

Africa in 1898 was about 23 millions sterling. This amount seems small for the huge continent, when we reflect that in 1901 the coal output of Wales alone was worth 19½ millions, and that of Northumberland and Durham about the same amount. But after reading Prof. de Launay's book, it needs no prophet to predict that Africa's mineral deposits will soon be more largely utilised.

ROWLAND'S WORK.

The Physical Papers of Henry Augustus Rowland.

Collected for publication by a Committee of the University. Pp. xi + 704. (Baltimore: Johns Hopkins University Press; London: Wesley and Son, 1902.) Price 30s. 6d. net.

PROF. ROWLAND'S friends have been well-advised in issuing as a memorial to their late colleague this volume of his collected papers. It enables us to realise more fully all we owe to him and to grasp the value and importance of his work.

Commencing with an early note sent to the *Scientific American* when the author was seventeen, the list of scientific papers concludes with an article on diffraction gratings, published in the new edition of the "Encyclopædia Britannica" after Rowland's death. Then there follow some six addresses on scientific subjects, a bibliography, and an account of the dividing engines he designed.

Dr. Mendenhall's commemorative address, delivered shortly after Rowland's death, fitly forms an introduction to the whole, and gives us a glimpse of his life and methods of work.

Rowland's fame came to him early, though not without some severe struggles and disappointments on his part, and it is a satisfaction to us Englishmen to know that it was Maxwell who first recognised his genius. Prof. Mendenhall tells again the story of his first serious paper, "On Magnetic Permeability and the Maximum of Magnetism of Iron, Steel, and Nickel," *Phil. Mag.*, 1873. The paper was more than once rejected in America because it was not understood, and finally it was sent to Maxwell, who wrote immediately that since the temporary suspension of their meetings made it impossible to communicate the paper to the Royal Society, he would send it to the *Philosophical Magazine*, where it appeared in August, 1873, Maxwell having himself, to save time, corrected the proofs. In this paper Rowland introduced the idea of the magnetic circuit as the analogue of Ohm's law, and developed the now well-known ring method of measuring permeability. In 1875, on his appointment as first professor of physics at the Johns Hopkins University, he came to Europe and worked for a time in Helmholtz's laboratory at Berlin, and by his researches answered Tait's question, put to Maxwell in these words—

Will mounted ebonite disc
On smooth unyielding bearing,
When turned about with motion brisk
Nor excitation sparing,
Affect the primitive repose
Of + and - in a wire?

To which Maxwell replies—

The mounted disc of ebonite
Has whirled before nor whirled in vain,
Rowland of Troy that doughty knight
Convection currents did obtain
In such a disc of power to wheedle
From its loved North the subtle needle.

And Maxwell goes on to explain that such convection currents will not produce electromotive force in a neighbouring wire unless the speed of the disc were variable.

The paper on the "Magnetic Effect of Electric Convection," No. 12, in the volume before us, was presented in the *American Journal of Science* for 1878; von Helmholtz had already announced the result to the Berlin Academy in 1876. Rowland returned to the problem with the same result in 1889, in a paper presented in the *Philosophical Magazine*, No. 43 of his collected works. As is well known, the results were challenged by Crémieu shortly before Rowland's death. Many readers of NATURE will remember the interesting occasion in Section A of the British Association at Glasgow, when Crémieu described how he had failed to obtain the effect. Those present felt that in view of the confirmation of Rowland's results obtained at Baltimore by Pender, Crémieu must have been misled, but no one could put his fingers definitely on the error. It is satisfactory to know, from the recently published joint work of Crémieu and Pender, that Rowland was right, and that a convection current of electricity does produce a magnetic field.

The research into the value of the British Association unit of resistance, No. 15, and a determination of the value of "v," No. 44, complete the series of fundamental electrical researches, though his collected papers contain many other memoirs of real importance.

In his experiments on the absolute unit of resistance, Rowland shows his usual acumen as a critic and skill as a mechanic and observer. Various lines of argument had shown that the B.A. unit, supposed to represent 10⁹ C.G.S. units of resistance, was in error. Rowland sums up effectively his criticisms on the method of the B.A. committee and points out the sources of error in Weber's method by damping adopted by Kohlrausch. He then describes his own method, a modification of that originally proposed by Kirchhoff, and, after a careful account of his apparatus and measurements, arrives at the result 1 B.A. unit = 0.9911 × 10⁹ C.G.S. units. A repetition of his experiments in 1884 gave 0.98627, while about the same time his pupil, Kimball, using Lorenz's method, arrived at the result 0.9864. The value obtained at the Cavendish Laboratory was 0.9867.

Part iii. of the collected papers deals with the work on Heat, and foremost among these is the great memoir on the "Mechanical Equivalent of Heat," a work which, if it stood alone, would have made Rowland's name as the foremost physicist of his nation.

The refinements of modern thermometry have enabled us to introduce some small corrections into certain of the results, but the work remains unrivalled.

Rowland was an engineer, and this stood him in good stead in all his researches, and nowhere more so than in the paper under consideration.

In arranging his laboratory, Prof. Mendenhall tells us, many of his friends thought he was giving undue prominence to the workshop, its machinery and tools, and to the men to be employed in it, but he planned wisely, for in original work "a well-manned and equipped workshop is worth more than a storehouse of apparatus already designed and used by others."

So, too, it was in the optical work described in part iv.; the concave grating is the child of the perfect screw, and he who would make a perfect screw must follow Rowland as he described his method in the article, "Screw," "Encyclopædia Britannica," ninth edition, No. 33 of the Collected Papers.

The secret is to correct the screw by grinding it in a long adjustable nut longer than the screw itself; thus, if the finished screw is to be 9 inches long, the nut should be 11 inches; as the grinding progresses the nut is closed in, and the grinding continues for two weeks, the nut being turned end for end every ten minutes and the screw kept in water constant in temperature to within 1°C. all the time.

It is not strange that machines which can rule gratings are rare.

The original paper on "Concave Gratings," No. 29, is a short one, but valuable details are given in No. 49, "Gratings in Theory and Practice," and in the "Encyclopædia" article already referred to.

The addresses which fill the last hundred pages of the book are full of interest. To many who have followed the accounts recently given in the pages of NATURE of the wealth and endowments of American universities, "A Plea for Pure Science" will appeal forcibly. Rowland was not satisfied that even America was doing all that was needed.

"The whole universe is before us to study. The greatest labour of the greatest minds has only given us a few pearls, and yet the limitless ocean, with its hidden depths filled with diamonds and precious stones, is before us. The problem of the universe is yet unsolved, and the mystery involved in one single atom yet eludes us. The field of research only opens wider and wider as we advance, and our minds are lost in wonder and astonishment at the grandeur and beauty unfolded before us. Shall we help in this grand work or shall we not? Shall our country do its share or shall it still live in the almshouse of the world?"

Or, again, in his last address, "On the Highest Aim of the Physicist," note his words, after speaking of the work of the Physician:—

"The aims of the physicist, however, are in part purely intellectual; he strives to understand the universe on account of the intellectual pleasure derived from the pursuit, but he is upheld in it by the knowledge that the study of nature's secrets is the ordained method by which the greatest good and happiness shall finally come to the human race."

Rowland unlocked some of the hidden chambers himself; he did more than this, he put into our hands the machine by which we may hope to forge the key which will open the door leading to some of the innermost recesses.

R. T. G.

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A VINE DISEASE.

Annales de l'Institut Central Ampélogique Royal Hongrois. Tome ii. Pp. vii+288+plates. (Budapest: Société d'Imprimerie et d'Éditions Pallas, 1902.)

THIS admirably printed volume is devoted entirely to an exhaustive study of the *Rot livide* of the vine, a destructive disease due to the ravages of a minute fungus known to botanists as *Coniothyrium Diplodiella*. The memoir reflects credit on the author, Dr. Istvánfi, not only on account of the thoroughness and clearness of the 288 pp. of text, but also from the beauty and completeness of the numerous (215) excellent figures set forth on the 24 plates.

Of the fifteen chapters into which the work is divided, the first deals with the somewhat extensive history of this now almost ubiquitous malady, the place of origin of which is not known with certainty, but which appears to have been more probably south-eastern Europe than the America to which we owe so many pests.

Chapters ii.-iv. are concerned with the description of the rot as manifested on the shoots and leaves of both native and American vines grown in Europe, and the pathological alterations induced in the tissues by the parasite.

The principal signs when the disease is advanced are brown spots and patches on the leaves, in the dead tissues of which the minute black pycnidia appear; the cortex shrivels, turns brown, and peels in fibrous masses as it dries. The dead twigs also show that the pith is destroyed, and similar pycnidia—frequently accompanied by other fungi such as *Botrytis*, *Pestalotzia*, *Colletotrichum*, &c.—appear on the surface. The dead twigs easily disarticulate at the nodes, and the leaves above, even if not directly attacked, shrivel and die because the diseased internodes cannot supply them with water. A characteristic chambering of the dying pith often precedes its total destruction, and may remain visible at the nodes long after the pith of the internodes has dried up.

Microscopic examination shows that the hyphæ of the fungus causing these destructive effects permeate all the softer tissues, and rapidly destroy the cortical parenchyma with the formation of large gaps filled with mycelium, and an interesting struggle for the mastery between fungus and host is evinced as the medullary rays, parenchyma and cambium attempt to heal up the wounds already made; in vain, however, and the hyphæ pass from cortex to pith *via* these medullary rays.

It is, of course, impossible to enter here into the numerous microscopic details, which, as might be expected from so able a histologist as Dr. Istvánfi, are very thoroughly done, and embrace many discoveries of interest, such as the sugar sphærocrystals in certain cells of the diseased cortex, the curious, cambium-like callogene layer, &c. Every botanist will find the careful microchemical reactions valuable, and the coloured diagrams of the behaviour of the diseased tissues are particularly instructive.

But it is not only the stems and leaves that are invaded by this fungus; it also attacks the grapes