In the cycle as arranged above, the first year is that which contains the year of maximum sunspot, and the eighth that of minimum sunspot.

With the figures in the text, the maximum winter rainfall occurs on an average rather more than a year before the minimum of sunspots, and the minimum of rainfall appears either to coincide with, or to follow the maximum of the sunspots, at about an equal interval.

While, therefore, the facts are so far favourable to a close connection between sunspots and rainfall in Upper India, they do not lead so much to the conclusion that the former directly affect the latter, as to their both being effects of some common and as yet undetermined cause.

It should be further noticed, both as a result of this investigation, and an example of one of the "new and unsuspected truths" which Mr. Blanford says are often incidentally brought to light, that the variations of the summer and winter falls are almost exactly contrary to each other, and as this has been found to occur not only in the years of the mean cycle, but also in individual years, it has been concluded by Prof. Hill that *in Northern India the winter rains are excessive when the summer rains are defective and vice versâ.*

This contrary variation, which is of itself a valuable discovery, is moreover shown to be due in some measure to a reaction of the winter on the summer rainfall. Thus, in years of heavy winter rainfall in Northern India, and therefore of heavy snowfall in the Himalayas, an excess of barometric pressure attended by diminished temperature, is found to occur during the earlier months of the year, which causes the air to move outwards from the centre of relatively highest pressure, and so bar the approach of the Arabian Sea current from the south-west, as well as the Bay of Bengal current from the south-east, and by thus compelling them to part with their moisture in other districts, such as the hills of Central India, or East Bengal and Burmah respectively, causes deficiency and drought over the Punjab and North-West Provinces, or Western Bengal.

On the other hand, in years of defective winter rainfall, the temperature is generally high, and the pressure low, in the early months of the year; while the currents from the south-east up the Ganges valley appear in full strength, and are accompanied by early and abundant summer rains.[1]

Mr. Blanford has partly attributed the high atmospheric pressure which occurs in the years of heavy snowfall, to the cooling thereby produced, but as this abnormally high pressure sometimes extends right down the Bombay coast, it is plain that the snowfall is not the only determining cause, and that we must look to some more general cause to explain the matter. Prof. Hill speculates very intelligently on this cause, but as the speculation requires confirmatory evidence, it will be as well perhaps not to dwell on it at present.

It may, however, be observed that this speculation accounts satisfactorily for the double oscillation of the Bengal summer rainfall with its *maxima* at both sunspot epochs, as well as the double oscillation of the annual rainfall of Southern India, noticed by the late Mr. J. A. Broun, F.R.S., in NATURE, vol. xvi. p. 334 (which, unlike that of Northern India, is solely due to the *summer monsoon current*) with its *minima* at both epochs, two remarkable facts, which might at first sight appear to be almost irreconcilable, if not unaccountable.

Before leaving this interesting and suggestive paper, it should be remarked that the variation in the winter rainfall of Northern India is shown to be closely connected with the curve of air-temperature in the tropics calculated up to 1862 by Dr. Köppen, and continued up to 1877 by Prof. Hill from Indian observations alone.

The following table gives the epochs of maxima and minima of both elements, and the conclusion can, we think, scarcely be resisted that there is a causal connection between them, since in every case but one, the rainfall epochs slightly *follow* those of the temperature :—

Maximum and Minimum Epochs of Tropical Temperature and Winter Rain

Minima.		Maxima.	
Temperature.	Rain.	Temperature.	Rain.
1836·9 ...	1837·8 ...	1842·7 ...	1842·7
1847·7 ...	1848·1 ...	1854·7 ...	1855·0
1858·4 ...	1860·6 ...	1865·1 ...	1865·5
1874·8 ...	1874·7 ...	(1876·3) ...	(1876·9)

[1] These opposite conditions are now so universally recognised, as almost to form a canon of Indian meteorology.

Similar variations are shown to exist in the winter rainfall of other parts of the world, as well as in the humidity of Russia and Siberia, which favour the hypothesis long entertained both by Prof. Hill and the writer, that "the winter rains in Northern India occur simultaneously with an increase in the quantity of aqueous vapour in the atmosphere over Eastern Europe and Western Asia, and that the cause of both may *possibly* be found in an unusually high temperature in the tropics, whereby the evaporation of the waters of the ocean is accelerated and the upper current of moist air known as the anti-trade has its velocity increased."

SCIENTIFIC SERIALS

American Journal of Science, August.—Principal characters of American Jurassic Dinosaurs, part vi.: Restoration of Brontosaurus, with plate, by Prof. O. C. Marsh. The restoration is effected by bones belonging almost exclusively to a single individual, which when alive was about fifty feet long; chief characteristics: long flexible neck, very short body, massive legs and feet, the latter plantigrade, and leaving footprints about a square yard in extent, very large tail with solid bones, remarkably small head, smaller in proportion to the body than that of any other known vertebrate, skull being less in diameter or weight than the fourth or fifth cervical vertebra. The living animal must have weighed over twenty tons, and appears to have been a stupid reptile of slow motion, without offensive weapons or dermal armature, amphibious in habits, feeding on aquatic and other succulent plants.—The evolution of the American trotting horse, by Francis E. Nipher. The minimum time of trotting a mile, in a previous paper determined at 93, is here reduced to 91 seconds, and it is suggested that the trotter will very probably finally surpass the race-horse in speed.—On concave gratings for optical purposes, by Henry A. Rowland, Professor of Physics, Johns Hopkins University, Baltimore.—Glacial markings of unusual forms in the Laurentian Hills, by Dr. Edmund Andrews. Several illustrations are given of the peculiar marks here described, which are chiefly curved striæ, serrated striæ, and curious scoop-marks, both striated and unstriated, very difficult to explain on any theory of glacial action.—Response to the remarks of Messrs. Wachsmuth and Springer on the genera Glyptocrinus and Retocrinus, by S. A. Miller.—On the present status of the eccentricity theory of glacial climate, by W. J. McGee. In reply to recent critics the author urges several arguments in defence of Croll's theory of secular variations in terrestrial climate.—On the commingling of ancient faunal and modern floral types in the Laramie group, by Charles A. White.—Notes on some fossil plants from Northern China, by J. S. Newberry. From the general character of these plants, which were collected by Mr. Arnold Hague, the author considers that Pumpelly and Richthofen's estimates of the great area and value of the North China coal and iron deposits are by no means unwarranted. The plants, all of the Carboniferous age, seem to prove that the Chinese coal basins belong to two great geological systems, one answering to that of the European and American coal-measures, the other probably referable to the Rhœtic and Lias.—Review of De Candolle's "Origin of Cultivated Plants," with annotations on certain American species, by Asa Gray and J. Hammond Trumbull.—On the supposed human footprints recently found in Nevada, by O. C. Marsh.

THE *Journal of the Franklin Institute*, August.—Cranes; a study of types and details, by Henry R. Towne.—A remarkable error in the common theory of the turbine water-wheel, by J. P. Frizell.—Béton in combination with iron as a building material, by W. E. Ward.—The grindstone, by J. E. Mitchell.—The Glover tower and the working of sulphuric acid chambers, by Moses A. Walsh.—On radiant matter spectroscopy, a new method of spectrum analysis, by William Crookes, F.R.S.—The cause of evident magnetism in iron, steel, and other magnetic metals, by D. E. Hughes, F.R.S.—National Exhibition of Railway Appliances, Chicago, Ill.—Obituary, Benjamin Howard Rand, Franklin Institute.—Notes.—Induced currents in reciprocal movements.—Twinkling of stars during auroras.—Spanish copper tubes.—Photozincography.—Orange peel.—Constitution of the sun.—Colour of distilled water.—Deep-sea explorations.—Generation of inflammable gases in the diffusion of beets.—Amber.

Journal of the Russian Chemical and Physical Society, vol. xv. fasc. 5.—On the formation and properties of oxide of

sodium, by N. Beketoff. The amount of heat disengaged during the complete hydration of sodium has been found equal to 55,000 calories, which figure, combined with that of Thomsen, gives 100,260 calories for the heat of oxidation of one molecule of sodium (50,130 for each atom).—On the naphtha lamp for burning heavy oils, examined at the Chemical Society's competition, by M. Andréeff.—On the naphtha of Caucasus, by MM. Markovnikoff and Ogloblin; second part.—The chief constituent parts of this naphtha, about 80 per cent. of it, would be hydrocarbons of the C_nH_{2n} series—C_8H_{16}, C_9H_{18}, and so on to $C_{15}H_{30}$. The authors propose to call them naphthenes, and describe their properties at length. The aromatic hydrocarbons constitute about 10 per cent. of the naphtha, partly known before, and partly seeming to belong to new series isomeric with the styrol series and its isologues. The oxygenated products, partly acid and partly neutral, play also an important part in the naphtha, which contains also a few phenols and lower hydrocarbons.—On naphtha; an answer to MM. Markovnikoff and Ogloblin, by Prof. Mendeléeff.—On the continuous graphic determination of the depth of shallow waters, by Prof. Petrushevsky. The author proposes to adjust to a boat a pole whose longer end would be dragged at the bottom of the river, whilst its shorter end would draw on a board the configuration of the bottom.—On the determination of the average coloration of a surface painted with different colours, by the same.—On the influence of light on the electrical conductibility of selenium, by N. Hesehus.

Archives des Sciences Physiques et Naturelles, July 15.—Verification of some atomic weights, by M. C. Marignac; first memoir, bismuth and manganese.—American ants, by Henry MacCook.—Ripple marks studied in Lake Leman, by Dr. F. A. Forel (one sheet of illustrations).—New researches on the Saturnian system, by W. Meyer.—Hypoxanthine in potatoes, by A. Weber.—Chloride of calcium, by V. Meyer.—Remarks on methods of determining vapour densities, by Alois Janny.—Acetoximes, by J. Petraczek.—On the aldoximes, by V. Meyer.

Rendiconti of the Royal Lombard Institute of Sciences and Letters, July 12, 1883.—Descriptive catalogue of a new series of rare or unpublished Greek coins and medals preserved in the Royal Numismatic Cabinet of Milan, by the curator, E. B. Biondelli. Amongst the 128 extremely rare and in some cases even unique specimens here described are medals of Julius Cæsar with Augustus from Achulla in Zeugitania, and of the two African Gordians from Cilicia, besides several coins from Sabrata, Thæna, Clypea, and other North African towns, including one of the Mauritanian king Ptolemy, son of Juba II., absolutely unique. The general catalogue of all the oriental and mediæval series, together with the historic and commemorative medals, is making rapid progress, and its publication is promised in a short time. The complete legends as far as legible are given in all cases, together with a brief description of the subjects.—The structure of the seeds in the family of the Oleaceæ fully described, by Prof. R. Pirotta.—On the functions of a single variant with more than two periods, π, π', π'' . . ., by Prof. F. Casorati.—Meteorological observations at the Observatory of Milan, with tables of barometrical and thermometrical changes, and records of relative humidity, direction of the winds, and cloudiness during the month of June.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, August 20.—M. Blanchard, president, in the chair.—Observations on the smaller planets made at the great meridian of the Paris Observatory during the second quarter of the year 1883, by M. Mouchez.—On a letter of General Stebnitski concerning the figure of the earth, by M. Faye. The Russian *savant* holds that the actual form of the globe, as expressed by the ideal continuation of the sea-level beneath the continents, differs from the theoretic ellipsoid not only in the undulations produced by the attraction of mountain ranges, and of the denser parts occurring here and there in the crust of the earth, but also in the deformations due to the attraction of the continents. In reply M. Faye contends that the mathematical surface of the globe is not modified by these causes, and that the level of the oceans is not sensibly affected by the influence of the mainland.—A study of the deformations and development of heat produced by the use of round-faced hammers in forging, by M. Tresca.—Observations touching a passage in M. V. Burg's recent communication on the use of copper as a preservative against cholera, by M. Vulpian. The author explains that a statement attributed to him by M. Tresca, regarding the use of copper as a prophylactic by English and French officers in Egypt, India, and Cochin-China, is groundless. He adds that he regards the advantage of the use of copper as a preservative as extremely doubtful.—On the separation of gallium (continued). Separation from tungsten and phosphoric acid, by M. Lecoq.—Experimental researches on explosive gas motors, by M. A. Witz.—Researches on the iodide of nitrogen; on chemical radiometers or iodide of nitrogen photometers; on the preparation in a low temperature of nitrogen, iodide of ammonium, and iodate of ammonia under the influence of light, and on the double iodide of copper and nitrogen, by M. Antony Guyard.—A contribution to the history of the formation of coal, by M. B. Renault. The author concludes that in many cases fossil coal is produced by the transformation *in situ* of the constituent elements of the plants whose forms it has preserved; that both the wood and bark have entered into the formation of coal, and that in the process of transformation the organic elements have diminished in size in a determinable proportion depending on the primitiue density of the constituent organic matter.—Remarks on the *Phylloglossum Drummondii*, by M. C. Eg. Bertrand.

BERLIN

Physiological Society, July 27.—Prof. H. Munk spoke regarding the doctrine of the functional restoration of the cerebrum first deduced by Flourens from experiments he made on the cerebrum of doves. Flourens had observed that, on the excision of but a small part of the greater brain, the disorders which resulted in the sensuous perceptions and intelligence of the animal operated on ceased after some time, and the animal then acted as before in its normal state. On the excision, however, of a larger part from the cerebrum, the subsequent restoration was only incomplete. Were, again, a very large part cut off from the greater brain, the resulting disorders continued to the end of the animal's life. Flourens had further concluded that the functions of the whole of the cerebrum were strictly equivalent to one another, and that every part of it was capable of vicariously taking the place of every other part. This doctrine propounded by Flourens regarding cerebral functions having, however, been overthrown in consequence of investigations by Fritsch and Hitzig and replaced by that of the localisation of particular functions in particular parts of the cortex cerebri, the phenomenon which to all observers, on the removing of less than a quarter from the hemisphere of the cerebrum, had suggested the idea of functional restoration of the brain, now received a different interpretation. By some investigators it was maintained that the restoration was to be explained by the function of the excided part of the brain being taken over either by the corresponding part of the other side or by some other part of the brain situated on the same side, in the cortex, or in the interior, in either case in addition to its own special function. Others, again, deemed the restoration only an apparent one; in reality no function was suspended by the removing of a part of the cerebrum, it was only a check that was imposed through the irritation of the act of separation, and when that was relieved, the normal functions came again into play. Prof. Munk has for several years carried on investigations into the functions of the cortex cerebri, leading, as is known, to the conclusion that a limited part of the cortex situated on the flap of the occiput was the seat of the central visual perceptions (the sphere of vision) and that another exactly defined part of the cortex, situated on the flap of the temples, marked the site of the acoustic perceptions (the sphere of hearing), while a third region was appropriated to the sphere of feeling. He has further prosecuted his inquiries into the question of the restoration of cerebral functions, and by experiment has endeavoured to determine whether the assumed restoration of functions previously discharged by parts of the cerebral cortex now removed were a true statement of the fact, and if so how this was accomplished. He first affirms the universally recognised fact that the restoration of matter lost to the brain by the excision of a part or parts of it in no case ever happened, but in every case after the excision the remaining mass only cicatrised. As regards functional restoration, then, his experiments in the spheres of sight and hearing led him to the following conclusions:—Were the spheres of sight or the spheres of hearing removed from an animal, it remained blind or deaf for the rest of its life; no restoration of the faculty in question ever took place in either case, though only limited por-