

at a loss to discover. Nor was even the inventor apparently satisfied, for we are told in the report that "in order to still further improve the quality of the effluent by longitudinal filtration, by oxidation, and by the action of micro-organisms, Mr. Scott Moncrieff devised what he has termed nitrifying channels. These in their simplest form consist of half-channel pipes joined together with cement and filled with coke." These channels were originally 30 feet in length, but subsequently they were increased to 80 feet. As regards the efficiency, or rather inefficiency of these channels, we are able to form an opinion from analyses given on pp. 19 and 20 of the report; from these it appears that the free ammonia *before* was 3·2 parts per 100,000, and *after* passing through the 80 feet channel 3·6 parts, whilst the albuminoid ammonia was '8 part *before*, and '64 part *after*, respectively, whilst in no case was more than a very small proportion of nitrate discovered in this effluent, showing that these channels are "nitrifying" in name only.

If we now inquire into the machinery involved in producing these results, we find that for a household of ten to twelve persons, the filter-bed was 10 feet long by 2½ feet wide, or 25 square feet in area, whilst the so-called nitrifying channel superadded to this was 80 feet in length (the diameter of these channels is not given). For a population of 1000 persons, therefore, a filter-bed, upwards of 2000 feet square, and a nitrifying channel, between 6000 and 7000 feet in length, would be necessary.

It is difficult to discover what claim to novelty Mr. Moncrieff's system possesses; the upward filtration of sewage was practised years ago, and has been generally abandoned on account of the far superior results obtained by downward intermittent filtration. As regards the nitrifying channels, these are simply downward filters of a very clumsy and expensive form, the inefficiency of which is attested by the analyses published in the report. One novelty indeed there is in Mr. Moncrieff's filters, to which they doubtless owe their "up-to-date" title of "cultivation filter-beds," for we are informed that when a new filter-bed is started it is "inoculated" with the liquid contents of an old one! As already pointed out, in the absence of any analyses of the raw sewage, the report gives us no information as to the work really done by the "cultivation filter-bed," but the effluent coming from it certainly contrasts very unfavourably with good effluents obtained either by filtration, irrigation, or chemical precipitation; as regards the work done by the "nitrifying channels," the analyses demonstrate this to be simply deplorable.

In conclusion, we would remark that the chemical analyses might advantageously have been made more complete, so as to render the figures comparable with those given in the best investigations on the purification of sewage; and we would point out that an analysis is not rendered more exhaustive either by expressing each determination in parts per 100,000 as well as in grains per gallon, or by drawing out the results in elaborate but meaningless curves of divers colours.

ARTHUR MILNES MARSHALL.

A GLOOM has been cast over the opening year by the news of what can only be described as a national calamity. Like his friend, Prof. F. M. Balfour, Milnes Marshall has been cut off in the midst of a life of scientific usefulness by an accident among the mountains which he loved. On the last day of 1893 Prof. Marshall, with several companions, started from the hotel at Wasdale Head for a day's climbing among the precipices of Scawfell. All the dangers and difficulties had been passed, and the party were looking for suitable views to photograph. Dr. Marshall had mounted a few feet higher than the others, and called out, "Here is the best place

for the camera," when almost immediately a large stone was seen to fall, followed by his apparently lifeless body. The precise details of the mishap will never be known—whether he stepped or sat down upon a rock loosened by the frost, or whether, as is thought by some well qualified to judge to be more likely, a stone fell upon him from above—must remain a matter for conjecture. The melancholy fact is sufficient that a young and brilliant student of nature passed in an instant from the full enjoyment of health and strength to the "cold obstruction" of death.

Arthur Milnes Marshall was born in 1852, and inherited a love of natural science from his father, a gentleman well known in engineering circles, as well as an enthusiastic naturalist and a microscopist of no mean reputation. He was educated first at a private school, and in 1871 entered St. John's College, Cambridge, where he was one of the earliest students of that school of biology of which he afterwards became so distinguished an ornament. In 1876 he obtained the entrance scholarship in natural science at St. Bartholomew's Hospital, and entered upon the study of medicine. It is hardly too much to say that this step was taken as a *pis aller*. He looked forward with anything but satisfaction to the life of a medical practitioner, and when, in 1879, he was elected to the newly-created chair of zoology in the Owens College, he entered with delight upon a career devoted to the advancement of his favourite science.

As might have been expected from the friend and companion of Balfour his first work was embryological, and consisted of a series of papers on the Cranial Nerves, published in the *Journal of Anatomy and Physiology* and the *Quarterly Journal of Microscopical Science* between the years 1877 and 1881. Though in matters of detail these papers may need correction, and though the "Segmental Value of the Cranial Nerves" is as much open to discussion as it was when Marshall wrote his thesis, these memoirs were at the time solid contributions to our knowledge, and have furnished a basis upon which other men have wrought. The culmination of his work in this direction has been the great work on "Vertebrate Embryology," of which an appreciative notice appeared in these columns so recently that it is not needful to do more than allude to it.

In 1881 the dredging operations of the Birmingham Natural History Society gave him the opportunity of studying the Pennatulida, and in the following year a report upon these animals was issued under the joint authorship of himself and his father. In this and in his subsequent papers on the "Pennatulida of the *Porcupine* and *Triton* Expeditions," and of the "Mergui Archipelago," written partly alone and partly in conjunction with Dr. G. H. Fowler, he carefully elaborated the distinctions between the various forms of zooids and traced the relationships of the genera on morphological grounds. Strong reasons were adduced for dissenting from the classification propounded by Kölliker, though Marshall never considered that he had enough material at command to justify him in proposing an alternative arrangement. On the whole it is probable that these memoirs will form his most lasting contribution to zoological science.

A paper on "The Nervous System of Antedon," containing the results of an Easter vacation spent at Naples, was valuable as establishing beyond question the views of the Carpenters regarding the nervous function of the central capsule and axial cords of Crinoids, but it is still more interesting as an example of Marshall's clear and logical method.

Marshall was a born teacher; his mind was of that rare order which not only sees a problem clearly itself, but is cognisant of every step taken in understanding it, and hence is able to enter into the position of those who approach it for the first time, and to see where their diffi-

culties will lie. His lectures were illustrated not only by wall diagrams, prepared by himself, but by sketches on the blackboard drawn with the clear decided stroke of a master-hand whilst he was talking. He was second to none in appreciating the importance of drawing as a means of fixing the details of a structure upon the student's mind, and it was his custom to offer annually a prize for the best note-book produced by a member of the class.

In his own investigations it was his practice to begin with the illustrations, and in this way the whole of the figures in his "Vertebrate Embryology" were drawn before a line of the text was written. This power of clear exposition and his long experience as a teacher rendered him a singularly competent writer of text-books, as is evidenced by "The Frog," and "Practical Zoology," each of which has passed through several editions.

His powers as a teacher and his powers as an athlete rendered him extremely popular with the students; his advice was often sought and was valued because it was always candid, whilst his geniality and kindness were such that his most outspoken criticism never gave offence.

It is no disparagement, however, to his powers as a scientific investigator and as a teacher, to say that his greatest distinction was his capacity for organisation, though this was as yet only known to those associated with him in administrative work; it is not too much to say that the great success which attended the Manchester meeting of the British Association was mainly due to his efforts as local secretary, whilst his services first as secretary and then as chairman of the Board of Studies rendered no small aid to the Victoria University in the early stages of its growth.

The University Extension movement in Lancashire and Cheshire loses one of its most ardent supporters. Though well aware of the necessary failings of this method of imparting instruction, he was firmly persuaded of its usefulness as a means of stimulating an interest in intellectual studies. He was an ideal Extension lecturer; his singularly lucid style enabled him to expound difficult biological problems to large popular audiences, whilst the truths he taught were indelibly impressed upon his audience by the striking and generally humorous language in which they were couched.

Marshall was elected a Fellow of the Royal Society in 1885, and served upon the Council for the year 1891-2. By his death the scientific world loses a conscientious and brilliant worker; the college and university a successful teacher and administrator; but what of those who are privileged to be his friends? He was a most stimulating influence in work, and a cheery companion in pleasure, whose geniality was never known to be ruffled by ill-temper or irritation. He concealed a deep seriousness beneath a jocular and almost boyish demeanour and phraseology, and whilst rejoicing in an unbounded flow of animal spirits himself, the sorrows of others touched him to the quick and called forth his practical sympathy. Science will progress and the college and university hold on their course but the place of our friend can never be taken by another.

NOTES.

IT is with deep regret that we announce the death of Prof. Hertz, the eminent investigator whose work marks an epoch in the history of electrical science. The information comes as a surprise to us, and we are grieved that one from whom so much more might have been expected has been cut off in the prime of his life. The gap produced in the ranks of scientific investigators by his death will not readily be filled.

PROF. P. VAN BENEDEN must be added to the list of men of science who have recently passed away, and whose loss

we mourn. He has just died at Louvain, at the age of ninety-three, but his works live and will always do honour to his name. He was a member of the Brussels Academy of Sciences, and had been professor at Louvain University for nearly sixty years.

WE regret to record the death of Prof. Forchhammer, the well-known archæologist; of Prof. K. L. Michelet, Berlin at the age of ninety-two; of Dr. S. Guttman, Geheimer Sanitäts-Rath, and editor of the *Medicinischen Wochenschrift*; and of Dr. L. Krahrmer, Ordinary Professor of State Medicine in Halle University.

BY the death of Dr. George Gordon, natural history in the north of Scotland has lost one of its most enthusiastic and oldest supporters. He died at the advanced age of ninety-two years, on December 12, after working nearly three-quarters of a century in the cause of science.

A COMMITTEE of eminent men of science, art, and literature, with M. Pasteur at its head, has been formed in Paris for the purpose of raising the funds to erect a monument to the memory of the late Dr. Charcot.

DR. R. BRAUNS has been appointed Professor of Mineralogy in the Darmstadt Technical High School.

A BOTANIC garden and arboretum has been established at Buenos Ayres, by M. C. Thays.

PROF. G. SCHWEINFURTH has started on his third botanical exploring visit to the Italian colony of Eritrea, on the Red Sea.

PROF. F. DELPINO, of Bologna, has been appointed Director of the Botanic Garden at Naples, and Professor of Botany in the University.

ONE of the bequests in the will of Mr. A. Peckover, who died last month, is the sum of £100 to the Linnean Society.

MR. F. E. IVES has been awarded the Elliott Cresson gold medal of the Franklin Institute for his system of colour photography, known as composite heliochromy.

THE Society for the Encouragement of Industry in the Netherlands offer a prize equivalent to £30, and a gold medal, for the best memoir on the production of electricity by wind-mills. Intending competitors must send in their schemes before July 1, to the Secretary of the Society, Haarlem, Holland.

ELECTRICAL engineers have as yet been unable to perfect a system of working tramways electrically along crowded thoroughfares. Inventors have long been engaged endeavouring to overcome the difficulties, and as an incentive to them to throw themselves into their task with renewed vigour is an announcement in the *Times* that the Metropolitan Traction Company of New York City has offered the handsome award of about £10,000 for a system of street-car propulsion which will be superior or equal to the overhead trolley system, but without possessing the objectionable feature of the trolley for crowded thoroughfares.

THE Committee on Science and the Arts of the Franklin Institute has issued a circular in which attention is directed to three awards under its control. The character and conditions of these awards are, briefly, as follows:—The Elliott Cresson Medal is of gold, and may be granted for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill, or perfection in workmanship. The John Scott Legacy Premium and Medal (twenty dollars and a medal of bronze) is awarded for useful inventions. The Edward Longstreth Medal of Merit is