tions. It seems not unlikely that the greater part of the meteorological perturbations of our globe will be found closely connected with such transient inequalities in the sun's activity.

Some of the factors concerned seem, however, more adapted to produce secular oscillations in the sun's evolution of heat, extending through periods like the thousands of years probably occupied by the glacial age, and by the antecedent age of arctic warmth.

The one impossible thing would seem to be that the conflict of all those struggling and discordant forces should generate such an equalized and perfected balance in their resultant, that the sun's emission of light and heat should continue uniform and undisturbed from age to age; that it should not, indeed, from time to time be subject to very great fluctuations. In this view of the question, it seems not unreasonable to claim at least a place of high consideration for this hypothesis among other unverified hypotheses of the cause of the glacial period.

It may be claimed in favor of this hypothesis that it serves to account for the antecedent age of arctic warmth, as well as for the glacial age. Dr. Croll's hypothesis wholly failed in this respect. Nor, as it occurred not earlier than the pliocene, can it be attributed to conditions belonging to the carboniferous period.

As an objection to the solar hypothesis, it has been alleged that a diminution of solar heat would forbid the evaporation required to supply a precipitation of snow adequate to form glaciers. To this it may be replied that existing glaciers, like that of Greenland, are by no means supplied from the copious evaporation of the tropics, which is all precipitated in the neighboring latitudes. They are fed from the far lesser evaporation of the neighboring open seas, including the extremities of the Gulf and Kurasiwo currents. It is estimated that a general reduction of temperature of 18° to 20° F. over the earth's surface would produce the glacial period. Even with such a reduction in the sun's supply of heat, a large evaporation would continue, as well as air and ocean currents distributing the reduced warmth. The necessarily resulting changes would not involve a suspension of evaporation and precipitation, but rather a transfer of the areas of glaciation from the arctic to the temperate zone, such as actually took place in the glacial age.

SERENO E. BISHOP.

THE CULTIVATION OF THE SUGAR-BEET IN OHIO.

"FARMERS' BULLETIN No. 3" of the United States Department of Agriculture is an abridgment of a monograph on the sugar-beet, recently compiled by Professor H. W. Wiley, chemist of the department.

Judging from European experience, it seems probable that the culture of the sugar-beet in America will be most successful within the limits of a belt of about one hundred miles on each side of the summer isotherm of 70°; that is, a line marking an average temperature of 70° for the months of June, July, and August. In Ohio this line follows approximately the southern shore of Lake Erie, so that the northern third of the State is included within the belt named.

The summer temperature is not the only climatic question that must be considered, however; as, for instance, the mild winters of southern California permit the piling of the beets in immense heaps, requiring no protection, or, at most, but a slight covering of straw, and thus extending the working season throughout the winter; whereas in northern Ohio the beets would have to be pitted or housed in expensive cellars or silos. Again, the California winter gives a season of three or four months during which planting may be done, or three times as long as in northern Ohio.

The soil most favorable to the culture of sugar-beets is one that is easily worked, and is fertile enough to produce rapid growth. The moderately sandy soils, and especially the black sands of northern Ohio, will probably be found well adapted to beet-culture. The fertile bottom-lands of the farm occupied by the experiment station at Columbus produce large crops of beets. Stiff, heavy clays will not be found satisfactory, as a rule, unless thoroughly underdrained and brought up to a high state of fertility by previous manuring and the growth of clover.

The variety of beet is an important point, but a yet more important one is the care with which the seed has been selected. In France and Germany the percentage of sugar in the beet has been very greatly increased by improvements in the production of seed.

The manufacture of sugar from beets involves the use of very expensive apparatus, and requires great technical skill. In 113 German factories the mean capital invested in each factory is nearly two hundred thousand dollars; and the total expense of manufacture is nearly eight dollars per ton, counting the beets at a little less than five dollars per long ton. The experience of the Ohio Experiment Station is, that, on suitable soils, beets can be raised at this price with a very wide margin for profit.

The bulletin referred to contains illustrations of machinery used in beet-culture, and many other interesting items which cannot be condensed into a brief abstract. The station has received a few copies of this bulletin for distribution in Ohio, and will take pleasure in sending them free of all costs to all applicants, while the supply lasts. Address Experiment Station, Columbus, O.

NOTES AND NEWS.

AN exhibition of all the means of advertising will be held at the Palais des Beaux-Arts, Champ-de-Mars, Paris, from May 17 to Sept. 15.

— For a year past, the crater of Halemaumau, in the volcano of Kilauea, Hawaii, has been in a state of high activity, the lava frequently pouring out through ducts upon the main floor of Kilauea. On March 5 sinking began, attended with slight earthquakes, extending into the neighboring district of Kau. By the 8th the collapse was complete. The interior cone, with the adjacent fire-lakes, had sunk out of sight; and the entire area of Halemaumau, over half a mile in diameter, is now occupied by a pit estimated at five hundred feet in depth. It was just five years after the last and similar collapse. As then, no fire is now in sight. Some fissure has opened in the side of the main column of lava, and discharged the contents under ground. It is perhaps not a mere coincidence that on March 4 the mercury in Honolulu reached the lowest point on record, 48°. The extreme cold of March 10 in England will be noted in this connection. A full report of the condition of Kilauea is expected from Professor Brigham, who is now on the ground.

— The forthcoming May number of the *Review of Reviews* contains, under the title "Three Empire Builders," some timely character sketches. One deals with Sir Henry Parkes, prime minister of New South Wales, the father of Australian federation, and chairman of the great constitutional convention which has just concluded its labors at Melbourne. Another deals with Sir John Macdonald. The third sketch has the Hon. Cecil Rhodes for its subject, Mr. Rhodes being the gifted young Englishman who, a few years ago, went out as a consumptive student from Oxford to regain his health in Africa, and who has been conquering a new empire for Great Britain with Capetown as its capital. Among the special features of the May number will be found an article entitled "Workingmen's Clubs vs. The Bar-Room." "The Progress of the World," an editorial department of the *Review of Reviews*, contains in the May number a map of Australia showing the newly federated provinces, several maps showing the course of the new Nicaragua Canal, and various portraits.

— At a meeting of the trustees of the Johns Hopkins University, held April 6, 1891, the president of the university stated that a lady in New England had authorized him to offer the university the sum of five hundred dollars, to be bestowed in annual prizes during the next ten years, under the following conditions: the

prize shall be awarded for the best essay written by a graduate student upon some subject in historical or political science, ancient or modern, and submitted by him or for him to the academic council. The prize shall consist of a bronze replica of a likeness of Chief Justice Marshall, together with printed copies of his decisions (if they can be obtained). The prize shall be known as The John Marshall Prize of the Johns Hopkins University. To indicate the character of the work which the donor desires to encourage, she requests that three copies of the likeness be given as prizes for three essays to be selected by competent judges from the essays already published by recent members of the university. She desires that the further regulations for the bestowal of the prize shall be made by the president of the university, with the concurrence of the academic council. If, at the end of ten years, any balance shall remain unexpended, it shall be devoted by the trustees to the continuation of the prize, or to any other object that they may select.

— An expedition into southern and eastern Maryland has been organized, through the co-operation of the Johns Hopkins University, the United States Geological Survey, and the Maryland Agricultural College. The project has been approved by the governor and Board of Public Works of the State, and one or more steamers of the Maryland Oyster Navy will be detailed for the accommodation of the members of the expedition. The object of the expedition is to study the natural resources of the southern and eastern portions of the State. The heads of the Johns Hopkins University, the United States Geological Survey, and the State Agricultural College have designated the following persons as a board of control: Professor W. B. Clark of the Johns Hopkins University, chairman; Professor Milton Whitney of the State Agricultural College, secretary and treasurer; Mr. W. J. McGee of the United States Geological Survey. The expedition was to leave Baltimore April 23.

— Among the results already obtained from the oceanographic expedition of the "Pola," organized by the Academy of Sciences of Vienna, are the following, as we learn from *Nature* of April 16: The water of the central basin of the Mediterranean was found to be warmer, denser, and richer in dissolved salts, than the western basin. As regards the penetration of light into the sea, a white disk was visible only at a depth of 43 metres, but photographic plates were affected at a depth of 500 metres. Starting from the surface of the sea, the quantity of oxygen dissolved at first increases with the decrease of temperature, but then again decreases, so that at a depth of 3,000 metres the proportion is the same as that at the surface. In no case was any free carbonic acid found. The nitrogenous substances in solution vary in inverse proportion to the depth: that of ammonia varies but slightly, but is greater in the lower strata.

— The next annual meeting of the Royal Society of Canada will open in Montreal on Wednesday, May 27, 1891. The sessions usually last one week. It is anticipated that the meeting will be attended by many distinguished persons eminent in literature and science from Europe and the United States as well as from the Dominion of Canada. The ordinary sessions of the society will be held in the buildings of the McGill University, and the popular evening lectures will be delivered in the Queen's Hall on St. Catherine Street. The museums and art galleries, with the educational, industrial, and other institutions of the city, will be opened to visiting members and associates. Local excursions to places of interest in the neighborhood will be arranged for; and receptions, garden-parties, and entertainments of various kinds, will also be provided. To members and associates attending the meeting, the Intercolonial Railway of Canada will issue return tickets over its system at a single fare. The Grand Trunk and the Canadian Pacific Railways, together with their connecting railways in the United States, will issue similar tickets at a fare and a third for the double journey. The committee are engaged in the preparation of a handbook, for gratuitous circulation among intending visitors, which will include an historical account of the society, together with other intersting scientific and local information, a copy of which will be sent on application. It will greatly facilitate the arrangements of the committee if intending visitors will promptly advise the local secretaries, 32 University Street, Montreal, of their intention. All persons interested in literature and science may become associates for this meeting, and are cordially invited by the local committee to be present thereat.

— At a meeting of the Royal Meteorological Society, April 15, the following papers were read: — "Some Remarkable Features in the Winter of 1890–91," by Mr. F. J. Brodie, in which the author points out the peculiarities or special features of interest in the weather which prevailed over the British Isles during the past winter, and states that in addition to the prolonged frost, which lasted from the close of November to about Jan. 22, he finds that the barometric pressure for the whole winter was about a quarter of an inch above the average, and that when the wind was not absolutely calm there was an undue prevalence of breezes from some cold quarter; that the percentage of winds from the southward did not amount to one-half of the average, the number of foggy days in London was no less than twice the average, and the rainfall over the greater part of the British Isles was less than half the average; that "almost every element in the weather has been influenced to an abnormal degree by the remarkable prevalence of high barometrical pressure, and, if we were called upon to define the season 1890–91, we should have little hesitation in giving it the name of the 'anticyclonic' winter:" "The rainfall of February, 1891," by Mr. H. S. Wallis, in which the author states that this was one of the dryest months upon record, the mean rainfall over England, excluding the Lake District, being only .066 of an inch, or about one-fortieth of the average: "On the Variations of the Rainfall at Cherra Poonjee in the Khasi Hills, Assam," by Mr. H. F. Blanford, in which it is stated that Cherra Poonjee has long been notorious as having a heavier rainfall than any other known place on the globe, the mean annual fall being frequently given as about 600 inches. Mr. Blanford has made a critical examination of the various records of rainfall kept at this place, and has come to the conclusion that the above amount is too high, and that the average annual rainfall is probably only a little over 500 inches.

— The "Hopkins House of Commons," founded in 1884 under the impulse given by Professor Woodrow Wilson, and for some years a very popular organization of Johns Hopkins University, has been revived. A preliminary gathering was recently held, and it was determined to continue the society by obtaining as many new members as possible, and resuming regular sessions. Four meetings have now been held with an average attendance of about twenty-five, and it is hoped that the success of the organization is assured. Both graduates and undergraduates are eligible to membership, and the meetings are open to visitors. They are held in College Hall at 8 o'clock every Monday evening.

— An attempt is to be made to establish an engineering laboratory at Cambridge University (England) on the model of those at the Central Institution, Kensington, and at University College, Liverpool. The syndicate appointed to consider the question report that "the study of mechanics gains much in utility, and loses nothing in educational value, by being approached from the standpoint of the engineer." "This is an important admission," says *Engineering* of April 17, "as the unfortunate engineer has had to stand any quantity of abuse from physicists, such as Professor Lodge, because he does approach these matters from his own standpoint, and works with quantities he understands, and measures daily, such as weights rather than masses, and pounds per square inch instead of dynes per square centimetre. Professor Greenhill, who is an old Whitworth scholar, has, it is true, supported the engineers; but many physicists seem to consider him as more or less of a traitor who profanes their mysteries, in making them intelligible to the practically trained man. Apart from this, however, every one will agree with the dictum of the syndicate quoted above. The abstract ideas of the mathematician become concrete entities in the practice of the engineer, and both pure and applied physics should benefit from the establishment on a proper scale of an engineering laboratory at Cambridge. The principal difficulty is one of money. A sum of $100,000 is required; and, Cambridge not being a large business town like Liverpool, there is no one there able to imitate the generosity of Sir A. B. Walker at the

latter city. Still, among the alumni of the university there are so many wealthy men who should be proud to come to the assistance of their alma mater. The university have out of their present funds provided a suitable site, and have provided annual grants towards the payment of demonstrators and the current expenses of the department. More, however, they are unable to do, without outside assistance, which, it is to be hoped, will be promptly forthcoming."

— We learn from *Engineering* that the Kew Observatory are about to undertake the testing of photographic lenses, as they have long done that of telescopes, sextants, and surveying instruments, as well as watches and thermometers. Lenses up to four inches in diameter will be examined, and certificates awarded according to the performances of the glass. They will be tested in sets, the trials beginning about the 1st and 15th of each month. A lens may be entered either for a class A certificate or a class B one. In the first case, the fee for which is 10s. 6d., the test will comprise the determination of the length of equivalent focus; size of effective aperture with every stop in terms of focal length; angle of field of view and size of plate effectively illuminated; number of external reflecting surfaces; coincidence of visual and chemical foci; presence of flare spot; workmanship of surfaces, structure and degree of transparency of glass; centring in mount; defining power; relative quality of illumination in different parts of field, and amount of astigmatism or optical distortion. For a class B certificate, at a fee of 2s. 6d., the test will consist simply of the determination of the length of equivalent focus; size of effective aperture with largest stop; angle of field of view; size of plate effectively illuminated; and coincidence of visual and chemical foci. Further particulars of the arrangements can be obtained from the superintendent, Kew Observatory, Old Deer Park, Richmond. The fees charged are certainly very moderate for the work undertaken, and, from the character already earned by the officials of the Kew Observatory, there can be no doubt that this work will be thoroughly performed.

— In the course of excavations which are being carried out in the neighborhood of Vienna by the Academy of Sciences, a cavern was discovered on the slope of the mountain at Baden. A correspondent writes to the London *Times*, "It was plain, on a cursory inspection, that the cavern had been used not only in the middle ages, but long previously. At the time of the Roman occupation, Baden was the encampment of a veteran legion who were well acquainted with the good qualities of the waters. Decided remains of the foundations of a vestibule were found at the entrance of the cave. In a niche hewn out of the rock was an altar with the sacrificial stone table. In front of the cavern was a regularly constructed building, fully ten feet below the surface of the ground above, designed probably to conceal the cavern behind, which was most probably employed as a temple to Mithras. There were two stalls for horses, fragments of utensils, knives, flint arrow-heads, carved bones, mixed up with Roman coins, lamps, and stamped tiles."

— M. Henniqué, the director of the colonial section which formed such a pronounced feature of the Paris Exposition of 1889, has followed up his suggestion for a colonial exhibition at Paris in 1892 with characteristic energy; and there is now exery prospect of success, according to *Engineering* of April 17. The scheme, too, has immensely widened, and the society formed for its furtherance includes several members of the institute, many scientific men and political notabilities all working in earnest. The exhibition will be opened on May 1, 1892. It is to be held, of course, on the Champ de Mars; and the principal sections will be located in the Machinery Hall, — one of the glories of the 1889 exhibition, and at present used for popular gatherings on a large scale. Villages and encampments will be erected by natives of colonies, who will inhabit them, and in this way illustrate aboriginal life. The primary idea is to gather a thoroughly representative collection of the produce of the colonies of all nations, while the scientific and mechanical departments will indicate the methods adopted and possibility of adoption for development. It is not necessary to say that the popular attractions will be largely in evidence: Parisian management implies that. M. Lockroy, who had much to do with the 1889 exposition, being at the time minister of public instruction, is taking an active interest in the project. He has been elected president of the General Colonial Society, which is providing the necessary funds to the extent of $1,400,000. As soon as the Municipal Council grant the use of the Champ de Mars, the society will communicate with various nations, inviting co-operation. Special requests are to be made to Great Britain. Agents are at the same time to be sent to Africa, Asia, and America to arrange for groups of aboriginal tribes being sent to the exhibition. These will be changed from time to time, the exigencies of the ever-varying climate being the chief consideration in making the arrangements, so that denizens of the tropic as well as Arctic regions may be presented for the amusement of the patrons of the exhibition as well as for the study of ethnologists.

— At the meeting of the French Meteorological Society on March 3, a communication from M. Marès showed that the weather in Algeria had been as remarkable during the last winter as in Europe. The author stated, says *Nature*, that in many localities the excessive rainfall had prevented the sowing of seeds; and in the mountainous districts, where the sowing had taken place early, the seed had been swept away by the torrents. About the third week in January a heavy fall of snow lay on the Mitidja and the Sahel for two whole days. The writer states that for the last thirty-five years, although he had sometimes seen snow fall, it did not lie an instant on the ground. The effects had been disastrous to early crops and to many animals.

— A pleasant series of summer studies in botany was begun on April 23 by the Torrey Botanical Club and the College of Pharmacy of the City of New York, whose members have jointly arranged a course consisting of lectures and excursions extending throughout the summer. This course has been provided as a means of instruction for those business and professional men and women who desire to become practically acquainted with the chief principles of the science of botany and with local flora, but who are deprived of the ordinary means of study provided by schools and colleges. The course will consist of ten lectures by competent instructors, and ten excursions into the woods and fields by the lecturers and students. Professor Henry H. Rusby, Professor Henry Kraemer, and Professor Thomas Morong will be the lecturers.

— The executive committee of the last International Congress of Americanists, which was held in Paris from the 14th to the 20th of October last, decided that the next session of the congress should be held at such place as the Spanish Government should be pleased to indicate. The Spanish Government has now designated the Convent of Santa Maria de la Rabida, in the province of Huelva, as the place of the ninth session of the congress, which will commence on April 1, and end on Oct. 6, 1892. The Spanish Transatlantic Steamship Line offers free passage to two officially accredited delegates to the congress from each of the American republics, and half fare for all other duly accredited members who may desire to attend the congress at Santa Maria de la Rabida. The Spanish railways will likewise give delegates half fares. Any duly accredited person desiring to take part in the congress can apply for membership to the Spanish consulate here, and for a merely nominal fee will receive the proper credentials. The Convent of Santa Maria de la Rabida has been chosen by the Spanish Government because it is the place where Christopher Columbus received his first real encouragement in his plan to sail westward in an attempt to discover the Indies, and because it is near Palos, the port from which he sailed. The International Congress of Americanists has two aims,— to contribute to the progress of scientific studies, relative to the two Americas, especially in times previous to and immediately after Christopher Columbus, and to bring more closely together the persons engaged in such studies. A number of papers bearing upon matters in which the congress is interested will be read at the different sessions. Any paper requiring more than twenty minutes to read should be submitted in advance. The classes of questions on which papers are invited, and the various particular subjects under each class, are history, geography, archæology, anthropology, ethnography, language, and paleography.