Marcello Malpighi.

(1628–1694.)

THE three-hundredth anniversary of the birth of Marcello Malpighi, the Italian whom Sir Michael Foster designated " anatomist, physiologist, botanist, pathologist, biologist, and above all natural philosopher," occurs on Mar. 10.

Born at Crevalcore, a village near Bologna, Malpighi was one of the sons of a small farmer. Proceeding to the University of Bologna, he engaged in medical studies, graduating there in 1653, after four years' work, with a doctor's degree. Three years later he transferred to the University of Pisa, taking up the professorship of medicine; here he formed a friendship with Borelli, the mathematician, who encouraged him to pursue researches in anatomy. In 1662, Malpighi removed to Messina to occupy the chair of medicine, remaining there four years. Always subject to insecure health, a request to return to Bologna was willingly obeyed, and there Malpighi spent twenty-five years, fruitful in results. Summoned to Rome in 1691 as first physician to Pope Innocent XII., he died in that city three years later whilst holding office. Such is the summary of his ordinary life avocations.

In reality, however, we must extend these boundaries and regard Malpighi as a philosophic naturalist, a pioneer investigator, and a founder of microscopic anatomy. He had constant resort to the microscope, observing with its aid the passage of blood cells from arteries to veins. He made discoveries relating to the structure of the kidneys and spleen. He also investigated vegetable structure. If not endowed with a subtle instinct—it has been said that his physiology was necessarily of the unspecialised kind—he was yet competent to make general conclusions, fully endorsed afterwards.

We may appropriately allude here to Malpighi's connexion with the Royal Society of London in its earliest days, and with contemporaries such as Boyle, Hooke, Oldenburg, and Grew. Oldenburg, ever anxious to foster relations with foreign investigators, was doubtless first in the field to invite correspondence from Bologna. It seems to have begun in 1667. In the following year Malpighi wrote to Gresham College, sending a book, and expressing readiness to communicate " philosophical matters." A bond was henceforth established with the Society which almost obliterated nationality, actuated as it was by a true spirit of fraternity.

At this time, moreover, there was much Italian sympathy for science, of the kind, that is, that existed. It is recorded that at the very next meeting after Malpighi's letter was received, two Italian gentlemen were present, introduced by Count Ubaldino. They acquainted the Society of the singular respect which the Cardinal Leopold de Medicis had for them, and that he desired to have his excuse made for not having himself returned his acknowledgments for the History of the Society sent to him, which he had been hindered from doing by his lately acquired dignity of Cardinal; but that since that time he had desired and already obtained the Pope's permission to correspond with the Society, of which he now intended to make use to let them see the esteem which he had of them and their institution. Whereupon the president thanked these gentlemen for acquainting the Society with so favourable an inclination of his Eminence to them, and that they would study to entertain so noble and promising a correspondence with all reciprocal services that might be acceptable to his Eminence.

At a meeting of the Society held on Feb. 18, 1668/9, " Mr. Oldenburg brought in a packet sent to him by Signor Malpighi containing a manuscript history of the silk-worm, its whole life, and the anatomy of all the parts thereof, consisting of twelve folio sheets with as many microscopic draughts in folio. It was ordered that the hearty thanks of the Society be returned to the author by a letter to be drawn up by Mr. Oldenburg; and that he and Mr. Hooke be desired to peruse those papers, and to make a report thereof . . . and that the consideration of publishing them be referred to the council." As is well known, the decision was taken to print the treatise, " De Bombyce," and Lord Brouncker, the president, communicated the order to Malpighi. Hooke had found it " very curious and elaborate, *well worth printing*."

On Mar. 4, 1668/9, Marcello Malpighi was proposed by Oldenburg as an honorary member, and elected *nemine contradicente*. Oldenburg was directed to draw up a special diploma. It is scarcely necessary to say—the fact is generally known—that Malpighi never attended any meeting at Gresham College, and hence the Charter Book does not bear his signature.

A letter to Oldenburg, presented on Mar. 23, 1670/1, contained " several curious remarks on the communication between the bronchiæ and lungs in frogs, lizards, and tortoises." On Dec. 7, 1671, a manuscript was produced, sent by Malpighi, containing an abstract of his observations and considerations of the structure of plants. It was ordered that he be solemnly thanked " for his singular regard for the Society and his great care of improving natural knowledge: as also that it be signified to him that Dr. Grew had made the like attempt in his ' Anatomy of Vegetables,' lately published in English; and that the Society would be very glad to see Signor Malpighi's labours on that subject brought to that perfection which was intended by him." In the spring of 1680 the Society sent to Bologna some small microscope glasses (by Mellin) as a present. Later on, Hooke announced the welcome gift from Malpighi of his portrait " very well painted, as big as the life." A letter full of tribulation was received from him in 1684 mentioning the burning of his house, whereby he had lost all his *adversaria* and microscopes.

Malpighi's autobiography, and collections of many important contributions to the anatomy of plants and discoveries in physiology, were published in London in 1696, under the auspices of the Royal Society. In 1897, Malpighi's native town, Crevalcore, marked the bicentenary of his death (1894) by a festival of homage, when a bronze statue of the philosopher, erected in the market place, was unveiled. A memorial volume was issued afterwards, containing appreciations by Virchow, Weiss, Haeckel, Kölliker, and others.

This brief notice, written for remembrance' sake, may fitly close, as it began, with words written long ago in this journal by Sir Michael Foster—" To look across two centuries at a great man, struggling with the beginnings of problems which have since come down to us, some in part solved, but others with their solutions put still further off by the very increase of knowledge, is a useful lesson to every one of us. In any case the great men who in the past opened up for us paths of inquiry . . . ought not to remain mere names known to us chiefly through being attached to some structure or to some piece of apparatus. We ought all of us to be able to form some idea of what they were and what they thought." T. E. JAMES.

Geophysical Prospecting.

By Prof. A. S. EVE, F.R.S., McGill University, Montreal.

" Here we are on Tom Tiddler's ground
Picking up gold and silver."
—*Song of an Old Game.*

AN eminent geologist has said that " the best way to find out what is under the ground is to bore a hole in it." Truly the diamond drill is the miner's best friend in exploration, presenting samples of successive layers for him to worry over with the geologist ; but drilling is an expensive game and the world is wide, so that some guidance is necessary as to where to bore the next hole.

Until quite recently the chief aids to exploration were (1) the divining rod, known in the U.S.A. as the ' doodle bug,' not now used by any mining engineer of repute ; (2) magnetic surveys, whereby can be found magnetic ores, such as magnetite or pyrrhotite, but ineffective for non-magnetic ores such as pyrites ; and (3) the intelligent applications of geological principles.

To-day, however, there is much more assistance available, new in type, and varied in character. Just as invisible and submerged submarine boats may be detected from the surface of the sea by some physical dissimilarity between the boat and its surrounding medium of sea water, so also ore bodies of fair magnitude can be detected by the wise appreciation of some inherent property different in the ore from the surrounding medium of rocks. Oil has not yet been detected by direct methods ; the search has been rather for folds below the ground or for salt domes, where the oil tends to collect in paying quantities.

Now the chief methods of ore hunting, which is a good sport, are these : (1) Electrochemical detection ; (2) electrical, tracing the equipotential lines between earthed conductors using direct or alternating current ; (3) magnetic methods, as heretofore ; (4) electromagnetic detection with direction-finding coils, not unlike direction-finding by ships at sea, only here the ore body must be stimulated by alternating currents flowing in horizontal or vertical loops, using audio or radio frequency. This is the hunt for an electrical echo.

In the search for oil the procedure is usually quite different, and this fact is evidence of the great flexibility of geophysical operations in the field. The chief methods for oil hunting are : (1) Seismic, using an artificial explosion and a seismograph a few miles away to detect the first swift message of the uproar, travelling by a route far down below the earth's surface ; (2) gravitational, using that most exquisite and sensitive apparatus, an Eötvös torsion balance ; (3) magnetic, where disseminated magnetite makes such search possible ; (4) electrical, just as for ore bodies, but on a larger scale. So far, no certain information as to the success of this last method over oil fields is available.

Many of these methods have been already well tested over ' proving grounds ' above known ore bodies, so that to some extent their rival merits are

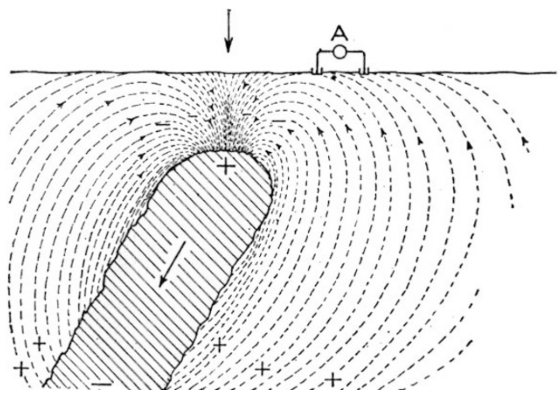

FIG. 1.—Diagram illustrating a sulphide ore body acting as a battery while being oxidised above by rain and surface water. Current lines are dotted and the galvanometer and two detecting electrodes are shown at *A*.

known to the initiated, while on the other hand many mine managers and engineers are puzzled to distinguish between those schemes which rest on a sound scientific basis, and other plans which may be termed psychological, fraudulent or subconscious methods, based on the mystical or unknown, sometimes worthy of study, but with a balanced scepticism.

Sulphide ore bodies are slowly oxidised by surface and rain water, so that the mass acts as a large battery with the negative electrode the higher, so that currents flow towards this upper region from below (Fig. 1). The current can be