stitute, and his assistants only after a satisfactory program had been worked out. At the present time over 300 experimental brick walls or panels have been erected in order to find the most suitable combinations of materials and workmanship. The following problems are being investigated: the rate of absorption and total absorption of moisture by brick; the surface characters of brick; the merits of different cementing materials, ranging from pure lime to pure cement, and of various sands and mortar pigments; the effect of varying the type of backing, both as to material and size of unit; the results of variation in workmanship, including pointing, tapping and the filling of head-joints; the effect of variation in design, involving a study of coping and parapet construction, of capillary contact, of condensation and of elasticity, and the behavior of mortar with reference to the other variables in all types of climatic conditions. All results of these studies will be published for the benefit of every one interested in building construction.

THE report of the Bureau of Science of the Philippine Islands for 1927 has just been issued. We learn from it that the *Philippine Journal of Science,* embodying the results of the research work of the bureau, was issued during that year in three volumes with an aggregate of 1,511 pages, 157 plates and 111 text figures. According to the report the *Journal* is sent to 919 paid subscribers and exchanges, while 109 copies are distributed free for review to associate editors and to others. The total mailing list is 1,028. This is distributed as follows: Philippines, 94; remainder of Asia, 185; Europe, 293; North America, 359; South America, 25; Africa, 29; Australia and neighboring islands, 43. These figures show that the journal is widely distributed to scientific institutions in all parts of the world. Two monographs were issued during the year, three were in proof and one was being prepared for the printer. The biennial publication on the mineral resources was issued for the years 1924–1925. This publication took the form of a twenty-fifth anniversary number and contains a summary of Philippine geology and mineral resources. Two popular bulletins, one press bulletin and an annual report were also issued during the year. The library continued to grow in size and usefulness and has maintained its high standard of excellence. During the year 14,521 volumes were added to the library, making a total of 108,808 volumes at the close of the year. The library receives 2,234 scientific periodicals of which 442 are paid subscriptions, 907 exchanges and 884 free. The number of publications used and charged out was 55,896, or a daily average of 154 publications. The number of visitors recorded was 12,593.

UNIVERSITY AND EDUCATIONAL NOTES

AN additional $400,000 has been given to the University of Pittsburgh in addition to the gift of half a million dollars already contributed by Maurice Falk and the late Leon Falk for the construction of the Falk Medical Clinic in the university hospital group. This gift makes possible the immediate construction of the building.

AN anonymous gift of $200,000 has been made toward the projected pension fund of $1,000,000 for professors of Cornell University. The gift is contingent upon the raising of the remainder of the fund.

THE new engineering building has just been completed at the Pennsylvania State College. It contains quarters especially designed for the use of the department of architecture, a large hydraulic laboratory, offices and recitation rooms.

A. L. O'BANION, for the past five years instructor in electrical engineering at Cornell University, has been appointed professor of electrical engineering at Clemson College, South Carolina, to succeed Professor S. R. Rhodes, who has been made head of the division of electrical engineering.

DR. TEMPLE FAY, for many years associated with the neurological staff of the school of medicine of the University of Pennsylvania, has been appointed head of a newly established department of neurosurgery at Temple University.

JULIAN J. PETTY has been elected associate professor in the department of geology at the University of South Carolina.

DR. OYSTEIN ORE has been appointed to a full professorship of mathematics at Yale University.

DISCUSSION

LUNAR ECLIPSES IN GENERAL AND IN THE PHILIPPINE ISLANDS

IN the early days of scientific astronomy, lunar eclipses, aside from an imaginary importance as omens and portents, were the only means whereby differences in longitude could be ascertained with any approach to accuracy. The longitudes of Ptolemy's map of the world were mostly dependent on this kind

of celestial signal, and the first determination of the longitude of Cambridge, Massachusetts, is said to have been made this way. The study of the phenomena of lunar eclipses with the telescope soon showed that precise determinations by this method were impossible, because the *shadow edge* is as much a subjective as an objective phenomenon and vanishes in hazy indistinctness as telescopic power increases. The attempt to use transits of the two shadow edges, preceding and following, across lunar craters and other marks led to the discovery that the observed diameter of the umbra is larger than that computed from dimensions and distances in the system sun-earth-moon. This enlargement is taken into account in a rather arbitrary way in the prediction of lunar eclipses by the addition of a fraction of the diameter to its value computed on the hypothesis of simple shadow casting. The explanation of this enlargement is probably psychological. So the observation of lunar eclipses lost the respect of exact astronomy.

The frequently great beauty of the partially or totally eclipsed moon has, however, held the interest of all observing astronomers. The remarkable shadings, from pale blue through greens to copper, dull chocolate and dead black, are frequently very striking, and they demanded a scientific explanation. Kepler explained this *lumen secundarium*, which shines in the earth's shadow, as the result of the refraction of sunlight through the rim of atmosphere along the line of sunset and sunrise. The colors are due to absorption and scattering in our air, and are essentially the same as the beautiful glows which enliven evening skies, when cirrus clouds, cumulo-nimbus tops and snowy mountain summits shine rosy in the last rays of the departing sun.

The keen attention which lunar eclipses aroused when they were still practical means of determining longitude inevitably brought out the fact that this *lumen secundarium* was by no means constant from eclipse to eclipse, or even throughout the same eclipse. Sometimes the moon shone out from the earth's shadow with the maria as plain to the eye as at an ordinary full moon; again the shadow was so dense and dark that the immersed moon could not be seen. Thus, Sviatsky has found in ancient Russian annals accounts of thirty-nine lunar eclipses, and among them statements that on May 10, 1389, April 20, 1399, March 10, 1476, and September 16, 1624, the eclipsed moon was quite invisible in the sky; the same annals mention at other times the blood-red color which the eclipsed moon more frequently shows. An ancient prophet speaks of the sun being turned into darkness and the moon into blood, so that the red color was well known long ago; but these Russian records of *black* eclipses go back farther than any others known to the writer.

It was a natural conclusion that this variation of color and brightness of the moon in the earth's shadow must be due to variations in the transparency of the rim of atmosphere along the sunrise-sunset line, and that its spectrum must show something of the absorption effects of air at different altitudes above the ground. Probably A. Danjon, the skilful astronomer at Strasbourg, was the first to collect systematically the records of lunar eclipses, as phenomena of the terrestrial atmosphere, and to study them for correlation with other phenomena. In 1920 and later he published conclusions based upon seventy eclipses, in which he announced the discovery that the brightness of lunar eclipses is in general and almost in detail a function of the time of occurrence in the solar sunspot cycle. This conclusion has been vigorously attacked, on the ground that the sunspot cycle has been too irregular and that the correlation is too vague. In fact, also, Danjon's papers[1] give no references to dates and sources, merely conclusions, and so it is not possible to study his data independently. The present writer's interest in low-sun phenomena, of which the lunar eclipse is one example, led him to compile the published records of lunar eclipse observations, 1860 to 1922, and to publish all essential data so found in a pamphlet issued in 1924 by the Smithsonian Institution.[2] In this a three-step scale, 2, 1, 0, of brightness was applied to about fifty eclipses. The main conclusions were that the earth's shadow is darker in its northern half than in its southern, that the moon's varying distance has little effect, that winter eclipses (northern season) have been bright, spring eclipses dim, that volcanic dust has acted to make eclipses dark and that no relation was found between the brightness of eclipses and the solar cycle.

Since that time the writer has continued to collect data on lunar eclipses, both ancient and currently occurring, and has two papers on the eclipses of August 14, 1924, and June 15, 1927 (the latter in press). Besides, there has come to hand a forty-four page manuscript in the microscopic German handwriting of J. F. J. Schmidt. This has been carefully copied in type, complete except for a few places where as yet inspiration has failed for the interpretation of spelling or meaning. This manuscript extends from No. 1, January 26, 1842, to No. 28, December 28, 1879, observed at Eutin and Athens,

[1] *Bull.* Soc. Astron. France, 35: 261–265, 1921.

[2] Smithsonian Misc. Coll., Vol. 76, No. 9, publication No. 2751.

respectively. In all these years this most assiduous observer missed but one chance to observe an important eclipse; on the night of May 1, 1855, he was so absorbed in watching the great eruption of Vesuvius then in progress that "I entirely forgot about the eclipse."

And now there comes to hand No. 7 in Volume 1 of the Publications of the Manila Observatory, "Observations of the Brightness of Lunar Eclipses in the Philippines," by the Reverend Miguel Selga, S.J., director of the Weather Bureau. Father Selga has found time among the engrossing duties of a responsible and important official position to observe lunar eclipses himself, to stimulate many others, professional scientists and untrained observers, to do the same in the islands from Jolo and Zamboanga to Baguio and Sagada, and to collect from the records of the observatory observations of eclipses running back to January 7, 1871—of which hitherto we had observations only by Birmingham, at Millbrook, Ireland, and Schmidt, at Athens—and to May 12, 1873—recorded hitherto only by Tebbutt, in Windsor, N. S. W. Also, the Manila observation of November 26, 1890, seems to be unique.

Father Selga acted partly in consequence of a request by the writer, directed to the Reverend José Algué, S.J., then head of the Philippine Weather Bureau, for observations of the eclipse of February 20, 1924. He wrote numerous letters to friends throughout the islands and to persons associated with the Weather Bureau, and received many responses from observers all through the islands. In a region like that, where clouds are incessant, the more numerous the observers, the better, even though their scientific equipment may average not high. Father Selga has continued the same plan on the occasions of the later eclipses of August 14, 1924, December 8, 1927, June 3, 1928, and November 27, 1928. One of the observations came from distant Yap Island.

The results of this Philippine activity may be summarized thus: Father Selga, adopting the three-step scale of brightness, agrees to the grade 1 assigned by the writer to January 7, 1871, May 12, 1873, May 24, 1891, and April 22, 1902; to the writer's grade 2 assigned to February 29, 1896, and grade 0 assigned to March 21, 1894. The eclipses of October 26, 1920, and February 20, 1924, he calls bright; but he differs from the writer's grade 2 with regard to August 14, 1924, which his Manila records lead him to call rather dark. With regard to the distribution of light in the northern and southern parts of the shadow, he says, "In the cases here reported, the moon passed five times wholly north of the geometrical center of the shadow, three times wholly south, and it was central four times. Two cases of bright eclipses coincide with central passages and one case with a south passage."

Again, "The general tendency for bright eclipses to occur in winter is not contradicted by these observations." As to Danjon's solar cycle relation:

> (1) The minimum of solar activity did occur in 1923; (2) contrary to Danjon's prediction and expectation, neither the eclipse of February 20 nor the eclipse of August 13, 1924, was very dark, gray or very little colored. Of the two, the August eclipse was certainly the darker; while, according to Danjon, the farther away from the minimum, the greater should be the brightness. . . . The supposed relation between the solar cycle and the brightness of lunar eclipses is not clear, to say the least; many more observations under exceptional conditions are to be made before the relation can be accepted with certainty.[3]

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A GENE FOR SUPERNUMERARY MITOSES DURING SPORE DEVELOPMENT IN ZEA MAYS

IN studying heritable functional sterility in maize, a case has been observed in which such sterility is due to supernumerary divisions of the young spores. This type of sterility is inherited as a simple Mendelian recessive.

The first and second divisions of the microsporocytes of sterile plants are apparently quite normal and result in the usual quartet of cells, each with a metabolic nucleus. In normal plants, the young spores undergo a growth period of at least several days, after which the nucleus divides vegetatively to form the generative and tube nuclei. In sterile plants, the young spores of the quartet immediately undergo a series of aberrant divisions. In the prophase of the first extra mitosis ten chromosomes appear. These ten chromosomes arrange themselves in the spindle and without splitting are distributed to the two poles, apparently at random. Cytokinesis follows and there result eight cells each of which usually has less than the haploid set of ten chromosomes. Each of these cells again divides in a similar manner, reducing the chromosome number still further. At least four such supernumerary divisions are known to take place in some cases, and probably many spores undergo even further division. These divisions are necessarily irregular and exhibit much lagging of chromosomes. Cells with only one chromosome in the spindle have been observed. Fragmentation of chromosomes appears to take place rather frequently.

[3] On page 3 the date September 4, 1913, should read 14—a typographical error for which the writer's pamphlet on the brightness of lunar eclipses is to be blamed.