

a relatively extremely small proportion. It is very probable that many of these widely ranging forms are somewhat local, if that term is not interpreted too narrowly. On the other hand, we should not expect winds to do less for insects, forms inheriting most admirable organs of flight, than for such wingless creatures as spiders. McCook, a well-known authority, states that ballooning spiders have been found more than 200 miles from land and at elevations of more than 1000 feet. He has concluded from a study of distribution in the tropical regions that these spiders may have actually circumnavigated the globe on the wings of the wind. The known distribution of certain small insects in tropical areas likewise suggests that winds may have played a most important part in carrying these minute, fragile insects. In other words, the ability of the organism to support itself in the air appears to be a most important factor in certain types of distribution.

There is very little question but that representatives of many species of insects are carried far beyond any point where they can possibly maintain themselves. Nature is extremely profuse in her provisions for the continuance of both plant and animal life; the greater

the hazard, the more liberal the provision as a rule. It appears reasonable to conclude that winds are carrying millions of insects daily into regions where they cannot possibly survive. A few especially favoured forms may by chance find their way to an area where there are livable conditions. One of the notable instances of this kind was the appearance of a caterpillar on the first crop of tomatoes and peas raised from seed in the out-of-the-way Cocos-Keeling Islands, although it was not a native species, and the parent moth must have travelled hundreds of miles over an inhospitable ocean. A similar case came to the writer's attention recently in connexion with a small patch of corn growing in a Chilean desert. Insects are all about us. Only occasionally do we realise the frequency with which they appear in unexpected places.

Fortunately for man, many of the more destructive species find themselves unable for one reason or another to take advantage of the wings of the wind. An economic application is that insect spread may be somewhat definitely limited by the winds which prevail when other conditions are favourable for dissemination.

Obituary.

DR. JOHN M. CLARKE.

JOHN MASON CLARKE, who died at Albany, New York, on May 29 last, was one of the foremost palæontologists of America. The son of a schoolmaster at Canandaigua, New York, he was born on April 15, 1857, and received his early education in the school which his father directed. He was inclined in boyhood to the study of geology and natural history, and he proceeded in 1873 to Amherst College, Mass., where he graduated in 1877. At Amherst he came under the influence of the professor of geology, B. K. Emerson, and so entered on his life-work. He began to study in earnest the Upper Devonian rocks and fossils in the neighbourhood of his home, and while holding a succession of small teaching appointments devoted all his leisure to original research.

By the end of 1884 Clarke had made so much progress, that he felt impelled to compare his results with those of European geologists, and he went to spend parts of two years studying under Prof. A. von Koenen in the University of Göttingen. There he graduated with a thesis on Devonian geology in 1885, and after holding another small teaching post, was eventually appointed assistant to Dr. James Hall, the well-known State Palæontologist of New York, in 1886. Thenceforward until his death he was connected with the Geological Survey of New York, becoming State Palæontologist in 1898, and State Geologist as well as Director of the State Museum in 1904.

Clarke's earliest papers on Devonian fossils were published in 1882, and were followed by a long succession which culminated in his two classic volumes, "The Early Devonian History of New York and Eastern North America," published by the Geological Survey of New York in 1908-9. At the same time he studied the Devonian fossils not only of Germany, but also of Brazil, Argentina, and the Falkland Isles. Among his

official duties he was also concerned with several other Palæozoic faunas, and he became the recognised authority on Palæozoic invertebrata in America. With Dr. James Hall he published "An Introduction to the Study of the Genera of Palæozoic Brachiopoda" in 1893-94; and with Dr. Ruedemann a monograph of "The Eurypterida of New York" in 1912. Both these are works of reference of permanent value.

In later years Clarke made good use of his ripe scholarship in considering some of the wider problems of the science to which he had devoted his life. As first president of the Palæontological Society of America, in 1911 he delivered an address on "The Philosophy of Geology and the Order of the State," and in 1921 he published a little memoir entitled "Organic Dependence and Disease." He applied his science to questions of state control, and argued that it pointed to individualism, not socialism, as the essence of progress.

Clarke was an attractive personality with very wide interests beyond those of his special work. As head of the State Museum he also controlled the science division of the department of education, and he was associated with many other organisations in the city of Albany. He will be mourned not only as an eminent man of science, but also as a model citizen.

A. S. W.

MR. D. R. STEUART.

DANIEL RANKIN STEUART, late chief chemist to the Broxburn Oil Co., Ltd., died at his residence, Blackhall, Edinburgh, on August 1. He was a well-known figure in scientific circles in the east of Scotland, and was a recognised authority on the chemistry and technology of shale oil and petroleum. Born at Bogside, Lanarkshire, in 1848, he studied botany and geology in his early youth, and, for reasons of health, spent some ten years in the open-air pursuits of gardening and farming; he received his chemical training at

the University of Edinburgh under Crum Brown, at Glasgow under Dittmar, and finally at Munich. His connexion with the shale oil industry, destined to be a lifelong one, began about 1875, when he became a laboratory assistant to the late Sir George Beilby at the Oakbank Oil Works. In 1877 he was appointed chief chemist to the Broxburn Company, and retired from that post five years ago.

Mr. Steuart was a strenuous worker, endowed with a mind of exceptional intellectual insight and power. His writings are well known, and include a number of articles, contributed to the Transactions of the Society of Chemical Industry, on the shale oil industry, petroleum, and brown coal; some of these are of practical interest, others in speculative vein. To the same Society he read a paper entitled "The Oxidation of Mineral Oils," and edited and read one by his nephew, Mr. B. Steuart, on "The Composition of Shale Naphtha." It was one of his regrets that his routine duties did not permit him to devote more time to organised research; he, however, strongly advocated the desirability of industrial research being taken up by qualified university workers. That his eminence as an authority on shale was widely recognised is attested by articles written by request to "Economic Geology" (U.S.), Ure's "Dictionary," Muspratt's "Chemistry," Thorpe's "Dictionary of Applied Chemistry," and an important contribution to the memoirs of the Scottish Geological Survey entitled "The Chemistry of the Oil Shales." In the last mentioned he propounded a theory referring to the origin of oil shales.

Mr. Steuart's humane instincts led him, in 1890-95, to direct public attention to the number of deaths caused by the use of low flashing burning oils in lamps. He wished the standard of flash point to be raised from 73° F. to 100° F., and gave evidence on the subject before a Select Committee of the House of Commons during the reading of the Petroleum Bill. The measure was unsuccessful, but as the light constituents of petroleum (the cause of low flash point) afterwards became valuable as motor fuel, Mr. Steuart had the satisfaction of seeing burning oils made safer by the elimination of much of the danger in the refinery.

R. H. FINDLATER.

PROF. O. BREFELD.

THE death was recently announced of Prof. Oscar Brefeld, the founder, and for fifty years a leader, of modern mycology. Born at Telgte in Westphalia, on August 19, 1839, the son of a wealthy pharmacist, whose business he was intended to inherit, he early took an interest in the lower plants, but it was not until 1868 that he began his mycological studies in earnest. At the outset he realised the necessity of sterilising the culture media and the apparatus, and of studying microbes and spores as individuals. For this purpose he introduced gelatine—which he replaced later by agar-agar—and devised the method of pure culture by thinning the medium so as to grow a colony from a single cell under continuous microscopic observation. Thus he laid the foundation of all subsequent microbiological study ten years before R. Koch took up the inquiry.

In 1870 the contemporary work of Pasteur led a Munich brewer to seek the assistance of Brefeld. Here he gained experience and a crop of fruitful ideas, but his work there was cut short by the Franco-Prussian war. From the siege of Paris he was invalided home after an attack of typhus and prosecuted his studies in Berlin. Here he took his doctor's degree, and in 1872 published the first volume of his great life work, "Botanische Untersuchungen aus dem Gesamtgebiete der Mykologie" (18 vols.), known as the mycologists' Bible. The following year saw the publication of his epoch-making researches on the Ascomycetes, especially on the cultivation of the blue mould *Penicillium glaucum* from a single spore to a mycelium with complete fructification. One cannot here go through the contents of successive volumes, but his important work on *Bacillus subtilis*, undertaken for the Prussian Government in 1878, demands mention. Brefeld did not, however, pursue bacteriology, feeling that his medical knowledge was too slender: Robert Koch was therefore substituted to become the "German Pasteur."

Brefeld, after habilitating as privat-docent in Berlin, became, in 1876, professor at the Forestry Academy in Eberswalde. Here he lost the sight of one eye. As a consequence of the "Kulturkampf" he was urged by the Government to become professor of botany at Münster in Westphalia. Here he continued to publish the most valuable work, until his removal to Breslau in 1898. In the year before the War, Brefeld resided in Berlin, where he lectured; but he became completely blind and had to resign his professorship.

Brefeld was a hard worker, entirely bound up in his life-work. He did not care to have pupils, but he trained a succession of assistants, among whom may be mentioned the Germans, Zopff, Alfred Möller, and R. Falck; the Norwegians, Holtermann and Sopp; the Swiss, Von Tavel; and the Hungarian, Gyula de Istvanffi. We are indebted to an article by Dr. Sopp in a recent issue of *Naturen* for the details of Brefeld's life.

WE learn from the *Chemiker-Zeitung* with much regret that on August 4, shortly before his fifty-fifth birthday, Dr. Friedrich Auerbach, younger brother of the physicist Dr. Felix Auerbach of Jena, and well known as the collaborator with Abegg in the "Handbuch der anorganischen Chemie," died suddenly of heart failure. Auerbach studied at his native town, Breslau, under Ladenburg, to whom for a while he acted as assistant, after which he was engaged for several years in industrial work. But his real interest lay in scientific investigation, and in 1903 he returned to Breslau, where Abegg had recently begun to build up a flourishing school of chemistry. Shortly afterwards he was transferred to the Imperial Health Department. At Breslau, Auerbach devoted his attention chiefly to physical chemistry, and he published many papers dealing with the theory of electrolytic dissociation and the theory and practice of the electrometric titration of acids. After the death of Abegg in 1910, Auerbach undertook the onerous task of editing the "Handbuch der anorganischen Chemie." Before the War he was a member of the International Association of Chemical Societies.