forms altogether a most attractive gift-book for an intelligent child.

Annual Record of Science and Industry for 1871. Edited by Spencer F. Baird, with the assistance of eminent men of science. (New York: Harper and Brothers, 1872.)

THE Americans are more fortunate than ourselves in possessing a Year-Book of Science edited by a scientific man whose name is a guarantee for the accuracy and value of its contents. The various items of information are arranged under thirteen heads, viz. (1) Mathematics and Astronomy; (2) Terrestrial Physics and Meteorology; (3) Electricity, Light, Heat, and Sound; (4) Chemistry and Metallurgy; (5) Geology and Mineralogy; (6) Geography; (7) General Natural History and Zoology; (8) Botany and Horticulture; (9) Agriculture and Rural Economy; (10) Mechanics and Engineering; (11) Technology; (12) Materia Medica, Therapeutics, and Hygiene; and (13)—a very small one—Miscellaneous, with a very brief Necrology appended. To each paragraph is added the indispensable reference to the authority. Prof. Baird's position as Secretary of the Smithsonian Institution at Washington has given him unusual facility for consulting all the leading magazines, and other scientific publications of Great Britain, France, Germany, Holland, and America, of which he has availed himself to the full. An account of the discoveries made in Italy, Sweden, Russia, and other countries of Europe, some of which are daily rising into more and more importance, has been obtained only second-hand. The whole is prefixed by a general Summary of Scientific and Industrial Progress for the year 1871, occupying sixteen pages, wherein the more noteworthy incidents in each department of science are briefly chronicled. The work is the result of great labour; and, as far as we have been able to test it, presents a very fair and accurate record of the progress of science during the year. To those who desire to possess such a record for handy reference, we can confidently recommend Prof. Baird's Year-Book as the best and most complete work in the language, and decidedly preferable to anything published in this country.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

Atmospheric Effect

AN atmospheric effect, which is sometimes observed in England, displayed itself here in great beauty yesterday. The western sun had been cut off from us by an intervening ridge, while the upper atmosphere was still filled with his light. There was a good deal of opalescent haze in the atmosphere, which, had the sun shone upon it uniformly, would have presented a tolerably uniform hue. But besides the haze, small detached clouds floated in the air, and behind each of them was a sheaf of shadow, drawn through the haze. The density of these shadows varied with that of the clouds which produced them, nor was the density uniform for all parts of the transverse section of the same shadow. The parallel bars of graduated shade thus produced converged, through an effect of perspective, to a point in the east, exactly as if the sun were going to rise there. The display of the convergent glory was strikingly beautiful.

The same effect showed itself at Oran during one of the evenings spent there by the Eclipse Expedition. I have seen it two or three times in England (always, I think, near the coast), the last occasion being in company with Mr. Hirst at Margate.

Faraday, if I remember aright, has described this effect. There was also, I believe, a question asked regarding it some months ago in NATURE. This brief account may interest the questioner.

Bel Alp, July 22

JOHN TYNDALL

Spectrum of Aurora

IN the article on the Aurora Borealis of Feb. 4, a translation of which appears in your issue of April 25, Prof. Respighi mentions having noticed the green line of the aurora when observing the zodiacal light; also, that this line was visible—more or less defined—from horizon to zenith, in every part of the heavens.

In 1867, when Angström observed the green line in the spectrum of the zodiacal light, he also detected its presence in all parts of the sky. From his own and Angström's observations, the Professor demonstrates the identity of the zodiacal light and the aurora. This appears to me, at the least, premature. Had the spectrum appeared only where the zodiacal light was perceptible to the naked eye, there would have been reason for believing it due to that light; but, be it noticed, the green line is everywhere seen as bright as in the zodiacal light itself. We have only to suppose that in both cases auroral phenomena, imperceptible to unaided vision, were present, and the spectra seen by Angström and Respighi are at once accounted for.

With all due deference to the great authorities just named, I may state that at Mr. Lockyer's request I have been observing the zodiacal light with a spectroscope since last December, and brilliant as the phenomenon has frequently been, I have hitherto failed to detect the slightest appearance of bright lines or bands. A faint diffuse—to use Capt. Herschel's nomenclature—spectrum, about as intense as that of a bright portion of the "milky way" is all I have yet obtained.

The spectroscope used is one of Browning's 5 prism ones.

G. H. PRINGLE

Camp Charmadi, South Canara, June 23

Kinetic Energy

IF the loss of kinetic energy in water which has flowed from lower to higher latitudes is due to friction, and represents work consumed in overcoming friction, as Mr. Croll maintains, how is the gain of kinetic energy in water which has flowed from higher to lower latitudes to be accounted for?

Mr. Croll's answer to this question will be awaited with interest.

J. D. EVERETT

Belfast, July 27

Bree on Darwinism

I AM very much obliged to Mr. Alfred R. Wallace for pointing out some errors of the press, and some of hasty writing which were not corrected in the proofs, of my work upon the "Fallacies of Darwinism."

I do not think, however, he has adduced anything which justifies his virulent condemnation of a work which he has not ventured to criticise, and I do not, however, write for the purpose of making any complaint. I hope to have the opportunity of answering his remarks upon another occasion.

My object in writing is, however, to request you will give me the opportunity of pointing out that no blunder which I have made is so great as that committed by Mr. Wallace himself, when he states that Darwin's imaginary human ancestor with cocked ears and a tail should have been evolved after the incoming of catarrhine monkeys, which creatures, by what I presume some might call anticipatory retrogression of development, have actually been placed by Mr. Darwin in the human pedigree, and separated from their congeners the platyrrhine or new-world monkeys, because they had so far reached the human goal to which they were tending as to lose their tails.

Also according to Mr. Wallace the cocked-eared creature must have not only re-evolved a tail, but have gone so far backward as to lose the human-shaped, and gain the canine-like "cocked ear."

C. M. BREE

Colchester, July 27

Volcanoes and Earthquakes

IT is generally admitted that an earthquake is due to the passing of a sensible wave through the earth's crust. It has also been observed that the occurrence of earthquakes is generally associated with eruptions from volcanic vents, usually in the neighbourhood, but not unfrequently at considerable distances. Now it is evident—and it has struck all observers—that there

must be some connection between the two classes of phenomena. The nature of this connection has been differently explained by different writers. But the purpose of this note is not to criticise existing theories, but to propose one, which I believe to be new, and to be capable of explaining why a sudden volcanic eruption must ordinarily be accompanied by earthquake shocks of greater or less violence (not necessarily always sensible), and why earthquakes may occur without any contemporaneous outburst.

In the preface to his "Physikalische Geologie," Bischof suggests that the phenomena observed in the laboratory should be taken as our guides to explain what happens in nature. Let us see, then, if in the laboratory we meet with any phenomena analogous to volcanoes and earthquakes.

When a reaction has to be performed in a sealed tube, and it is expected that much gas will be evolved, and consequently the pressure in the tube be much increased, it is one of the commonest precautions to draw out the tube to a capillary orifice before closing it. When this precaution has been neglected, and even although the point be allowed to blow itself out in the flame of a lamp, an explosion not unfrequently attends the attempt to open it. Let us consider the circumstances.

We have a tube whose walls are being pushed out by a very high pressure from within, which, however, it resists; but at the moment that this pressure is suddenly relieved at one point, the tube bursts. What is the cause of the explosion? It clearly cannot be the mere reduction of pressure. As long as the pressure was equally distributed over the walls of the vessel, we have seen that it was successfully resisted; as soon, however, as it was suddenly relieved at one point, a great inequality in the tension of the gas in the immediate vicinity of this point would be the result, the gas immediately at the opening assuming at once the atmospheric pressure, while that at, say, the eighth of an inch from it is at the tension of the gas in the tube. The practical effect of this sudden inequality of pressure would be to produce a tug on the mass of elastic fluid, which would cause the walls momentarily to tend to collapse, and this tendency to collapse would be transmitted through the glass as a wave. This wave would to a certain extent distort, and therefore weaken, the walls; and consequently, if the pressure inside were great enough, it would burst them; if not, the only effect would be that a shock would traverse the walls of the vessel, and the pressure would relieve itself by the orifice.

Now, suppose the vessel to be a subterranean cavity containing an atmosphere of very great tension, and that suddenly the envelope gives way at one point, what will be the result? Just as in the case of the glass tube, the sudden relief of pressure will, in the way indicated above, cause the walls to experience a momentary collapsing impulse, which will be propagated as a wave until extinguished by the imperfect elasticity of the crust. The sudden outburst will be a volcanic eruption, and the consequent collapsing shock will be an earthquake, which either will or will not be accompanied by rending of the crust, according to the strength of the walls and the greatness of the pressure.

It is, however, not necessary that there should be a visible volcanic eruption. For, suppose two such subterranean cavities at different pressures, separated from one another by a wall weaker than that which separates either of them from the outside of the earth; then, if the pressure in the one becomes so great as to burst the barrier between the two, the result will be an earthquake. And similarly, the pressure in the two thus united cavities may go on increasing until they burst into a third, and so on until they come to a vent, which is either open or weak enough to yield to the pressure. In this way an earthquake and an eruption may be in intimate connection with one another, although a considerable interval of time intervene between the occurrences, and the localities affected be at great distances from each other. And it is possible that some connection of this kind may have existed between the earthquake of Antioch and the eruption of Vesuvius, both having been extreme in their violence. Indeed, the whole series of disturbances, commencing with the earthquake in California and terminating with the eruption of Vesuvius, noticed by Mr. Corfield in *NATURE* of May 23, may possibly find an explanation under this theory.

The effect of sudden relief of pressure in weakening the walls of vessels explains many cases of explosion which otherwise appear anomalous. Thus, high-pressure boilers have been frequently observed to burst at the moment when the engineer turns on the steam.

In conclusion, the above sketched theory assumes nothing but what we know to be fact. We know that, at least in the neighbourhood of volcanoes, there must be subterranean cavities whose

atmosphere is at an exceedingly high-pressure, for we not only see it emitted from the vent, but it projects enormous masses of rock high into the air, thus testifying to the energy with which it was endowed. Further, given this high-pressure atmosphere, it is certain that, on its being suddenly relieved, it would communicate a shock to the crust, and this, on being felt outside, would be described as an earthquake. I think it is therefore clear that some earthquakes must be produced in this way. Of course this does not include the possibility of there being other causes of concussion which might produce similar effects.

Edinburgh, June 10

J. Y. BUCHANAN

On the Cohesion of Figures of Creosote, Carbolic and Cresylic Acids

WITH reference to the note by Mr. J. H. Spalding contained in *NATURE* of June 13, I am reminded by my friend Mr. Rodwell that some five or six years ago I showed him the cohesion figure of carbolic acid. A crystal of this acid was taken up on the end of a platinum spatula, and gently delivered to the surface of clean water contained in a clean glass; the crystal gave a few jerks, then suddenly liquified, and displayed its highly characteristic figure so well described by your correspondent. I may further remark that I showed this figure in the chemical section of the British Association, at Manchester, in September 1861, and a drawing of it is given in the plate which accompanies my paper in the *Philosophical Magazine* for October of that year. In this paper it is described as "an exaggerated form of the figure of creosote; the water seems to tear it to pieces; the crispations are amazingly active, and the disc quickly breaks up and disappears. Indeed, while a drop of creosote will endure five minutes on the surface of an ounce of distilled water in a small glass, a drop of carbolic acid will last only a few seconds on the same quantity of water. The cohesion figure is however quite characteristic of the substance, and cannot be for a moment mistaken for any other substance that I have examined."

Creosote, carbolic and cresylic acids, and newly-distilled oil of cloves, give remarkable figures of the same type, each of which is characteristic of the substance.

Mr. Spalding remarks that warm water destroys all action, by lessening, as he supposes, the adhesion of the liquids. I am sorry to have to object to this remark, but I have no doubt that Mr. Spalding was led to make it by employing unclean water or an unclean recipient. If distilled or even ordinary tap water be heated over a spirit lamp in a clean flask, and be poured into a clean vessel, the surface of the water is active at all degrees between the temperature of the air and just below boiling. On the surface of cold water a drop of creosote passes through the following changes:—(1) As soon as the drop is placed on the surface of the water the figure is formed for an instant; (2) it splits open and forms a kind of brittle arc, which (3) is shivered into a number of separate discs, each of which is a perfect cohesion figure of creosote. These figures perform their evolutions independently of each other, sailing about with rapidity, but never clashing with or disturbing each other. In the *Philosophical Magazine* for June 1867, figures are given of these different phases of the figure.

Now, if the water be heated to 100° Fah., or from that to 150°, a drop of creosote deposited on its surface produces a good active figure, but it does not split open or form the brittle arc above referred to; it sails slowly over the surface, firing off volleys of small globules in radial lines, and only when much wasted does it split into smaller systems. All this is what might be expected from the diminished surface-tension occasioned by the heat. Indeed, it is a beautiful illustration of the slight diminution of surface-tension in hot water as compared with cold. In consequence of not splitting open, the duration of the figure is greater on the surface of hot water as compared with cold.

Carbolic and cresylic acids are also very active on hot water, at all temperatures up to 210° Fah.

C. TOMLINSON

Highgate, N.

Hereditary Instinct

WILL you allow me to recount to your readers what appears to me to be a striking instance of the transmission of impression in animals?

A few years ago I bought in Skye a perfectly uneducated Skye terrier. The first accomplishment which I taught him was