

THURSDAY, JANUARY 5, 1871

## PROGRESS OF SCIENCE IN 1870

THE year which has just come to a close has neither been characterised by many new and striking scientific discoveries, nor have any novel applications of Science to ordinary industry and manufacture attracted special attention. The work done has been more a strengthening of that of past years, and a confirming or a disproving of theories and experiments, than the inventing of new ones. In one branch of Science only has any great advance been made, and that, as we shall presently show, we believe to have taken place in Geology. But this advance is one somewhat overlooked at present; but still of so important a character that, when once fully recognised in all its bearings, it may tend to disprove much of the geological teaching of the present day.

Taking the various Sciences as much as possible separately, we will begin with ASTRONOMY. Here attention has been chiefly directed, as has been the case for so many years past, to the Sun. Since it is now generally understood that when once the nature of this vast self-luminous body is accurately made out, much light will be thrown on many now perplexing and strange phenomena, the Eclipse of the 22nd of December last was anxiously watched for, and all possible observations were taken here by those who were unable to take part in the Government Expedition to Spain and Sicily. It is to be hoped that the labours of this Expedition, in spite of accident both on land and sea, and the unsatisfactory state of the weather at the time of observation, will yet yield results of great importance. At any rate we may fairly congratulate ourselves that at last we have a Government which has shown itself in other instances besides this special one, not unmindful of the claims of Science and of the value of accurate scientific investigation.

Mr. Lockyer and Mr. Huggins have continued their spectroscopic observations of the Sun, and Prof. Zöllner has published a very valuable paper on the solar prominences, theorising very boldly as to the temperature and pressure at the Sun's surface;\* while in America Prof. Young has worked with good results at the same subject. Before leaving this branch of our subject, we would mention that Mr. Proctor has published some novel views as to the constitution of the stellar systems, which, under the somewhat fanciful titles of "star-drift" and "star-mist" must be familiar to most of our readers.

Whilst the vast domain of ORGANIC CHEMISTRY has been still further widened by the innumerable workers who plunge into this branch of the subject and neglect the many untrodden paths in Inorganic Chemistry, nevertheless no special or important discoveries are to be chronicled, unless we may mention the beautiful process by which Indigo has been synthetically constructed by M.M. Emmerling and Engler, following closely on the artificial manufacture of Alizarine by M.M. Liebermann and Graebe.

MOLECULAR PHYSICS has occupied a large share of attention, and the discussion before the Chemical Society on the existence, or non-existence, of Atoms and Molecules, has only too clearly shown how doctors differ

amongst themselves, and that the very foundations of a Science, considered so essential by some, are utterly repudiated by others. A very remarkable paper on the Size of Atoms, originally published in these columns (NATURE, vol. i. p. 551) by Sir William Thomson, in which he gives four distinct trains of reasoning by which he arrives at a proof of their absolute magnitude, has attracted much attention, and has been translated and copied into most of the continental and American scientific journals. Dr. Thomas Andrews has also pursued his remarkable investigations on the Continuity of the liquid and gaseous states of matter. The death of Prof. Wm. Allen Miller, F.R.S., and Dr. Matthiessen, F.R.S., have left sad voids in the ranks of our English experimental chemists.

In BIOLOGY, the investigations of Prof. Tyndall, "On Atmospheric Germs, and the Germ Theory of Disease,"\* have contributed to a clearer knowledge of the nature of some of the most virulent of our infectious diseases, and have caused those diseases to be studied in a much more scientific manner than before.

The theory of Spontaneous Generation, which has been very prominently before the scientific world for the last ten years, has, during the past year, been very strongly attacked on the one hand by Prof. Huxley, and defended on the other by Dr. Bastian and Dr. Child. In his Inaugural Address to the British Association meeting at Liverpool, Prof. Huxley gave a long review of all the researches on the subject, from the time of Spallanzani and Needham to the present day, and declared his belief, after carefully weighing the evidence on both sides, that all life has its origin in some pre-existing life, and that Spontaneous Generation, or, as he termed it, Abiogenesis, is not now proved to take place. The investigations of Dr. Bastian, originally intended to have been read before the Royal Society, were published instead in these columns, in a series of three long articles (NATURE, vol. ii. pp. 170, 193, 219), in which he gave the reasons for his belief that Spontaneous Generation certainly does occur. Feeling himself attacked and his experiments somewhat underrated by Prof. Huxley in his Address, he criticised it at considerable length, and detailed the results of some new experiments (NATURE, vol. ii. pp. 410, 431, and 492) which confirmed his previous deductions.

The Darwinian theory of Natural Selection has been attacked by Mr. A. W. Bennett and Mr. Murray,† and defended by Mr. A. R. Wallace and others; Mr. Wallace having also vindicated his claims to priority in this question, since he published many of the now-recognised theories and speculations on the subject of Natural Selection, at a time when he was resident in the East Indies, and entirely unacquainted with what Mr. Darwin had written on the same subject.

As respects GEOLOGY, during the past year the Government has continued its grants of money for the purpose of Deep Sea Dredgings, and at present the report of the most recent Expedition is anxiously looked forward to. The results of the Expedition in the autumn of 1869, as given to the public by Dr. Carpenter, Prof. Wyville Thomson, and Mr. Gwyn Jeffreys during the past year, have been of the greatest possible interest and importance. They found that on the same level, at the

\* See NATURE, vol. i. pp. 327, 351, 499, &amp;c.

† NATURE, Vol. iii. pp. 30, 49, 65, and 154.

bottom of the deep sea, two different deposits are in process of formation side by side, each characterised by a distinct Fauna, and yet apparently produced under perfectly similar conditions of land and sea, area, depth of water, &c. On investigating this curious result, however, it was found that the temperature of the water circulating over these two areas is very different, and that this mere difference of temperature is capable of entirely changing the character of the fauna of the simultaneously formed deposits. Thus an entirely new element is brought into geological speculations, since it is shown that at one and the same time strata may be accumulated containing widely different organic remains. In addition to this, they have shown that the calcareous deposit known to us as chalk is now being deposited all over the bed of the Atlantic Ocean, and there are many weighty reasons for believing that this deposit has gone on steadily ever since the time during which we imagined the cretaceous rocks of the world to have begun and ended. Many organisms formerly supposed entirely extinct have been re-discovered in these deep-sea dredgings; and, in short, much has been done to show that our past geological reasoning requires thorough and careful revision. Prof. Gümbel's discovery of the existence of *Bathybius* and similar organisms at all depths, and stretching over an indefinite period of geological time, is of the greatest importance in relation to this subject. Prof. Agassiz, on the other side of the Atlantic, has published reports of the deep-sea dredging off the Florida Coast, and has stated that the results of his researches, and those of others, both English and Scandinavian, have convinced him that there is life all over the sea bottom, and that where evidence of marine life cannot be found, we are justified in calling in the agency of the sea to explain certain obscure facts. These conclusions cannot be without their important bearing on many commonly received geological theories.\*

In BOTANY many very careful series of observations have been made in the physiological department. Among the most important we may mention those of Prillieux and Ducharte in France, confirmed by Dr. M'Nab in this country, that, contrary to the previously accepted hypothesis, plants do not absorb any appreciable amount of aqueous vapour through their leaves; and those previously announced by M. Dehérain, that the evaporation of water from the leaves of plants is due to sunlight rather than to heat, and proceeds independently of the degree of saturation of the atmosphere. Much attention has also been paid in Germany, Italy, and England, to the fertile field of the phenomena of fertilisation, opened out by Mr. Darwin's observations.

In METEOROLOGY there is no great advance to chronicle. It still remains a Science without a head, a chaotic mass of facts with no definite order or arrangement; for though many are working at this subject, and some valuable papers on the Origin of Winds and Storms have been published, still no definite progress can be ascertained.

The splendid appearances of the Aurora Borealis, visible all over the British Isles in September and October, have directed public attention to those unmistakeably magnetic phenomena, and to the connection which exists between

\* During the past year all the most important papers on Deep-Sea Dredging have appeared in these columns, and we would refer our readers to Vol. i. pp. 135, 166, 267, 612, 657; Vol. ii. pp. 257, 513, &c.

their appearance, great magnetical perturbations, and large solar spots. They have been examined very frequently during the past year by means of the spectroscope, and there is distinct evidence of lines in the green and red portion of the spectrum, the latter presumably due to hydrogen. We would direct attention to our desire to publish a complete tabular list of the more remarkable meteorological phenomena of the past year, so as to be serviceable to observers in all parts of the world. To render this as perfect as possible, we would invite the kind co-operation of all those interested in the subject who can forward us any data.

We cannot conclude without noticing how much Science has lost during the latter half of the year just ended by the fearful struggle that has taken place between France and Germany, where each nation has brought into requisition all the resources of Science only to inflict as much injury as possible on the other. For nearly six months we have witnessed the sad sight of workshops shut up, laboratories closed, universities and public schools wanting both professors and students, and the friendly emulation of similar tastes and pursuits turned to the fierce rivalry of the sword. Science will have to deplore the untimely loss of many of her most attached workers, and their country will have lost those who would in happier times have done her as much honour at home as they have shown bravery in the field. Whilst the French Academy, shut up in besieged Paris, has brought the art of ballooning to its present state of perfection, so that now it is used as a means of communication with the outside world, the result of the subtle strategy of the Germans, and the scientific education they so generally possess, has been to give them advantages which have, to the present time, baffled their adversaries.

J. P. E.

#### THE INTELLIGENCE AND PERFECTIBILITY OF ANIMALS

*The Intelligence and Perfectibility of Animals from a Philosophic Point of View. With a few Letters on Man.* By Charles Georges Leroy, partly under the pseudonym of "The Naturalist of Nuremberg." (London: Chapman and Hall, 1870.)

THESE Essays, written nearly a century ago, seem to have been intended chiefly as an answer to the doctrines of those French philosophers who maintained that animals were merely animated machines, or, as it was expressed by Buffon, that "the animal is a purely material being, which neither thinks nor reflects, but which nevertheless acts," and that "the determining principle of the animal's actions proceeds from a purely mechanical influence, absolutely dependent upon its organisation." Our author, on the contrary, maintains that the mental faculties of animals are strictly comparable with those of man; that they remember, combine, and reflect; that they are capable of self-improvement; and even that they possess a true language fully adapted to their needs. To support his views he gives what we may term a generalised life history of several animals, such as the wolf, fox, stag, fallow-deer, and roebuck, which his position of Ranger of Versailles and Marly gave him ample opportunities of studying. The chief fault of these interesting sketches is, that they detail hardly any