served and a term like Alexandrian series be established as a valid stratigraphic title.

Charles Keyes

ALABAMA ARGILLACEA IN MINNESOTA

The cotton-worm moth, *Alabama argillacea* Hubn., appeared in Minnesota during the past season at several different places. The first recorded appearance was at Garden City, Blue Earth County, September 21, where it was proving injurious to a variety of everbearing strawberries. The moths punctured the fruit and apparently did considerable injury.

Between the tenth and the fifteenth of October, several other inquiries from other places were received, complaining of this moth injuring strawberries. One complaint came from Rochester, Minn., one from St. Paul, and one from Excelsior, which is on Lake Minnetonka, west of Minneapolis. The moths apparently stayed but a very short time in each of these places. Between the fifteenth and nineteenth of October the nurseryman at Garden City, Minn., had further trouble from these moths. He stated in a letter that they were most abundant about the twentieth of September, after which they disappeared, becoming rather scarce, but appearing again in numbers about the fifteenth of October.

These few notes may be of interest to entomologists, as they show the northern flight of the moths; also that they will feed on fruit, if fruit is available at that time.

William Moore

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CHEMIHYDROMETRY

The writer has been searching for a name for the new method of measuring the flow of rivers, the discharge of turbines and the capacities of reservoirs by means of chemicals mixed with liquids. *Chemihydrometry* seems to convey the idea exactly, but it can be criticized in at least two respects. It is a compound whose component parts are derived from two different languages, which is not good form, and the second part is almost exclusively used when it refers to the determination of density or specific gravity.

An appropriate name for this new branch of engineering will soon be in demand and it is, therefore, suggested that other names be submitted by your readers for consideration.

B. F. Groat

EYE SHADES FOR MICROSCOPICAL WORK

To the Editor of Science: The eye shade described in Science for May 28 is identical in plan though not quite as perfect in construction as one sold for many years by dealers in microscopic supplies. It was designed by Dr. R. H. Ward and is illustrated in earlier editions of Gage, "The Microscope" (*e. g.*, VI. ed., p. 59), and in various catalogues of micro accessories as Ward's Eye Shade. In the later editions of Professor Gage's book it is replaced by another form which in the author's judgment probably meets the needs of the case more satisfactorily.

The discussion which Professor Gage gives in connection with the figure of the eye shade regarding the care of the eyes is worthy the more careful consideration of the laboratory teacher. Such problems receive little, if any, attention in the training of graduate students, and college classes suffer when every new generation of teachers comes to practise on them.

X

SCIENTIFIC BOOKS

The Climatic Factor as illustrated in Arid North America. By Ellsworth Huntington, with contributions by Charles Schuchert, Andrew E. Douglass and Charles J. Fullmer. Carnegie Institution of Washington, Publ. 192, 1914. 4to. Pp. 341, richly illustrated.

The senior author of "The Climatic Factor" has for a number of years endeavored to throw light upon the relations between changes in climate and human activity, and the wealth of fact which he personally has hitherto brought to light and correlated with the investigations of others, especially archeologists, in that region called the cradle of western civilization, together with interpretation in terms of climatic oscillation, have won for him much recognition both from a wide circle of the

intellectual laity and within the narrower circle of more critical students. A more fascinating volume to those who endeavor to glimpse the ancients as living beings overcoming and being overcoming by their environments, than "Palestine and Its Transformation" has rarely been written, and in it Professor Huntington in a measure has anticipated the feature of the present volume which to the biologist especially will make the most intimate appeal. As the author remarks in his preface, his thesis of climatic pulsations within measurably recent times may till now have been open to the criticism that the facts may have been arranged to fit the theory, but granting this to be so, we have now given us indubitable evidence, mathematically treated, derived from growth rates of the "big trees," so that in the absence of instrumentation we are supplied with a rainfall curve dating back over 3,000 years, which, viewed broadly, is little less dependable for that lack.

The method of attaining this end is credited to Professor A. E. Douglass, who, while resident in Flagstaff, conceived the idea of showing association between meteorological variations and astronomical phenomena during long periods of time for which records are not available. This method is presented by him in Chapter XI. of the volume. The fundamental data are the measurements of the growth rings in old trees obtained in numbers sufficient to allow the determination of the amount of error due to various causes and their elimination. The errors considered by Douglass are those introduced by the irregularities of growth due to discontinuity of moisture supply during the growing season, such errors being of relatively greater importance in comparing growth and recorded rainfall, during a comparatively short period of years. The results of the investigation are correct within a range of 70 to 82 per cent., and certainly sufficiently so to warrant reliance upon tree growth as an indicator of climatic variations. Growth rates for a period of 500 years were then studied, a correction for age being indicated, and from the result it is clearly to be inferred that climatic pulsations have occurred during the period in question. These, it is finally argued, are expressions of weather changes due to sunspot activity, a view supported by data from German trees.

In the following chapters Huntington applies the above method, introducing an additional correction for "longevity," the effect of which is to still further rectify the curve embodying a correction for age, and to make the sinuosities of the growth curve comparable at all points throughout its extent. The evidence for pulsations of growth is further found in trees widely scattered from Maine to California. It is, however, to be noted that inverse growth fluctuations occur, as for example when a change which produces a "drought in the north may produce an excess of moisture in the south." This extension of method then leads the way to a dramatic climax in the following two chapters in which the special difficulties presented by the "big trees" of California are dealt with and the interpretation of their growth curves is presented. The original data are recorded in the statistical portion of the volume, where 28 pages are found crowded with tabulated figures at which one must look in order to form some conception of the enormous amount of work of a purely inductive kind upon which the author's conclusions rest. The derived curve of tree growth for 3,000 years and the curve for climatic change in western Asia based upon historical data, on page 172, must remain, whatever the minor inaccuracies may turn out to be, of preponderating interest for students of climate, and will become an item of classical value.

From these curves there emerges the conclusion that beyond the cycles of lesser amplitude embraced within shorter time periods (120, 21 and 11 years) others occur "of the length of centuries" but without recognizable periodicity, and that these pulsations, to use the author's favorite term, have been synchronous in western America and western and central Asia. His methods, tested against each other in this volume, point also to a condition 300 years ago on the whole moister than now obtains.

Inquiry into the possible causes of the discoverable fluctuations occupies Chapter XIX., in which a variety of evidence, including solar

constants, sun-spots, the prices of wheat, size of crops, growth of trees and comparative temperature fluctuations at various points of the earth's surface, contributes to support the conclusion that the "solar hypothesis," meaning the occurrence of sun-spots and a correspondingly cyclic change in the sun's radiation are sufficient to and do account for the causation of measurable meteorological results. The larger question of climatic change during the vast extent of geological time is attacked by Dr. Charles Schuchert in a paleometeorological monograph incorporated into the volume as Part II., in which the crustal deformation of the earth due to gravitational agencies is seen as the cause of change and redistribution of climatic zones. It seems conclusive that periods of mountain-making have been followed by cooler times, though, as Huntington and Schuchert both admit, there still remains the difficulty of accounting for the apparent causal relation between these, for the minor fluctuations of climate which are now in progress, and for the interglacial climates characterized by higher temperatures. At this point the solar hypothesis appears to articulate with that of crustal deformation. A full and impartial discussion of all the theories, in itself quite exemplary, strengthens the authors' positions, but for these details the original volume must be examined.

There remains of the reviewer's task a necessarily brief and equally inadequate mention of the body of evidence from the point of view chiefly of human activity, but including certain topographic facts.

The salient condition for the studies lies in the sensitiveness of the semi-arid desert to apparently minor deviations from the normal course of rainfall, and, for the author's purpose, its effect upon human economy. That these fluctuations of precipitation have occurred, there is abundant evidence in records, and in the fate of modern enterprises; and, according to Huntington, in the making of terraces, new and old, but all embraced within comparatively recent times, which can be seen at the present time well illustrated in the Santa Cruz River at Tucson, in the different levels of lake beds, in the fixation of older and movement of later sand dunes, as illustrated in the White Sands of the Otero basin and in the different ages of ancient aboriginal villages. Evidences of an earlier large population were studied in localities found in the whole wide region from south New Mexico to northern Sonora. The close examination of these evidences is so masterfully done, and with such intimacy of touch, that one feels, as it were, a thread of drama running through it. While the contemplation of history seems to lengthen the years agone, that of the earlier culture of the desert seems, in these studies, to bring us nearer to the past. In particular, the account of the condition on the lower Altar may be cited in illustration of method and treatment. This valley, beginning at the village of Altar and ending at Disemboque on the Gulf of California, contains a string of villages either occupied, as Caborca, with 1,500 inhabitants, and Buzani with a mere handful, but with the ruins of a mission, or uninhabited—and recognizable only from the usual signs—artefacts, foundations, canals, villages extensive enough to accommodate 1,500 folk, perhaps more. Lands now either cultivated opportunistically, but less and less as the gulf is approached or not at all, but always extensive enough for the support of large numbers of the primitive people, together with signs of irrigation works, combine with the ruins, to form a setting for a numerous people. But the people are not there. All the facts point to a condition when agriculture was possible and water was in quantities sufficient to supply the villages by means of canals, in the absence of wells (as at Buzani). A feature of especial interest described is the curious terraces or trincheras found at various localities. These merge with rectangular areas, discernible now only from an eminence, on the lower gentler slopes. These trincheras were undoubtedly for agricultural use, and this view taken by Huntington, receives support from the occurrence of similar trincheras observed by the reviewer in the fastnesses of the Sierra Madre of Chihuahua, associated with the ruins of ancient villages. But if for agriculture, whence the water? A little arithmetic shows pretty conclusively that they could not have been irri-

gated, since the work, which would have been done by the women, would have amounted in the case of the Great Trinchera to enough to demand a population of 15,000, "where now there are scarcely more than 200," in view of which it seems far more likely that dry farming was possible, and this in turn supposes a greater rainfall than occurs at present.

But the main effort is to show that not only has there been a change in rainfall during the last few hundred years, but that the whole region studied presents evidences of successive stages of culture. The evidence derived from human agencies is of course the more difficult to obtain and interpret, but taken together with that from other sources, it gives more than suggestive strength to the discussion. For example, the early Spaniards found no inhabitants in the Chaco Canyon, while their artefacts show them to have been different from the more modern Pajaritans. The extremely dry character of the region indicates that it would have become uninhabitable earlier than other localities which have been occupied at later dates.

In this connection southern Mexico is treated as a test case and similar conclusions are arrived at, while three other chapters deal with Yucatan, with Guatemala and the Highest Native American Civilization, and with the Relation of Climatic Changes to Mayan History. The rich indications, buried now in well-nigh impenetrable jungle, of a highly able and intelligent people, are found in a region which forbids at the present any approach to civilization at all, in view of the great heat, disease and the consequent debilitating effects. But a small decrease in rainfall would alter these conditions, so that what would cause the disappearance of people in temperate regions would permit their greater development in the tropics, since a diminution of rainfall sufficient to allow the development of dense forests would cause them to be replaced by jungle, and the jungle, in turn, by bush. A healthful atmosphere would thus displace a noxious one, and human progress, otherwise inhibited, would be stimulated. But this means that while the deserts of the southwest are drier now than formerly, the scenes of former Mayan greatness are now moister, in apparent contradiction to the major thesis of the volume. At this point a paper is contributed by Dr. Charles J. Kellmer on "The Shift of the Storm Track." It is shown that during an interval of 21 years the storm track has shifted a small distance to the west and south, and it is perhaps more than a mere coincidence that the magnetic pole has also shifted (according to Bauer) westward and (chiefly) southward. This broaches the subject of the latitudinal change of climate due to this cause, and if, as Huntington contends, such changes have occurred in the lands of the Mayas, the general contention that the profound changes in human culture, indicated by their reliquiæ, are due to them. In this light, the Mayan history is reviewed in Chapter XVIII., and a parallel is drawn between the climatic changes as registered by tree growth and the rise, decline, renascence and ultimate reduction to a rather low grade of culture, of the Mayan people, not so low, however, as that of other tropical peoples. In this study, history and archeology are brought together, and if the results are, as Huntington says, not too much to be depended on, the treatment again illustrates the method of coordinating evidence from these and other sources in order to get a broader view of the possible causes of culture changes in the past. The sum total of the work is to strongly indicate a general parallelism between these changes in central America and the desert regions to the north and those of central and southwestern Asia as correlated with the climatic pulsations indicated in the growth records drawn from a minute's study of the California trees.

The volume is a big one, and really too big and too detailed, and with evidence drawn from too many kinds of sources for competent review by a single reader. If this review fails in the critical attitude, a good purpose will be served if, besides indicating the scope of the studies, the general attention is directed to large and conscientious effort, supported by great if restrained enthusiasm, to work out an intricate problem which has an intimate bear-

ing on the history of the human race, that of the relation of culture to climate. Much as has been done, the author would be the last to say that more than a breaking of the ground has been accomplished. He himself is as busily engaged now as before, deriving evidence from all sources available to him, as witness the recent papers on the relation of climate and civilization, work and weather, in *Harper's Magazine,* forecast doubtless of more extensive study of the same kind.

A single matter of book-making should be especially mentioned. In a note to the reader, following the table of contents, a list of segregations of chapters is given for the direction of those more especially interested in one field of thought than another. Such schemes are helpful in these days of much publication.

Francis E. Lloyd

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THE PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (NUMBERS 1–4)

Four numbers of the *Proceedings of the National Academy of Sciences* have now been issued. These contained in 258 pages a total of 70 articles, including the report of the autumn meeting of the Academy. The average length of the contributions was therefore 3.7 pages, which lies well within the limit of 6 pages, or 2,500 words, set by the editors.

The number of articles in the various branches of science is as follows:

Mathematics	11	Astronomy	11
Chemistry	13	Geology	2
Paleontology	1	Botany	4
Zoology	5	Genetics	5
Bacteriology	2	Physiology	8
Anthropology	5	Psychology	2

The inadequate representation of certain sciences, such as physics, geology and pathology, is largely accidental, as many authors in these fields have indicated their intention of contributing to the *Proceedings.*

The arrangement of the articles according to geographical distribution into Eastern, Middle West, and Pacific also shows a reasonable distribution over the whole United States. The figures are:

Eastern ...35 Middle west ...21 Pacific ...13

The Pacific figures show the activities of the great Lick and Mt. Wilson observatories in astronomy; and the Middle West has an exceptional representation in mathematics.

A number of the papers which have appeared in the *Proceedings* were read before the Academy at its autumn meeting and have therefore appeared in abstract in Science. Without making exceptions in the case of these papers, the contents of the first four issues of the *Proceedings* may be outlined as follows:

Astronomy.—An analysis of the radial velocities of nebulæ by W. W. Campbell shows that the planetary nebulæ are on the average moving much faster than the helium stars, which are supposed to be nearest to the nebular condition; and this leads to the suggestion that these nebulæ may have arisen by the collision of fast moving stars with resisting media.

H. D. Curtis, from a study of photographs of nebulæ taken at various times throughout a period of thirteen years, concludes that there are upon the plates no evidences of internal motion and little if any of proper motion, indicating great distance and enormous size for these objects.

The announcement of the discovery of the ninth satellite of Jupiter is made by S. B. Nicholson.

R. E. Wilson reports abnormally high radial velocities (some 250 km. per sec.) for nebulæ in the Magellanic Clouds, and calls attention to the importance of determining the velocities of stars in the clouds to ascertain whether the clouds as a whole may have such a velocity.

Kapteyn's theory that the universe is mainly composed of two great streams of stars is strongly supported by a statistical study of stellar radial velocities by J. C. Kapteyn and W. S. Adams. New observations of faint stars show that the streams extend to the greatest distances for which data are available.

A. van Maanen's measures of stellar parallaxes with the sixty-inch reflector are apparently of very high precision.