

Metchnikoff

Ilija Ilich Mechnikov, who in later life became universally known as Elie Metchnikoff, was born in the province of Kharkov, Little Russia, on 16 May, 1845. Even before he entered the lycee at Kharkov his interest in physiology and zoology had already been stimulated and after graduation from the University (in that city) he went on to further studies in Germany. Awarded a travelling studentship by the Russian Ministry of Public Instruction he extended his German experience and went on to the Marine Biological Laboratory at Naples where Ernest Haeckel had already (1860) observed the wandering cells of the body fluids of several marine invertebrates.¹ In 1867, Mechnikov returned to Russia to lecture at the new University of Odessa; soon afterwards he was appointed professor of zoology at St. Petersburg; in 1868, in 1879 and again in 1882 he visited Messina in Sicily.

Mechnikov brought his interest in the development of the digestive tube and his microscope with him. By injecting carmine into starfish larvae he was able to watch, hour by hour, “intracellular digestion” by the wandering “amoeboid” cells. The fact that carmine was not a nutrient rankled in his mind and he later recalled² how in the bliss of solitude a new thought flashed across his inner eye in Messina in 1882:

‘One day when the whole family had gone to a circus to see some extraordinary performing apes, I remained alone with my microscope, observing the motile cells, when ... it struck me that similar cells might serve in the defence of the organism against intruders (Agitated) I said to myself that, if my supposition was true, a splinter introduced into the body of a starfish larva, devoid of blood vessels or of a nervous system, should soon be surrounded by motile cells as is to be observed in a man who runs a splinter into his finger. This was no sooner said than done

I fetched a few rose thorns and introduced them under the skin of some beautiful starfish larvae as transparent as water.

I was too excited to sleep that night in the expectation of the result of my experiment, and very early the next morning I ascertained that it had fully succeeded.

That experiment formed the basis of the phagocytic theory, on the development of which I devoted the next twenty-five years of my life.³

It was in Vienna on his return journey to Russia that the Greek “phagocyte” for eating or devouring cell was suggested as the name for these wandering cells.

In 1884, Mechnikov described “den Kampf der Phagocyten gegen Krankheitserreger”, the struggle of phagocytes against agents of disease, first in the protection of *Daphnia*, the water flea, against fungal spores³ and later in the ability of mammalian leucocytes — a crucial extension — to engulf and digest anthrax bacilli⁴.

Two years later, Mechnikov was appointed director of the Bacteriological Institute in Odessa but in 1887 he visited Louis Pasteur in Paris and asked for a post in the new Institute. Appointed sub-director, with responsibility for microscopic anatomy, he settled in Paris, and began in Francophile fashion to call himself Elie Metchnikoff. The discovery and success of antitoxins had greatly fortified the humoral theory of immunity and the defence of the cellular theory now became a full-time task, but one not beyond the powers of its formidable protagonist, who early on recognised that the two processes were complementary. His *Immunity in Infectious Diseases*, first published in French (1901), was soon translated into German, Russian and English and in 1908 he shared the Nobel Prize with Paul Ehrlich. Full of years and honours he died in Paris on 15 July 1916.

Metchnikoff⁵ distinguished clearly between natural and acquired immunity and between microphages (polymorphs) and macrophages:

polymorphs are first on the scene and later macrophages surround the “battlefield” protecting normal from invaded tissue by a barrier against the spread of inflammation. His observation that antibody activity was much greater in liquids rich in macrophages (e.g. peritoneal fluid) led him to believe that antibodies were produced by macrophages. Although he selected the wrong cell, he was the first to recognise the cellular origin of antibodies and fifty years were to elapse before it was recognised that macrophages process or present the antigen to antibody-forming lymphocyte precursors.

C. S. BREATHNACH

References

- 1 Haeckel E. Die Radiolarien. Berlin: Georg Reimer, 1862.
- 2 Metchnikoff O. Life of Elie Metchnikoff. Boston: Houghton Mifflin Co, 1921. (translation from French).
- 3 Metchnikoff E. Ueber eine Sporosspiizkrankheit der Daphnien. Virchows Archiv 1884; 96: 177-95.
- 4 Metchnikoff E. Ueber die Beziehung der Phagocyten zu Milzbrandbacillen. Virchows Archiv 1884; 97: 502-526.
- 5 Metchnikoff E. Die Lebre von den Phagocyten und deren experimentellen Gruendlagen. In: Kolle W and von Wasserman A eds. Handbuch der pathologischen Organismen. Jena: 1913.