transparency of the sky, the value of the earth's albedo has been determined to be 37 per cent. Combining this with the mean value of the "solar constant" (2.1 calories in round numbers) there remains $1.32\,\pi R^2$ calories available to warm the earth as a planet. This would maintain a perfect radiator or "absolutely black body" at 256° absolute temperature. The radiating surface of the earth as a planet is not its solid and liquid surface, for clouds during half the time cut off terrestrial rays entirely. During the other half, as the measurements of Rubens and Aschkinass, Langley, Keeler, Very and Nichols suffice to indicate, the water vapor is sufficient to cut off nine tenths of the terrestrial rays. Accordingly the earth's radiating layer may be set at about 4,000 meters above sea level, where the mean temperature is about 263° absolute. If this layer were a perfect radiator, its maximum emission would be $1.45\,\pi R^2$ calories, so that the solar constant can not exceed 2.33 calories unless the albedo exceeds 37 per cent. This maximum possible value is in reasonable accord with 2.1, the adopted value, and differs no more than would be expected in view of the uncertain temperature and radiating power of the earth's radiating layer.

A statistical comparison of the monthly temperatures for the last quarter century of 47 inland stations distributed as well as possible over the world indicates variations, often more than four times the probable error, in the mean temperature of the world. These changes of temperature, amounting to several degrees centigrade, may be caused by variations of the sun.

The magnitude of temperature changes caused by solar changes of short period is much greater for inland than for coast or

island stations. This accounts in part for the failure of Mr. Newcomb to find decisive indications of cosmical temperature influence in his recent study of temperature. Furthermore, coast and island stations do not respond simultaneously or always in the same direction to changes of solar radiation, as is shown by a comparison of monthly changes at stations in latitude 5° N. with the monthly changes of insolation. This consideration accounts still further for Mr. Newcomb's failure to find evidence of cosmical temperature influence.

The disagreement of Mr. Langley's often quoted value, 3.0 calories, for the "solar-constant," with that here adopted (2.1 calories) is due entirely to a supposed failure of the exponential transmission formula for homogeneous radiation. There is no sound evidence of such failure, and therefore we must accept Mr. Langley's direct results of 2.06 at Lone Pine, or 2.22 at Mountain Camp, or still better their mean 2.14, as his value of the "solar constant." Thus the method of homogeneous rays as employed at sea level (Washington), at 940 meters (Lone Pine), at 1,800 meters (Mt. Wilson), at 3,500 meters (Mount Whitney) yields values of the solar constant agreeing within the limits of accuracy of the observations and of the real variability of the sun.

R. L. FARIS,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 439th meeting was held February 8, 1908, President Stejneger in the chair.

Dr. L. O. Howard gave a lantern slide lecture on "Some New Parasitic Work." He mentioned some recent observations on parasites imported from Europe for the purpose of destroying *Porthetria dispar* and *Euproctis chrysorrhœa* in New England, detailing especially the interesting habits of *Pteromalus egregius* Först., and the success which has been achieved in forcing extra generations in the laboratory in the winter. He also spoke particularly of the *Trichogramma* and *Telenomus* egg-parasites of *chrysorrhœa* and the methods used in breeding these forms artificially. He further spoke of new and important work being carried on by his assistants in Texas and Louisiana in breeding native parasites of the cotton boll weevil; and also of the biology of *Lysiphlebus tritici*, an abundant parasite of the *Toxoptera graminum*. He announced that the *Lysiphlebus* has recently been discovered to be parthenogenetic. Some recent work by F. M. Webster, of the Bureau of Entomology, U. S. Department of Agriculture, and his assistants, with the parasites of *Cecidomyia destructor* was described. The principal parasite, *Polygnotus hiemalis* Forbes, has been found to be polyembryonic, and a *Tetranychus* has been found to be hyperparasitic in the cells of the *Polygnotus*. The paper was introduced by some general considerations in regard to parasitism with insects.

In reply to a question Dr. Howard said that the campaign against the gypsy moth had thus far produced no visible effect on the abundance of the species, but immediate success was not predicted. While the state of Massachusetts may be impatient of results, they may be four or five, or even ten years in coming and of course may possibly never come at all. He is hopeful, however, that among the forty to fifty species of its parasites means will be found to hold the moth in check, though American parasites of these parasites may enter into the problem.

The next paper, entitled "List of Plants for Aquatic Gardens," was by Mr. H. W. Clark, and was illustrated with lantern slides.

In looking through the literature at hand on water gardens, a number of desirable aquatic and marsh plants were found unmentioned. Among the charads, several species are very attractive, their symmetrical forms, dainty green colors and bright red fruits adding much to the beauty of the pond-bottom. *Chara robbinsii* is a delicate densely branched form growing in shallow water or at the water's edge, sometimes partly exposed. *Chara foliolosa* is a robust but very symmetrical form. There are several other charas equally desirable. *Nitella batrachosperma* is a minute but beautiful plant, the branches be-

ing clustered in little dark green globes along a slender, almost invisible stem.

Among the mosses the sphagnums would be very desirable for the water's edge. Some forms are quite attractive, but their chief value lies in the fact that they furnish the natural substratum for many interesting plants such as pitcherplants, *Droseras* and the like.

Riccia lutescens is a very attractive little plant, the fronds floating on the surface like little green butterflies. Their ordinary method of reproduction by dividing into halves makes them especially interesting.

The swamp horsetail, *Equisetum fluviatile,* frequently grows over considerable areas in shallow places and a patch of these plants adds to the landscape a peculiar and ancient charm. This horsetail grows quite tall, and is symmetrically and abundantly branched.

The selaginellas are graceful creeping plants counted worthy of greenhouse room, and are frequently regarded as greenhouse plants. About some of the lakes of northern Indiana the attractive little *Selaginella apus* is quite common in black ground near shore, and remains green the winter through.

Among the pondweeds, three of the most desirable species, *Potamogeton amplifolius,* attractive for its large leaves and graceful form; *P. perfoliatus,* an erect symmetrical plant; and *P. robbinsii,* a prostrate plumose form, are especially worthy of consideration.

Of the grasses, the holy grass, *Savastana odorata,* a species growing in moist ground and quite conspicuous by reason of its yellow stamens, would be a valuable species. In addition to its showiness, it is delightfully fragrant.

It is a matter of surprise that in connection with aquatic gardens no one has mentioned the reed *Phragmites phragmites.* In addition to being one of the stateliest and most handsome of grasses, its place along waterSides is established by tradition reaching back to the time of the Greeks.

The sedges furnish a large number of interesting and valuable species. The low cyperus, *Cyperus diandrus,* is common along lake beaches and is an attractive little plant, *Cyperus strigosus,* which grows in wet grassy places is a striking and handsome plant; if cut green the beautiful heads may be kept indefinitely. *Kyllingia pumila* is fragrant as well as attractive and grows in quite wet places. *Scirpus cyperineus* is an exceedingly stately and handsome sedge. Chief in attractiveness of the sedges, and indeed among all plants, are the species of cotton grass. The slender cotton grass, *E. gracile* is very effective, especially when in patches. The fruit, which is conspicuous in early summer, consists of little silken white tassels, three or more to the stem, and give the appearance in the distance of lodged snow-flakes. *E. virginicum,* which comes into fruit later in the season—from August to September—is also very striking and effective.

In the genus *Carex,* two of the most attractive forms are found in wet places; these are *Carex asa-grayi* with a globular head, and *Carex comosa* with an elongate, bristling head. *Carex leptalea* has a small head, but is attractive on account of the contrastive white and green colors to be found in the scales and perigynea.

One of the most desirable aquatics for planting about the margins of ponds is *Spathyœma fœtida.* This plant is "in bad odor" chiefly because of a bad name. The name "skunk-cabbage" does much more to keep it unpopular than anything else. In some parts of the country it is known as "quick will"; another name in some parts of the country is "Midas' ears." They have been seen on sale at the Washington (D. C.) market as "swamp lilies" and are said to have been sold on the streets of New York as "rare orchids from the Philippines."

By Thanksgiving the spathe of the "quick will" is already formed and colored, ready to be pushed up above the ground at the first sign of spring. The spathe of this flower is exceedingly variable in color, ranging from pure yellow to deep reddish purple. They are also exceedingly variable in form, some of the spathes being long-pointed, others short and round. They frequently come double. This

variability in nature suggests that they would vary into desirable forms under cultivation and selection.

Among the duckweeds are the most minute of the flowering plants, and it would add interest to one's pond to have in it a plant which, flower and all, is no larger than a pinhead. Our two species of *Wolffia* are interesting on this account.

Another interesting minute form, *Wolffiella floridiana,* usually escapes observation both on account of its small size and its habit of being usually submersed. It consists of small strap-shaped fronds which frequently cohere, forming stellate objects. This plant would find plenty of room in a saucer and the growing of it might lead to interesting observations as the flower and fruit are as yet unknown.

M. C. MARSH,
Recording Secretary

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

AT the meeting of January 7, 1908, Dr. D. S. Lamb exhibited a calvarium showing ostitis deformans, a disease found only in the white race, and anthropologically interesting.

Doctor H. Pittier read a paper on "The Native Tribes of Costa Rica." Doctor Pittier described the general conditions of environment governing the natives of Costa Rica and stated that the tribes at present are as numerous as in early times. A brief account was given of the customs of the natives.

Mr. G. N. Collins illustrated with slides his "Notes on the Indians of Chiapas." The Soki and Tzotzil Indians of Pantepec were especially referred to and a brief account given of the modes of subsistence, architecture, arts and customs.

Dr. O. F. Cook, in his paper "Notes on Guatemalan Indians," spoke of the great number of natives in that country. The Indians of Alta Vera Paz were particularly examined. Many slides illustrating the deforesting, reforesting, cornfields and cottonfields were shown. Doctor Cook believes that the high interior did not encourage habitation till comparatively recent times. A series of views illustrating the cotton cloth industry was received with interest. The appearance and customs of the Kekchi and Cahabon Indians inhabiting this portion of Guatemala were discussed.

WALTER HOUGH,
General Secretary

THE BOTANICAL SOCIETY OF WASHINGTON

THE 44th meeting was held November 23, 1907. Vice-president Piper presided and twenty-three members were present.

The first paper, by Dr. R. E. B. McKenney, "Botanical and Other Notes on Bocas del Toro," was a description of the plant life of the province of the republic of Panama bordering the Caribbean Sea, adjacent to the republic of Costa Rica, and an account of banana culture in that region.

The conditions on the two sides of the isthmus are quite different. On the Atlantic side there is no distinct dry season, but less rain falls in February and March than in the latter part of the year. In the winter months the average temperatures vary from 88° F. to 92° or 93°, and in the summer months from 92° to 95°, with the minimum temperatures of 60° and 65° respectively. In the Pacific province of Chiriqui, which is separated from Bocas del Toro by the mountain range forming the backbone of the isthmus, the temperature ranges are nearly the same, but there is a distinct dry season during five or six months of the year when the vegetation becomes parched and dry. The pastures are burned over annually. On the Atlantic side the vegetation is luxuriant, with almost impenetrable jungles, mangrove swamps along the seacoast and thickets of giant stemless palms; and farther inland forests of palms and exogenous trees of many species overgrown with aroids and other climbers. On the Pacific side there are stretches of grass and sharply outlined patches of shrubbery, agaves and various genera of cactus.

The most important industry of Bocas del Toro is banana culture. Formerly many hawks-bill turtles were caught in the adjacent waters for the sake of their shells, and fifteen years ago the exportation of tortoise shell from this region was commercially important. Settlers attracted by the turtle fisheries began

to plant bananas in isolated patches, and soon there were extensive plantations. These plantations have been purchased by the United Fruit Company, which has also large possessions in the neighboring republic of Costa Rica. Dr. McKenney gave an interesting account of the methods followed in propagating and cultivating bananas, the gathering of the fruit and its shipment to the United States. He also spoke of the various ways in which the fruit is prepared for food by the natives and its preservation by drying. During the past few years many of the banana plants of this region have been suffering from a disease, which Dr. McKenney has been studying. His results have not yet been published.

The second paper, by W. M. Scott and J. B. Rorer, was an account of the "Apple Leaf-spot Disease," the result of experiments made by the authors during the past season at Bentonville, Arkansas, in connection with spraying demonstration work. For the first time it has been conclusively demonstrated that the reddish-brown spots on apple leaves, which cause premature defoliation and ultimately the death of the trees, are caused by *Sphæropsis malorum* Peck, and that *Conithyrium pirina* (Sacc.) Sheldon, to which the disease was attributed by Alwood and others, is merely saprophytic and has nothing to do with those spots. Pure cultures of both fungi were obtained from spots on apple leaves and spores from these cultures were used for inoculation tests. Twenty-four out of thirty apple leaves sprayed with sterile water containing spores of *Sphæropsis malorum* developed a large number of spots two weeks later, while leaves sprayed with sterile water containing spores of *Coniothyrium pirina* developed no spots. The latter fungus, however, was found growing on the dead areas caused by the *Sphæropsis,* as well as on spots produced by other causes.

The third topic was the "Method of Preparing and Preserving Type Material," by H. B. Derr. Botanical specimens exhibited by lecturers and handed about in classes are liable to serious injury. Several methods have been devised to protect such specimens, as well as type material which is subject to frequent examination. Thus far all have been unsatisfactory. Mr. Derr exhibited several cases containing specimens of barley from Sweden and hybrids of wheat and rye, which were mounted so that they could be examined carefully and at the same time were protected from injury. The cases consisted of a rectangular wooden frame, the sides of which were dove-tailed together, holding in a groove near the front a pane of glass and having a removable back lined with a sheet of raw cotton, or antiseptic cotton, upon which the specimen was laid.

This ended the scientific program. During the supper which followed various topics of botanical interest were discussed, and attention was called to several recent publications. While seated at the table the members of the society were addressed by Mr. Tong, one of the guests of the evening, a Chinese student engaged in the study of rice culture in the United States.

The 45th meeting was held December 21, 1907, Vice-president C. V. Piper presiding.

The first regular topic on the program was a "Pot-pourri of Rusts and Smuts," by Dr. E. M. Freeman. Dr. Freeman described various types of smuts and called attention to the present problems relating to them, particularly those in connection with the natural modes of infection. He gave an account of a series of tests of infection of barley at different stages of flowering, reviewing briefly the work of Biffin and others on the problems of resistance to smut. Dr. Freeman also gave an account of a long series of cross-inoculations of the uredospores of stem rust on various grains, which was in effect a continuance of a paper previously presented to the society on the same subject. The work hitherto done in this country has been chiefly on treatments for prevention of infection. Very little has been done on life-histories of smuts. The speaker discussed four types of smut life-histories:

(*a*) *Corn Smut.*—Infection is not specialized to any one kind of meristem, but any part may be affected. Infection may take place in

later stages of extraseminal life of corn plant.

(*b*) *Bunt of Wheat.*—Seedling infection. Infection is specialized to stem top meristem. It occurs only in earliest stages of extraseminal life of host plant.

(*c*) *Loose Smuts of Wheat and Barley.*—Floral or intraseminal infection. Infection also specialized to the stem, the growing point of the meristem. It occurs in an early stage of intraseminal life of host plant.

(*a*) *Fungus of Lolium temulentum.*—Method and occurrence of infection as in type (*c*), but spore formation probably abandoned and the beginnings of a symbiosis possibly established.

Many problems relating to the details of type (*c*) are yet unsolved, as for instance, the behavior of spores in regard to stigmas, and the results of different periods of infection.

The second paper on the program was by Professor Bruce Fink: "Present Problems in American Lichenology." Professor Fink called attention to the lack of workers in the field of American lichenology, caused in all probability by the fact that the subject has little economic significance. The literature on this branch is unarranged and even uncollected, and the speaker is now engaged in studying the literature bearing on the subject. Up to the present time he has collected about 500 titles. The structure of the lichens interferes with the ordinary technique of sectioning and staining, but these difficulties are not more serious than those met with in the study of fungi, which have been for the most part overcome. There is great confusion in the nomenclature and classification of lichens; and no agreement has been reached as to the limits of genera and the way in which types can be fixed. Lichens are the first vegetation appearing on unoccupied land, and are of fundamental importance ecologically. Their relation to soil and subsequent vegetation has, however, been little studied. The old problem of the relation of the symbionts in the lichens, whether mutually beneficial or antagonistic, is still unsolved. With the exception of the area about New Bedford, Massachusetts, very few localities have been carefully studied in relation to their lichen flora. Professor Fink has himself listed some 500 species from Minnesota. He concluded his paper with a plea for greater popularization of the study of lichenology.

This ended the evening's program. At the luncheon which was served Dr. Freeman addressed the society informally, taking leave of his associates on the eve of his departure for his new post at the University of Minnesota.

W. E. SAFFORD,
Corresponding Secretary

DISCUSSION AND CORRESPONDENCE

INHERITANCE OF FLUCTUATING VARIATIONS

TO THE EDITOR OF SCIENCE: In the issue of SCIENCE for January 31 Professor Bigelow asks Dr. Ortmann how he would account for correlation between parents and offspring in cases of fluctuating variations, if variations of this type are not transmitted. I do not wish to answer this question for Dr. Ortmann, but I do wish to call attention to some confusion in the use of the term "fluctuating variation." It is necessary for us to agree on its meaning in order to avoid misunderstandings. Let us consider for a moment the different types of variation and decide on which of them may properly be included under the term "fluctuating variations." In the first place, there are some variations which I think we will all agree are not included. Two of these relate to real evolutionary changes. First, organisms in their phylogenetic development acquire new characters. We may mention the horns of cattle as an example. The development of hair or feathers as an external covering is another example. Even these characters may be looked upon as, in a sense, modifications of previously existing ones. Second, a character already present may undergo permanent change. In this way we get the various shapes of leaves, say of the genus *Quercus*. We may also include here the loss of certain characters which were formerly possessed. For instance, red swine have lost the power of producing black pigment. It is conceivable that very little of the variation we find in a generation of individuals from