ing of the other theory some years before; and, in spite of Professor Ferrel's letter, it still seems to me that I was right in saying that the convectional theory needs revision in the light of Dr. Hann's results, but by revision I do not mean abandonment.

The incompleteness of the new theory is not a reason for being silent about it. It should be welcomed, if only for the reason that it will cause a healthful revision of previous views. The value of multiple working hypotheses has been so well set before our scientific readers, that nothing more need be said on that point. I will not venture to speak for Professor Ferrel, but I am sure that practically every meteorologist in the country will profit from a serious re-examination of his knowledge of the theory of cyclones in the light of Dr. Hann's researches.

As to the process by which the general circulation of the atmosphere shall produce cyclones and anticyclones, it is not to my mind necessary that this should be worked out completely before the suggestion of it may be profitably made. But it does not seem impossible that the general winds might here and there crowd together, owing to irregularity of flow; that, where crowded together, anticyclones would appear; and that, between the anticyclones, cyclonic whirls might be formed. It would be indeed a satisfaction if I could here answer all the pertinent questions, and give all necessary explanations, about such a problem; but, if we may judge by the treatment that dynamical meteorology has received thus far in this country, there is only one American who can do that. I wish that he might consider the possibilities of some such process arising from the general circulation of the atmosphere as is outlined above, and, after working them out rigorously, state them as clearly as he has explained the general circulation of the atmosphere itself. Whatever truth there is in the convectional theory of cyclones would not be harmed by such an investigation, while whatever truth there may be in the hypothesis of driven cyclones would pretty surely be discovered by it.

There is a corollary to the suggestion made by Dr. Hann, that may be of interest to those who seek for an explanation of our past glacial climates. It is generally recognized, that, if there were an increase in the activity of our winter cyclones, there would be an increase of snowfall as well; and, if this were carried far enough, the accumulation of snow might last over the summer. The increase of cyclonic activity would presumably accompany an increase in the general circulation of the atmosphere, if cyclones in our latitudes are driven by the general winds; and this would appear in that hemisphere whose equatorial and polar contrasts of temperature were strengthened. Such strengthened contrasts might be expected in the hemisphere having its winter in aphelion, and particularly at times of maximum orbital eccentricity. I do not mean to imply that a glacial period might depend on this condition alone; yet it may be one of many whose varying combinations at times produce a glacial climate, as Croll and J. Geikie and many others have shown; but this particular element of the combination does not appear to have been recognized.

W. M. DAVIS.

Harvard College, Cambridge, Mass., Dec. 27.

Moisture in Storms.

NEXT to the action of heat in storms, the part that moisture takes in them has been greatly emphasized. The so-called "condensation theory" of storms has had wider acceptance than any other. We may imagine a limited portion of the earth's surface heated up by the sun, and this more or less of a circular shape. There will be induced a tendency to an uprising current of heated air, which will continue so long as the central portion is warmer than the air surrounding it at the same level. This tendency, however, would be quickly brought to rest were it not for the fact that the uprising column has its moisture condensed, which liberates latent heat and causes the column to rise still faster. Here is a most remarkable fact, notwithstanding that the release of this moisture diminishes the total amount in the air, and the latent heat warms up the air, both of which causes would stop precipitation at once; yet we are taught that the force of the storm is increased by this process. There is another serious objection among many. If rain occurred at the centre of the storm, this theory might be plausible; but since the bulk of the rain in this country occurs three hundred miles to the eastward of the centre, and over only about one-fiftieth part of the area covered by the storm, it requires an enormous stretch of the imagination to grasp the causation of our wide-extended storms through this condensation effect. We may add still another consideration. It is fairly well ascertained that the upper limit of our storms, as shown by pressure and temperature observations at Pike's Peak (14,134 feet), is far above four or five miles, and may extend to the limits of the atmosphere. Now, the bulk of our precipitation is formed within 6,000 feet of the earth's surface: hence it is plain that the condensation of moisture plays a very subordinate part in our wide-extended storms, and has nothing to do with their generation or maintenance.

I do not propose to discuss at this time all the objections to this "condensation theory," which have been repeatedly advanced both in this and other journals, and which have not been answered, but I wish to present a recent most extraordinary abandonment of this theory by Dr. Hann, who stands at the head of the old school on the continent. I quote from a translation, by Professor Blanford of London, of a recent statement by Dr. Hann. Speaking against the condensation theory, he says (*Nature*, Nov. 6, 1890), "These views are such as I have always enunciated (for a long time, indeed, without any apparent result) in opposition to the then prevalent theories of the local origin of barometric minima through the agency of condensing water-vapor (as contended by Mohn, Reye, Loomis, and Blanford). They now begin to make way and prevail. Most clearly is this seen in the case of Loomis, who, in the course of his own persistent study of the behavior of barometric minima and maxima, has been compelled by degrees to give up the 'condensation theory' to which he formerly adhered so strongly, and to ascribe the origin as well as the progressive movement of cyclones to the general circulation of the atmosphere."

The importance of this utterance from such an authority cannot be exaggerated. While I have shown that Dr. Hann has been misled by his study of mountain observations, yet it seems to me this avowal on his part reaches out far beyond that. As I have just shown, the very life and existence of the old theory depend upon condensation of moisture. Now, if Dr. Hann, who must understand this fact most thoroughly, has deliberately set it aside, must we not conclude that it has an inherent weakness in itself to his mind. Those who are familiar with Loomis's work will be surprised to learn that he ever abandoned the condensation theory of storms.

It would seem that this controversy over the condensation theory is rapidly culminating, and the indications point to a speedy downfall of that theory. It is a remarkable fact that all the objections urged against this theory, now these many years, have been studiously ignored; but a few words from a recognized authority, even though based upon a wrong interpretation of facts, seem to make headway very rapidly. Surely Hann, Davis, and Blanford form a most formidable front against this theory, and it is high time its defenders should come to its assistance ere it be too late.

H. A. HAZEN.

Washington, Dec. 13.

["Letters to the Editor" continued on p. 8.]

NOTES AND NEWS.

AT a meeting of the Royal Botanic Society on Dec. 13, as we learn from *Nature* of Dec. 18, the secretary answered various questions as to the destructive action of fogs on plants. He said it was most felt by those tropical plants in the society's houses of which the natural habitat was one exposed to sunshine. Plants growing in forests or under tree shade did not so directly feel the want of light; but then, again, a London or town fog not only shaded the plants, but contained smoke, sulphur, and other deleterious agents, which were perhaps as deadly to vegetable vitality as absence of light. Soft, tender-leaved plants, and aquatics, such as the *Victoria regia*, suffered more from fogs than any class of plants he knew.

—"The Harvard Yard," an original etching by Robert R. Wiseman, shows the "Harvard Yard," with a good view of the group of older buildings. The plate is of large size. No plain prints of the etching are to be had for the present, at any rate, possibly not at all. Each remarque artist-proof is printed on imperial Japan paper, and bears the signature of the artist and a remarque representing the seal of the university, printed in dark crimson. The publishers are the Frederick A. Stokes Company, 182 Fifth Avenue, New York City.

—*Nature* states that a novel whaling expedition is about to be undertaken by three Americans whalers, which have gone to the Arctic regions to winter at the mouth of the Mackenzie River. In order to be well supplied with food, they have taken what will last for two years, and they expect also to get food from the whalers in the summer. This is the highest point any whaler has reached, being a thousand miles from the North Pole. Directly the ice breaks after the winter, the whales come to the mouth of the river in great numbers to feed, and it is expected that a large number of them will be secured.

— A paper by Mr. W. B. Mason in the "Transactions of the Seismological Society of Japan" deserves the attention of all who take special interest in seismology. It contains, according to *Nature* of Dec. 11, a list of earthquakes recorded at telegraph-stations in central and northern Japan from Aug. 11, 1888, to Dec. 31, 1889. Mr. Mason, while allowing for various sources of uncertainty in the observations, thinks that some results may be deduced from what are still meagre statistics. Thus, of the 151 earthquakes recorded in Tokio, only 89 were felt at the other telegraph-stations. Some of those which were felt at all the stations seem to have been felt at almost exactly the same instant: in other words, there was no indication of a progression of the earthquake from point to point.

— Some three years ago MM. Fremy and Verneuil, two French chemists, succeeded in producing rubies artificially. The crystals obtained, says *Engineering*, were small; and since then the inventors have been occupied with the problem of increasing the size of the rubies obtained. To this end considerable changes have been made in their methods of operating. In place of using pure alumina, as in their previous experiments, alumina alkalinized by potassium carbonate is used. This addition of an alkali does not alter the purity of the crystals obtained, while it facilitates their regular formation. In their original experiments the operations were completed in twenty-four hours, but they have now succeeded in prolonging the re-action over several months, with the result of obtaining much larger crystals. As much as seven pounds weight of rubies have been obtained at a single operation. Even yet, however, the crystals are small, but are at least sufficiently large to mount, which was not the case with the first essays of the inventors.

—The curious idea of preserving dead bodies by galvanoplastic method is not new; but we note that a Frenchman, Dr. Variot, has been lately giving his attention to it (*La Nature*). To facilitate adherence of the metallic deposit, says *Nature* (Dec. 18), he paints the skin with a concentrated solution of nitrate of silver, and reduces this with vapors of white phosphorus dissolved in sulphide of carbon, the skin being thus rendered dark and shiny. The body is then ready for the electric bath, which is served by a thermo-electric battery, giving a regular adherent deposit of copper if the current is properly regulated. With a layer of one-half to three fourths of a millimetre, the envelope is solid enough to resist pressure or shock. Dr. Variot further incinerates the metallic mummy, leaving holes for the escape of gases. The corpse disappears, and a faithful image or statue remains.

— Mr. J. M. Coode records, in the new number of the *Journal of the Bombay Natural History Society*, the following instance of an exceptional method of hunting which the panther is occasionally forced to adopt. Mr. Coode was lately asked by the patel of a village in the Amraoti district to accompany him one evening to a forest nursery of young bamboo shoots, to assist in killing a large boar which nightly visited the place and did immense damage. As stated in *Nature*, they waited for some time, when, just as it was getting dark, they heard the short guttural sound of a panther, and heavy footfall of some running animal. The noises came nearer and nearer, until a nilghai and a panther could be distinctly seen against the sky-line, the former being chased by the latter. The nilghai kept moaning, and was evidently in an abject state of fear. The two ran round in a circle of about one hundred and sixty yards diameter, within thirty yards of where the observers were standing, and passed them twice, both animals making their respective noises. They then disappeared, but Mr. Coode has reason to believe the nilghai got away.

— At the last meeting of the Physical Society (London), as reported in the *Electrical Review* of Dec. 19, Mr. Shelford Bidwell, F.R.S., told a great many useful facts about selenium cells and their behavior; and he gave several experimental illustrations, the most effective of which points to practical applications. Mr. Bidwell connected one of his selenium cells with a delicate relay, which in its turn caused a circuit to be established with an automatic switch and an electric lamp. So long as sufficient light impinged upon the selenium, the electric lamp did not act; but, directly the gas (or daylight in practice) diminished to a certain degree, the electric lamp shone forth in its glory, and again became extinguished when its rival re-appeared. The fact of any light going out could thus be signalled to a distant attendant, and this would be useful in case of ships' lights and numerous other purposes. The effect of different colored glass interposed between the light and the cell revealed peculiar results upon the properties of the selenium, and Dr. Thompson suggested that one could almost imagine the near possibility of seeing by electricity if the effects of colors could be transmitted to distances in some analogous manner.

— It is stated in the "Proceedings of the Royal Geographical Society" (December, 1890) that M. Thoroddsen, the well-known explorer of Iceland, has returned to Reykjavik from his summer excursion into the district between Borgarfjord in the south and Gilsfjord in the north. The topography of the country as shown on existing maps was found to be fairly accurate. The geological results of the journey are more novel. The volcano situated at the extreme point of the peninsula of Snaefellenes was visited. It is especially interesting from the fact that clear indications have been found that this volcano commenced its eruptive activity long before the glacial epoch; and, although no outbreak is known to have occurred within historical time, it is tolerably certain that its activity continued to comparatively modern times. The volcanoes of the district traversed have not the same direction as those in the south of Iceland, viz., from south-west to north-east, but range themselves in a semicircle round Faxe Bay, which is a distinctly volcanic depression. M. Thoroddsen's expedition was largely supported by Baron Dickson.

— Some experiments have just been made at Annapolis by the United States Government with the object of testing the resistance of nickel-steel armor-plates at low temperatures. The plate tested, according to *Engineering* of Dec. 12, which had already received five shots under ordinary conditions, was fired at twice more,—once before subjecting it to a freezing mixture, and once afterwards. A 6-inch gun was used with a powder charge of 44½ pounds, and a Holtzer shell weighing 110 pounds, the striking velocity being 2,055 feet per second. The first shot struck 15 inches from the edge of the plate, and the projectile penetrated till its point entered the wood backing, reaching a distance of 13½ inches from the face of the plate. The shell rebounded, and was picked up entire at a distance of 40 feet from the plate. The plate showed a crack 14 inches long extending down to the left edge of the plate, and another horizontal crack 13 inches long, both of which were apparently through cracks. The plate was then put in a freezing mixture of ice and salt, and its temperature reduced to 28° F. The second shot was then fired, the conditions being similar in all respects to the first. The shell, however, broke up badly, about one half remaining on the plate, and the other half flying to fragments. A triangular piece of the plate, 26 inches across the top, broke off, and was thrown 25 feet in front of the plate. A wide gaping crack connected the hole with

one of the shot-holes previously made in the plate. Numerous old cracks were opened and enlarged, and other new ones made, the longest being 24 inches. With the exception of two cracks, the injury to the plate was in the neighborhood of previous fractures. The perforation of the two rounds was much the same.

— The Swedish expedition to Spitzbergen under the leadership of G. Nordenskiöld and Baron A. Klinkowström returned in safety to Tromsö, as we learn from the "Proceedings of the Royal Geographical Society." The party landed first of all at Horn Sound, whence G. Nordenskiöld made his way on snow-shoes overland to Bel Sound; but the deep snow prevented geological work. The longest stay (July 18 to Aug. 10) was made at Ice Fiord. The farthest point north reached was Lagö, east of Hinlopen Straits. The passage was still quite blocked with ice, and, there being but small chance of being able to penetrate to the Seven Islands, the return voyage was commenced. On their way back, the travellers made hydrographical explorations on the Norwegian islands.

— Professor Brückner of Berne, Switzerland, has recently called attention to the existence of climatological periods of about thirty-five years for the whole globe (more marked in the interior of continents). The years 1700, 1740, 1780, 1815, 1850, and 1880, says *Nature* of Dec. 18, appear as centres of cold, wet periods; while the years 1720, 1760, 1795, 1830, and 1860 are centres of warm, dry periods. During the warm periods the passage of oceanic air to the continent has been hindered, and during the cold it has been favored, increased rainfall occurring in the latter case.

—We learn from *Engineering* of Dec. 12 that Mr. P. Schoop, of the Oerliken Electrical Works (Switzerland), with the object of rendering accumulators more portable, has adopted the plan of absorbing the electrolyte with gelatinous silica. With this object, Mr. Schoop adds a small quantity of sodium silicate to the cell. This is decomposed by the sulphuric acid, and the silica is liberated in the form of a translucent, firm, and elastic jelly, which is unattacked by sulphuric acid, or by the more powerful oxidizing agents which come into existence during the charging. The jelly but slightly increases the resistance of the cell, though it somewhat diminishes its capacity in watt hours. The best method to adopt in gelatinizing a cell is to add to three volumes of sulphuric acid, at a density of 1.25, one volume of sodium silicate at a density of 1.18, and leave the mixture to itself for twenty-four hours. At the end of that time the whole liquid is set to a jelly. In charging a cell, a small quantity of liquid rises to the surface of the jelly, but this disappears again during the discharge.

— The French Government have had carried out for them a number of experiments on gun-steel at very low temperatures. Both hardened and unhardened specimens were subjected to a variety of tests at temperatures of between 75° and 100° below the zero of the Fahrenheit scale. The specimens were cooled, according to *Engineering*, by immersing them in a bath of solid carbonic-acid gas and sulphuric ether, several pounds of the gas being required for this purpose. The first set of tests were simply intended to determine the expansion of the test bars per degree; and the results, though somewhat irregular, showed that the expansion per degree decreases with the temperature. A number of test bars were then prepared in sets of threes, two of each set being used as reference bars, and tested at the temperature of the surrounding air, while the third was cooled down to between 75° and 100° below zero, and then tested, with the following results: both the hardened and unhardened bars had their elastic limit raised by about 11 per cent by being tested cold; the breaking load of the unhardened bars was raised about 3 per cent, and that of the hardened by about 6 per cent, by the cooling; the elongation of the unhardened bars was diminished 12 per cent, and that of the hardened ones 14 per cent; the contraction of area was also less in the bars tested cold. None of these changes are, however, permanent, as the bars completely recovered their original properties on attaining the ordinary temperature of the air. All the above tests were made in tension in the usual way. For gun-steel, however, the resistance of the metal to shock is of more importance than its strength under a quiet tensile stress. A number of bars were accordingly prepared in sets of threes, as before, and one bar of each set was cooled down to between 75° and 100° below zero, and tested by means of a falling weight, the other bars of each set being tested in the same way at the ordinary temperature. The experiments showed that cooling the bars much increased their brittleness. Thus, on an average, each unhardened bar required 5.9 blows to break it when cooled, as against 14.6 blows for specimens tested under ordinary conditions. With the hardened bars, the reduction in strength was less, 12.57 blows being required as an average at the low temperature, and 14.4 at the ordinary temperature. As before, the metal regained its qualities as its temperature rose. Some further experiments seemed to show that metal into which a great deal of work had been put was less affected by a reduction in temperature, but this requires confirmation.

— According to the *Journal de la Chambre de Commerce de Constantinople*, the greatest electric project which has yet been suggested is being planned,—the construction of a line from St. Petersburg to Archangel. The electric current would be supplied by a series of generating stations distributed along the line. It is estimated that the cost, including the rolling stock, would be 46,509 francs per kilometre.

—*Nature* states that at a recent meeting of the Paris Academy of Medicine, M. Motais of Angers maintained that myopia, or short-sightedness is one of the products of civilization. An unexpected proof of this view was found in the condition of the eyes of wild beasts, such as tigers, lions, etc. M. Motais, having examined their eyes by means of the ophthalmoscope, discovered that animals captured after the age of six or eight months are, and remain, hypermetropic, while those who are captured earlier, or, better still, are born in captivity, are myopic. This short-sightedness is evidently induced by artificial conditions of life.

— On Monday, Dec. 15, Mr. T. G. Pinches read a paper before the Royal Asiatic Society, on the newly discovered version of the story of the creation. He had had the good fortune, in the course of his investigations into the contents of the unregistered tablets in the British Museum, to find in one of them, brought home by Mr. Rassam in 1882, a still earlier version than that which the late Mr. George Smith had translated. It was a bilingual tablet, the text being Akkadian, and the gloss Assyrian; and while the date of the tablet itself was, like the rest of those in Assur-bani-pal's library, not older probably than 650 B.C., the Akkadian text was, in his opinion, an exact copy of an older document, which had, in all probability, been put into its present shape 3000 B.C., or even earlier. One side, the obverse, as described in *Nature*, is devoted to the creation story: the other, the reverse, is simply an incantation form for the purification of the great temple tower E-zida, now so well known as the mound called Birs-Nimrud. The text might be roughly divided into three paragraphs or sections of about ten lines each. The first describes the time when nothing was, neither "the glorious house of the gods," nor plants, nor trees, nor cities, nor houses, no, not even the abyss (Hades) nor Eridu (regarded by the author as Paradise). The second section describes the making of Paradise with its temple tower E-Sagila, founded within the abyss. Then was Babylon made, and the gods, and the land, and the heavens, and mankind. The third section then proclaims the creation of animals, plants, and trees (in that order) of the Tigris and of the Euphrates. The fourth records the building of cities and houses. Of all except the last, Merodach, the god, seems to be the active creator, and he is also to be understood as the builder, through men, of the cities, etc. Mr. Pinches pointed out several interesting words and forms occurring in this oldest form of the creation account, which had subsequently assumed so many diverging shapes. A discussion followed, more especially on the word "Adam," rendered by Mr. Pinches "foundations" (of earth), but by Dr. Zimmern "living things." This was probably the origin of the Hebrew word "Adam."