

with the object of ascertaining whether the effect was due to a complementary tint, and am thoroughly convinced it was not. At four o'clock, or a little after, the moon was distinctly green on a blue-gray sky-ground, with very thin gray cloud-drift floating over it. At the same time the whole of the western sky was lit up with a very pale whitish-yellow, to which neither blue nor green would be complementary. There was not a vestige of crimson or rose colour at that time in any part of the sky. Later, when the crimson supervened, the green tint of the moon was only very slightly intensified, so slightly indeed as to leave me still in doubt whether there was any change at all. It stands to reason, moreover, that if the result were due to the presence of crimson in the sky we should frequently see a green moon. Some other cause must therefore be sought in explanation of this new phenomenon. If we may accept Mr. Lockyer's conclusions with regard to volcanic action—and he certainly establishes a very strong case—the cause is not far to seek. It would be especially interesting to ascertain over how wide an area the effect was visible. Some records from observers at a distance would be very valuable.

Ealing, December 10 SYDNEY HODGES

P.S.—In quoting my letter to the *Standard* last week you gave a wrong name—Hooper instead of Hodges.

THERE is one point in connection with this subject to which much attention has not been given, namely, the increase of light, especially in the morning. Having slept out of town lately, I have been able to watch the sunrises, and to be exact I will describe in few words what occurred on Wednesday last, December 5. The eastern horizon is bounded by a hill some 50 feet high as seen from my house. At 6 a.m. I saw, rising in a semicircular form above the horizon, and tolerably defined in outline, a beautiful red coloration of the sky. The colour spread along the horizon in a westerly direction, and at 6.30 the entire vault of heaven was suffused with this red colour. When it was first noticed, namely at 6 o'clock, the light was sufficient to illumine the garden, as in the early morning in summer. At 6.15 the light was sufficiently strong to enable me to read the figures on my pocket-watch at the head of my bed, namely eighteen feet away from the window. The sun rose above the horizon at 8h. 5m., and at 10° farther west than the first burst of colour which I noticed. As the sun rose, the red colour disappeared, and it was entirely lost before the sun was fully in view. I am told by friends who were in Düsseldorf on November 30 that at 6 o'clock on that morning their rooms were lighted up so that everything was plainly visible. They at first supposed that the light was produced by a large fire opposite; but they soon discovered that it arose from this red light which you have now so well explained.

December 10 B. E. BRODHURST

NOT having noticed any letter in NATURE stating that the remarkable red glow seen in so many places after sunset was also observed in Ireland, perhaps you will permit me to mention that during the past fortnight, and especially since the 24th ult., it has attracted much attention here. This day week my steward insisted that the heather was on fire on the hills and that we were only watching its reflection. Since then the phenomenon has been even more remarkable, and the farm labourers have been enabled to remain at work in the fields ten to fifteen minutes later than usual. A bank of cloud generally separates the red glow from the horizon. Before sunrise the sky has sometimes a strange reddish look, and at 4 a.m. on the 29th ult. the brilliant roseate hue (referred to in the *Times* as having been seen in London at 5 a.m.) was witnessed here. RICHARD M. BARRINGTON

Fassaroe, Bray, Co. Wicklow, December 2

ACCORDING to a letter from my brother, dated Yokohama, September 22 last, the sun was completely obscured there two days after the earthquake took place in the

Straits of Sunda. He writes:—"What a terrible earthquake that must have been in the Straits of Sunda. Incredible as it may appear, two days afterwards the sun here was completely obscured, and, on its reappearance, was quite *blood red*, while every now and then jets that looked like smoke passed across its disk. This lasted for two days," and he adds that "it is conjectured that this is caused by the volcanic smoke and ashes having been driven up here by the south-west monsoon."

32, Fenchurch Street, E.C., Dec. 8 W. HAMILTON

A FEW days since I was mentioning to my family that I remembered how splendid the colouring of the sky was at Malta after sunset in the year that "Graham's Island" appeared. In this morning's *Times* that island is alluded to, and I think you may be interested in the perusal of the accompanying pamphlet (printed for private circulation only). My father (Capt. Sir le Fleming Senhouse, K.C.H.), you will see, landed on the island, and named it after the then First Lord of the Admiralty. The great beauty of the sunsets we have been having have forcibly reminded me of the colouring I saw so many years since at Malta.

Hillside, Guildford, Dec. 8 ELIZABETH M. PITMAN

A correspondent sends the following:—

IT may interest your readers to know that in reference to the splendid sunsets we have seen in England lately I received in a letter from Lieut. C. K. Hope, R.N. (*en route* by inshore passage to the Cape of Good Hope) the following account of an extraordinary phenomenon witnessed by him on October 26 soon after crossing the equator:—"H.M.S. *Orontes*, October 26.—Last evening shortly after sunset the sky bearing from us between north-west and south-west suddenly burst into a red glowing light; the highest point attained an altitude of probably 35° or 40°, and from there tapered gradually away on both sides to the horizon. It showed brightest about 7.15, it being nearly dark at the time, and lasted till 7.30, gradually dying away till about 8 o'clock, when very little of it was left. I could have understood the phenomenon if we had been 40° further north or 20° further south, but on the edge of the tropics such a thing is very strange."

December 5

THE JAVA ERUPTIONS AND EARTHQUAKE WAVES

THE following communications have been sent us for publication by the Hydrographer of the Admiralty:—

Extract from a letter of Commander the Hon. Foley C. P. Vereker, of H.M.S. *Magpie*, dated Labuan Island, October 1, 1883:—

"... The noise of the detonations caused by Mount Krakatoa, resembling distant, heavy cannonading, was distinctly heard by us and the inhabitants of this coast as far as Bangney Island on August 27. The weather at that time was also much unsettled, with thick hazy weather, and peculiar clouds to the southward, and the sun while at a low altitude assumed a greenish hue for several days. . . ."

Extract from a letter of Staff-Commander Coghlan, R.N.:—

"*Western Australia, Perth, September 14, 1883.*—This coast has been visited by waves and volcanic disturbances (sounds as of the firing of guns inland, &c.), apparently associated with the Sunda Strait outbreak.

"News is anxiously looked for from our north-west coast, as a wave 15 feet high, coming at high water, would lay Cossack, the mouth of De Grey River, Carnarvon (north of Gascoyne), and other places under water. In Champion Bay a wave rose 8 feet above the usual high-water mark. At Fremantle, King George's Sound,

and along the south coast, a wave of less height was experienced

"The *Meda*, on our passage down from Ashburton River (when distant from 50 to 100 miles off the west coast of Australia, and about 1000 miles south-south-east of Sunda Strait), was visited by a shower of volcanic dust (in appearance like prepared "fuller's earth"), which fell some time between sunset of August 30 and sunrise of August 31, the wind being on-shore at the time.

"If the dust were associated with the disturbances in Sunda Strait of August 27 and 28, it must have travelled 1050 miles in three days."

BICENTENARY OF BACTERIA

[WE have received the two following communications on this subject:—ED.]

AT the present time, when so many anniversaries of great men and great events are celebrated, it seems opportune to remember that exactly two centuries have passed since a discovery of the greatest consequence was made in the Netherlands. In a letter dated September 14, 1683, from Delft, to Francis Aston, F.R.S., of London, Antony van Leeuwenhoek gives notice to the Royal Society that with the aid of his microscope he has discovered in the white substance adhering to his teeth very little animals moving in a very lively fashion ("animalcula admodum exigua jucundissimo modo sese moventia." "Arcana naturæ detecta," Delft, 1695; "Experimenta et Contemplationes," p. 42). They were the first Bacteria the human eye ever saw. Among them Leeuwenhoek distinguishes several species, the descriptions and drawings of which are so correct that we may easily recognise them. The rods, with rapid movement penetrating the water like fishes, are *Bacilli*; the smaller ones rotating on the top are *Bacterium*; one undulating species is *Vibrio rugula*; the parallel threads of unequal length but of equal breadth are *Leptothrix buccalis*; though motionless, they belong to the moving *Bacilli*. Leeuwenhoek wonders how, notwithstanding the scrupulous care with which he cleans his teeth, there could live more animalculæ in his mouth than men in all the provinces of the States-General. Some years later, not perceiving again the movements of the Bacteria between his teeth, he supposes he had killed them by taking hot coffee at breakfast; but very soon he discovers anew the old species, and the new drawings of *Bacillus* and *Leptothrix* which he sends to the Royal Society in the middle of September, 1692 (*loc. cit.*, p. 336) are still more accurate than those of 1683. They have not been surpassed till within the last ten years. It deserves our highest admiration that the first discoverer of the invisible world could already reach a limit which has never been overstepped, though the members of the Royal Society, when considering two hundred years ago the curious communications of the philosopher of Delft, may have scarcely foreseen that his astonishing discovery had opened to science a new path which only in our own days has led to the most important revelations about fermentation and disease.

FERDINAND COHN

Breslau, November 27

It cannot be a matter of indifference to English men of science, and especially to the Fellows of the Royal Society, that the bicentenary of the discovery of those immensely important agents of putrefaction, fermentation, and disease, the Bacteria, is at hand.

It was to the Royal Society of London that Antony van Leeuwenhoek communicated his discovery, and we may be sure that neither he nor the Royal Society of that day anticipated the extraordinary interest which would attach itself in two centuries' time to the organisms discovered by the patient and accurate student of minute life.

Leeuwenhoek's "discovery" is a remarkable example of that unexpected giving of rich gifts to future generations of men which marks the progress of scientific research in all its branches. It is for the Royal Society to devise some means of celebrating this bicentenary in such a fashion as to use the great interest and even fascination which Bacteria have at this moment for the English public, so as to excite sympathy with pure and unremunerative scientific research. Antony van Leeuwenhoek is the type of the single-minded student of living structures. The investigation of the properties and life-history of Bacteria, although commenced by him two hundred years ago, is still in its infancy. Schwann, Pasteur, Lister, Cohn, Nägeli, and Koch have brought us within the last fifty years far beyond Leeuwenhoek's first discovery, but a hundred such men are needed to carry on the work of discovery. Who will employ them? Are we to wait two centuries more for knowledge about Bacteria which lies, as it were, ready to our hands, waiting to be picked up? Knowledge which will probably save many thousands of lives annually—if we may judge by the results already attained by the discovery of the relation of Bacteria to the supuration of wounds and to the production of diseases.

The Royal Society could not better celebrate the bicentenary of its Dutch correspondent's discovery than by taking steps to urge on the English Government the expenditure of ample funds upon a new and vigorous prosecution of the study of the relations of Bacteria to disease, in fact upon the foundation of a national laboratory of hygiene.

L.

THE UPPER CURRENTS OF THE ATMOSPHERE

ALL winds are caused directly by differences of atmospheric pressure, just in the same way that the flow of rivers is caused by differences of level; the motion of the air and that of the water being equally referable to gravitation. The wind blows from a region of higher towards a region of lower pressure, or from where there is a surplus to where there is a deficiency of air. Every isobaric map, showing the distribution of the mass of the atmosphere over any portion of the earth's surface, indicates a disturbance more or less considerable of atmospheric equilibrium, together with general movements of the atmosphere from regions of high pressure towards and in upon low-pressure areas. All observation shows, further, that the prevailing winds of any region at any season are merely the expression of the atmospheric movements which result from the disturbance of the equilibrium of the atmosphere shown by the isobaric maps as prevailing at that season and over that region. All observation shows, in a manner equally clear and uniform, that the wind does not blow directly from the region of high towards that of low pressure, but that, in the northern hemisphere, the region of lowest pressure is to the left hand of the direction towards which the wind blows, and in the southern hemisphere to the right of it. This direction of the wind in respect of the distribution of the pressure is known as Buys Ballot's Law of the Winds, according to which the angle formed by a line drawn to the centre of lowest pressure from the observer's position, and a line drawn in the direction of the wind is not a right angle, but an angle of from 60° to 80°. This law absolutely holds good for all heights up to the greatest height in the atmosphere at which there are a sufficient number of stations for drawing the isobarics for that height; and the proof from the whole field of observation is so uniform and complete that it cannot admit of any reasonable doubt that the same law holds good for all heights of the atmosphere.

In low latitudes, at great elevations, atmospheric pressure is greater than it is in higher latitudes at the same height, for the obvious reason that owing to the lower temperature