not absolutely straight lines, it does not necessarily follow that the sum of its angles is equal to π: for Euclid himself is quite ready to admit that. No: Prof. Clifford must have meant that those three sides, though *absolutely straight* to us, creatures who can only imagine a homaloidal tridimensional space, are curved in a sense (thanks to a fourth dimension) which vitiates the Euclidian law.

Of course he may disclaim this interpretation: or he may assert that in the case supposed the three sides are both straight and curved, or neither straight nor curved, if such be his view. But until I see his disclaimer I shall hold that he meant to suggest to his audience that straight lines (proved to be so by the standard of straightness which is alone imaginable by creatures constituted as we are) are in another sense really curved, and as such afford an observable exception to the Euclidian Law. Now I say that, constituted as we are, we could have seen straight lines only as straight, and therefore we simply *could not* see those sides otherwise than as verifying that Law; and so we could never bring to the test of observation the question raised by the great quaternion of geometers; and therefore must for ever remain in absolute ignorance whether the space, in which we "live and move and have our being," be (in another relation) something different from what we find it to be in relation to our faculties. C. M. INGLEBY

Athenæum Club, Feb. 8

Earthquake in Pembrokeshire

I HAVE received a letter from the west part of Pembrokeshire, dated February 3, from which the following is an extract:—

"Last Saturday, at 7 A.M., my bed shook twice under me; and at the same time the servant went into the dining-room, the fire-irons rattled and the room shook; an hour later, ——'s bed shook twice."

I do not know whether any notice has been taken of the occurrence elsewhere. I have paid some attention of late years to the indications of earthquakes in this neighbourhood, and am inclined to think that slight tremulous movements take place more frequently than may have been supposed or recorded. They would naturally be unnoticed in the daytime, and their detection would depend upon accidental wakefulness at night.

Hardwick Vicarage, Feb. 8 T. W. WEBB

Meteorology of the Future

IT is with some satisfaction that I have read in NATURE of December 12, 1872, the very interesting paper of Mr. J. Norman Lockyer, entitled "Meteorology of the Future," giving adhesion and the support of his name to the discovery of Mr. C Meldrum, of a cycle of 11 years in the recurrence of the maximum of cyclones and rainfall in the southern hemisphere; a cycle corresponding with that already recognised in the maximum of sun-spots. But I have been somewhat surprised to see that my name has not been mentioned by Mr. Lockyer in reference to Mr. Meldrum's paper, as I have also published a paper on the connection of sun-spots with rainfalls, storms, cyclones, &c, prior to the first paper of Mr. Meldrum, which appeared in NATURE, October 24, 1872. Thinking that my paper has escaped your notice, and trusting that you might have some interest to see it, I take the liberty to forward it to you with this same mail. It was published in the *Boston Daily Advertiser*, November 2, 1871. Over a year has elapsed since its publication, and few are the days on which I had no opportunity of seeing the sun and scrutinising its spots with especial care, with the aid of telescope and spectroscope; and to-day I do not see the necessity of changing a word of the conclusions which I had come to in that paper. Only it appears that, in addition to the laws which I have drawn out, the position of the moon will have to be taken in consideration as a complicating element; as it seems that the conjunction and opposition have a tendency to increase the influence of the spots on our atmosphere, while the quadrature diminishes it in a certain measure. I could make some other remarks taken from my greater experience on the subject, but they are of secondary importance, and I will wait for another opportunity to publish them.

Perhaps I did not guard myself sufficiently in my paper, and have not explained with a sufficient amount of clearness, that though the effect of sun-spots on the weather is general all over the globe, yet the result cannot be expected to be absolutely the same; as local causes, very numerous, like mountain chains, forests, rivers, coasts, oceans, and climates, have an independent influence on the distribution of rains and the direction of winds, &c. But local causes are of a secondary order, and will be easily determined when once we are sure that the primary cause of atmospheric disturbances is to be found in the solar spots L. TROUVELOT

Cambridge, Mass., Jan. 27

Deep Wells

SINCE the question of the supply of water to deep wells was touched upon in NATURE (vol. vii. p. 177), in connection with the rainfall of 1872, I have been in hopes each week of seeing the subject thoroughly and scientifically discussed. It will be recollected that while we were all sneezing and spluttering, and thoughtlessly complaining of the long-continued wet, Mr. Bailey Denton deprecated the premature interference of the Archbishop of Canterbury with the rain, on the ground that the deep wells were not yet filled. This raised a great deal of discussion; people lost their tempers over the rain; and the country seemed to be divided into three bitterly hostile parties—the supporters, the opponents, and the suppliants of Providence. But still the geologists held aloof, and no one even answered the question, "What is a deep well?" but continued to talk as if wells were divided into two classes, deep and shallow, by a hard and fast line.

I therefore venture to hope that some geologist will take up the question in your columns, and give us a few facts instead of opinions. Meanwhile, I will state the case as it appears to me. With the exception of chalk and limestone formations, deep wells are, I believe, unknown in hills. In the side of a hill water comes naturally to the surface in a spring. Wells are only required—or, at all events, deep ones—at a distance from hills. They derive their water from water-bearing strata supplied in all cases either directly from hills, or indirectly from hills through the leakage of river-beds. No amount of rain falls upon cultivated, and therefore comparatively low-lying, land in Europe, sufficient to penetrate to even a shallow well through the earth immediately around it. This, at least, I presume to be the case, for 33 per cent. of their own bulk may be taken as an average amount of water for average soils to be able to retain and hold, so that if a well were 15 ft. deep to the top of the water it could not be affected by less than 5 ft. of rainfall, and when we deduct the enormous proportion of the 5 ft. that would be lost by evaporation and intercepted by vegetation, it is manifest that even 5 ft. of rain could not penetrate 15 ft. through any ordinary average soil. How, then, could any rainfall penetrate to a "deep" well of, say 100 or 200 ft. in depth?

Feb. 9 W. HOPE

THE GRESHAM LECTURES ON PHYSIC

THE Hilary Term Course of Lectures on Physic were delivered at the Gresham College, Basinghall Street, by Dr Symes Thompson, on the evenings of the 17th and 18th ult., and the subject of the discourses upon this occasion was the important and interesting one of Contagious and Infectious Diseases. The professor started on his career of familiar explanation by describing two recent instances of outbreak of infectious disease in rural districts, in which the introduction and march of the fell agent of communication through the ranks of the small community could be distinctly traced. In the one case, the infection of scarlet fever was brought to the village of Flindon, in Hampshire, by a girl who came from Worthing, and served in a small general shop which was resorted to by all the villagers. Only two houses in the village that had children in them, escaped from the disease. In the other case, enteric fever was taken to Whitchurch, in Hampshire, by a young woman from Basingstoke, who returned to Basingstoke to die, after only six days' sojourn in Whitchurch. The fever, nevertheless, spread from the house in which she stayed, and within the next seven months there were seventy cases of enteric fever in a small community numbering only 1,450 people. The instance at Whitchurch acquired especial importance and interest, because it was made the ground for an investigation and report by the Local Government

Board, which now concerns itself with matters of this class. The inspector, Dr. Thorne, found that the place had been remarkably healthy until the potential cause, or infection, of the fever was conveyed to it by this chance visitant; but that it was most cunningly and elaborately prepared to receive and energise the deadly influence when once it came in the way. About one-third of the town stands upon the porous gravel of the alluvial bed of the river Test, and into this gravel, side by side, shallow wells were dug, to furnish the place with water, and pits were hollowed for the reception of all kinds of refuse filth and exuviæ incident to the conditions of life obtaining with a town community. Special care seems to have been taken to place the wells at a somewhat lower level than the pits containing the sources of pollution, whenever this was possible, as if to make sure that the liquid refuse should run into the reservoirs of the water; and in a few road-drains that had been laid down in the streets, commodious catch-pits were provided, to serve as traps and lurking-places for the offensive waste. Piggeries and small manure-yards were profusely scattered through the streets; and when once the enteric disorder had appeared, in order that it might have the fairest possible field for its operations, it became in some instances the practice to put sound people to bed with relatives actually suffering from the fever. In the case of Whitchurch, it amounts almost to a demonstration that the bowel discharges of the chance visitant from Basingstoke, containing the poison of enteric fever, must have been passed immediately into the water that was provided for the general service of the town; and that an exhaustless supply of the particular pabulum that is required for the elaboration of fresh quantities of the poison for the propagation of the malady, was kept ready on hand with the poison and the water. Enteric fever came by chance to the neighbourhood of Whitchurch; but, once there, it cannot be said that it made itself at home, and spread through the houses of the community by chance. The most elaborate provision had been made in the township to secure for it an easy resting-place, and a ready path of dissemination.

These cases of actual occurrence were happily selected by the Gresham Professor of Physic as the text of his discourse, because they aptly illustrate the value of the popularisation of information of this class, a result which it is the object of the Gresham College to insure. In the fever outbreak at Whitchurch, enlarged upon by Dr. Thompson, and from which something like every fourteenth member of the community was infected more or less gravely before the plague was stayed, nothing could be more clear than that the lodgment and seed-bed of the pestilence was prepared for it by human agency, but of course in entire ignorance of the dreadful work that was being performed It is scarcely possible to believe that, if any single member of the constituted "nuisance authority" and "sewer authority" of Whitchurch had ever been present at the Gresham College when a lecture upon infectious and contagious disease had been delivered by the Gresham Professor of Physic in its theatre, there would have been an eight-months-long prevalence of enteric fever in the town.

The obvious, and indeed only certain, cure for evils of this character is the spread of sound information regarding matters that affect, and physically influence, health and disease, and the enlightenment of public opinion. The inhabitants of Whitchurch were the only people in this case who could possibly have been the efficient guardians of their own well-being.

Dr. Thompson designedly touched lightly upon the precise nature of the seed-germs of contagion; he satisfied himself upon this occasion by pressing home to the ordinary understanding, the great and incontrovertible fact, that diseases of this character, which sometimes decimate crowded communities, and which at all times levy a heavy tax upon human vigour and life, are caused and spread by influences which are well known to human intelligence, and largely within the sphere of human governance and control. Each form of infectious fever has its own characteristic habit and idiosyncrasy. Enteric fever and cholera tend chiefly to disseminate themselves through water, passing into the wells and fountains of daily supply, and at times travelling from house to house in the milk-cans of the easy-conscienced dairyman. Scarlet fever hybernates in a drawer, and after long months of seclusion comes forth with some old and cast-aside garment to be thrown with it round the throat or head of some new victim, and so to start thence upon a fresh career. Typhus fever crawls sluggishly almost fron hand to hand and mouth to mouth, and is immensely sociable and companionable in its spirit, languishing away when condemned to solitary confinement. Typhoid fever generates itself where filth, overcrowding, and impure habits of life prevail; and relapsing fever glides in the track of privation and misery. But the entire band of the ruthless co-fraternity agree in their subordination to known laws, and controllable conditions.

The beneficent influences and allies upon which human intelligence draws in dealing as efficiently and successfully as it now can with the work of controlling these evil ministrants, are, in the main, careful isolation of the sick; the preservation of the water from which daily supplies are derived in uncontaminated purity; the uninterrupted ventilation alike of hospitals and dwelling-houses, and fresh air; the immediate removal from the vicinity of active human life of all material contaminations that issue from the bodies of the sick, and the destruction of their morbific influence and energy by mixing them with antiseptic and disinfecting chemical agents such as carbolic acid, sulphuric acid, chlorides of lime and zinc, permanganate of potash, and charcoal; the preservation of the vital forces and resisting powers of the living frame by a well-ordered temperate rule of life, and avoidance of any undue indulgence in any kind of excess; and above all things the cultivation of an intelligent and ever enlarging familiarity with the great material conditions of nature that have been made the means of working out the marvellous arrangements and operations of civilised human life.

In considering the influence and powers of the various health-preserving chemical substances that are spoken of as antiseptics and disinfectants, it should be understood that agents of the character of carbolic acid, which are properly antiseptics, operate mainly by arresting the progress of fermentation and decomposition, while agents of the nature of Condy's fluid (permanganate of potash), chloride of lime, and especially charcoal, which are properly disinfectants, act by absorbing the noxious products of decomposition. Dr. Thompson very prettily illustrated this part of his subject by stopping the gradual evolution of bubbles of gas from a fermenting solution of sugar by adding to it a few drops of carbolic acid, and by showing that any drinking water that contains a hurtful trace of the rotten egg gas, sulphuretted hydrogen, immediately discharges the beautiful violet colour of Condy's disinfecting fluid. But his most telling illustration was the mortal remains of a defunct rat which he presented to his audience enshrined in a glass jar, and simply embalmed in charcoal. This rat was placed in the jar with the charcoal, at the termination of its natural life, some six or eight years ago; and from that time to this has been kept in the laboratory of Charing Cross Hospital for the greater part of the time with only a light paper cover over the jar. At the present time there remains of the rat's organism only the bones and a few hairs. But throughout the lengthened period of decomposition, no trace of disagreeable smell was at any time emitted. All gaseous products of decay were at once seized, and held by the charcoal.