THURSDAY, FEBRUARY 22, 1872

## THE ROCK THERMOMETERS AT THE ROYAL OBSERVATORY, EDINBURGH

THE whole of the observations made with these instruments (reading to hundredths of a degree Fahrenheit) from 1837 to 1869 having been reduced on a uniform plan, and found to exhibit some well-marked supra-annual cycles, a paper on the subject and on their relations to the sun-spot cycles of similar period but diverse shape was sent in to the Royal Society, London, on March 2, 1870.

Since then two eminent astronomers, one of them being Mr. Stone, the newly appointed Astronomer Royal at the Cape of Good Hope, and the other Mr. Cleveland Abbe, Director of the Cincinnati Observatory, have published somewhat similar deductions touching atmospheric temperatures in reference to sun-spots; Mr. Stone basing on thirty years of South African temperature observed by his indefatigable predecessor Sir T. Maclear; and Mr. Abbe on sixty years' temperature observed on the elevated station of Hohenpeissenberg near Munich, under the superintendence of Dr. Lamont, the Bavarian Astronomer Royal; both parties, equally with myself, using the same famous series of observations of sun-spots, as made by M. Schwabe, and discussed both by Prof. Wolf and Prof. Balfour Stewart. More recently still a Canadian writer, employing the returns of the Toronto Observatory for many years past, considers that he has established a connection between the amount of annual rainfall there and the sun-spots; and of these again with the periods and dates of several interlacing streams of circum-solar meteors. And within the last few days the Radcliffe Astronomer announces in his report for 1871 that the *mean* azimuthal direction of the wind at Oxford, rigorously computed from automatic records during the last eight years, varies year by year through a range of 58° on the whole, between *maximum* and *minimum* of visible sun-spots; the tendency of the wind to a westward direction increasing with the number of spots, and with such west wind, it is to be presumed, the amount of rain also.

These results touch closely on the hopes of physicists to render meteorology more of an exact science by getting at its cosmical relations, but they also touch equally close on another point where the highest science is at present completely dumb, although too it is the very point where the utmost amount of benefit might be conferred on the largest numbers of the people, viz., some approximate indications of the character of the seasons for a year or two beforehand; or indeed, very much as I did make a first attempt, for the two winters of 1870-71 and 1871-72, in the paper presented to the Royal Society in the spring of 1870.

How intimately the well-being of the poor generally, as well as of the agricultural classes, depends on those characteristics of weather which no scientific society can at present foretell, and no Ministry prevent in their destructive effects to the national revenue when they do come, the following letter may serve as a better example than anything that I could prepare on theory alone:—

"Webb's Green, Hales Owen, June 12, 1871

"To C. Piazzi Smyth, Esq., Edinburgh

(Copy)

"Sir,—I am a reader of *Chambers' Journal* and a farmer of some 600 acres. In the publication of Messrs. Chambers I read that you had expressed an opinion from certain observations you had made that the late winter would be very severe. For the general run of weather prophets I have very little respect; but every respect for opinions that are the result of scientific induction.

"Consequently I conducted my farming operations with due regard to your prognostication, and as the result has been a profit to me, I write to thank you. Gratitude has been defined as 'a lively sense of favours to come,' and from that view and in consideration of the present weather if you could give me your opinion of the weather that you think likely to prevail for some time to come I should feel much obliged.

"I have not troubled you with this epistle entirely from a selfish point of view, for besides being a farmer I am unfortunately an employer of a very underpaid class of workmen, hand rail makers.

"Now that stocks of wheat are exhausted, meat is a luxury to which railers cannot aspire; and if the season continues ungenial, before the harvest of 1872 there may be absolute scarcity of bread. I want to get up a fund for emigration, but if you could give me any information as to the probabilities of season that would dispel my gloomy anticipations for next winter, I should rejoice.—I am, &c., &c. (Signed) "THOMAS BISSELL"

But I have so little desire to incur responsibility for any weather predictions that I have gladly availed myself of the opportunity of the publication of the 13th volume of the Edinburgh Astronomical Observations to lay before the public by means of the several Plates 11 to 15 inclusive a complete graphical representation of the whole series of Edinburgh rock-thermometer observations, and on which I will merely venture the following explanatory remarks:—

1. The most striking and positive feature of the whole series of observations is the great heat-wave which occurs every eleven years and a fraction, and nearly coincidently with the beginning of the *increase* of each sun-spot cycle of the same eleven-year duration. The last observed occurrences of such heat-wave, which is very short lived and of a totally different *shape* from the sun-spot curve, were in 1834·8, 1846·4, 1857·8, and 1868·8, whence, allowing for the greater uncertainty in the earlier observation, we may expect the next occurrence of the phenomenon in or about 1880·0.

2. The next largest feature is the extreme cold close on either side of the great heat-wave; this phenomenon is not quite so certain as the heat-wave, partly on account of the excessive depth and duration of the particular cold wave which followed the hot season of 1834·8. That exceedingly cold period, lasting as it did through the several successive years 1836, 37, and 38, was, however, apparently a rare consequence of an eleven year minimum occurring simultaneously with the minimum of a much longer cycle of some forty or more years, and which has not returned within itself since our observations began. Depending therefore chiefly on our later observed eleven-year periods, or from 1846·4 to 1857·8, and from the latter up to 1868·8, we may perhaps be justified in concluding that the minimum temperature of the present cold wave was reached in 1871·1, and that the next similar cold wave will occur in 1878·8.

3. Between the dates of these two cold waves there are located, according to all the cycles observed, even including that earlier one otherwise exceptional, three moderate and nearly equidistant heat-waves, with their two intervening and very moderate cold waves, but their characters are quite unimportant as compared with what is alluded to under heads 1 and 2; and with regard to all the waves, it may be just to state that there has been in observation more uniformity, and will be therefore in prediction more certainty for their dates than for their intensities.

C. PIAZZI SMYTH

February 1872

## DARWIN'S ORIGIN OF SPECIES

*The Origin of Species by means of Natural Selection; or the Preservation of Favoured Races in the Struggle for Life.* By Charles Darwin, M.A., F.R.S. Sixth edition, with additions and corrections. (London: J. Murray, 1872.)

FEW are the writers, scientific or otherwise, who can afford, in every successive edition of their works, to place side by side the passages which they have seen reason to alter, from a change of view or any other cause. And yet to this point we find especial attention called in each succeeding edition of Mr. Darwin's "Origin of Species." And herein lies the true humility of the man of science. Science is often charged with being arrogant. But the true student of Nature cannot be otherwise than humble-minded. That man is unworthy of the name of a man of science who, whatever may be his special branch of study, has not materially altered his views on some important points within the last twelve years.* The means at our command for obtaining correct views of the laws which govern Nature are ever increasing, and if we only

Let knowledge grow from more to more,

this can but cause that

More of reverence in us dwell,

reverence for the eternal constancy of Nature's laws, with respect to which we even yet know so little. But a false pride more often tempts men to conceal than to avow their change of opinion. Mr. Darwin carries the contrary practice perhaps to an excess. But such a course necessarily disarms criticism of its sting; and if the learner sometimes ventures to point out wherein he differs from the master's conclusions, it is only in the hope that the interchange of opinion may lead to a removal of the difficulties which prevent a complete accord of thought.

The sixth edition of the "Origin of Species" is considerably smaller than its predecessors; but this does not arise from any diminution of matter, but from the use of smaller type. There has been, in fact, considerable addition, and our province will be simply to call attention to those points in which previous editions have been amended or amplified. Already, in the fifth edition, Mr. Darwin had stated that the able criticism of his work which appeared in the *North British Review* had induced him to modify his views with regard to the frequency of the occurrence of characters which are not useful to the individual; we find now, on some other points, a similar modification of opinion.

It has always seemed to us that one of the weakest parts of Mr. Darwin's statement of the theory of natural selection is the emphasis with which he asserts that single instances of departure from the law would prove the theory to be unsound. In the present edition, speaking of the rattle of the rattlesnake—the only effect of which has been stated to be to direct to the snake the attention of its enemies—he goes out of the way to repeat that "if it could be proved that any part of the structure of any one species had been formed for the exclusive good of another species, it would annihilate his theory." Why it would annihilate his theory, we must confess we are unable to understand; since Mr. Darwin repeats in this edition even more emphatically than in previous ones that "he is convinced that natural selection has been the main, *but not the exclusive*, means of modification of species." Since then other causes have been at work to cause the evolution of species, why may not some of these causes be able to produce parts beneficial to the race rather than to the species? In the special case, however, under consideration, the rattle of the rattlesnake, an American naturalist comes to the rescue of the Darwinian theory. Mr. Darwin was probably not aware at the time of writing that Prof. Shaler had stated his belief, from the result of observation, that the rattlesnake's rattle is actually beneficial to it, its object being to imitate the sound of the cicada or other insect which forms the food of many birds, thus attracting them within its power, and accounting for the apparent "fascination" of its prey, which must now be consigned to the limbo of travellers' tales.

The greater part of the additional matter in this edition is naturally devoted to a reply to the objections urged in Mr. Mivart's "Genesis of Species." In replying to Mr. Mivart's objection to the theory that "mimicry" has resulted by the process of natural selection, on the ground that the early stages of resemblance would have no useful tendency, the following sentences appear to us to be open to objection, or to be wanting in clearness:—"But in all the foregoing cases the insects, *in their original state*, no doubt presented some rude and accidental resemblance to an object commonly found in the stations frequented by them." "Assuming that an insect *originally happened* to resemble in some degree a dead twig or a decayed leaf." What is meant by the "original state" of an insect? Every insect-form must have been evolved from some previously existing simpler form by a gradual process, and the "rude or accidental resemblance" must be due to the operation of the same causes that produced the finished likeness. We must acknowledge that Mr. Darwin appears to us to fail to grapple with the difficulty in the way of the application of his theory, that either the early stages of the "mimicry" are useless, or that the exact reproduction of figure and pattern in the "mimicing" insect is a mere freak of nature. Mr. Darwin states his belief that "the sight of birds is probably sharper than ours," which would tell heavily against the utility of the first approaches towards resemblance; Mr. Wallace, if we recollect rightly, has expressed a contrary opinion.

Mr. Mivart's objection with regard to the curious fact

* The first edition of the "Origin of Species" was published in 1859.