

## Jules Bordet: immunologist, bacteriologist and Nobel Prize winner

This year marks the 150th anniversary of the birth of Jules Jean Baptiste Vincent Bordet, to give him his full name, the Belgian immunologist and bacteriologist.

Bordet's discoveries relating to the fields of immunology and bacteriology were rewarded by his election as foreign member of the Royal Society, while he was working in German-occupied Brussels in 1916 and the award of the Nobel Prize in physiology and medicine in 1919.

Jules Bordet was born in 1870 in Soignies, a small town some 25 miles from Brussels, where his father was a school master. Four years later, the family moved to Brussels. As a schoolboy, Bordet was especially interested in chemistry, and set up a chemical laboratory in the attic of the family home. At the early age of 16 years, he entered the University of Brussels to study medicine rather than chemistry, and qualified Doctor of Medicine in 6 years rather than the usual seven.

As a student, Bordet had already carried out some original research, for in 1892, his first year since qualification, he published a paper on the defence against phagocytosis provided by the bacterial capsule. For this piece of original work he was awarded a Belgian government travelling bursary, which took him to the Pasteur Institute in Paris, where he worked from 1894 to 1901 in the laboratory of the Russian microbiologist Elie Metchnikoff. Here, he rapidly developed a reputation as a highly gifted young investigator.

His stay was interrupted by a short period in the Transvaal in South Africa, where he was sent by the Institute to study the cattle disease, rinderpest. There he devised a technique of immunising cattle by injecting them with small amounts of serum from convalescent animals and then exposing them to infection, so that the resultant mild attack of the disease would confer immunity.

In 1900, the University of Brussels decided to set up an 'Institut Antirabique et Bacteriologique' and offered the post of Director to the 29-year-old Bordet. This involved him in a great deal of administrative work but seemed hardly to affect his scientific output. In 1907, he was awarded the title of Professor of Bacteriology.

He continued his work in the difficult days of the German occupation of Belgium during the First World War of 1914–18.

Now to consider some important aspects of Bordet's broad palette of research. In 1895, he demonstrated that serum from immunised animals was bacteriolytic in vitro, provided the serum was fresh. If it was heated to 55°C it lost this property, which was restored by the addition of fresh normal serum, and not necessarily serum from the same animal species.

Evidently, bacteriolysis required the presence of two substances; one of these was a specific antibody, and the other a non-specific substance, now called complement, which is present in the serum of many normal animals. A remarkable discovery for a young man of 25 years.

Four years later, in 1899, he described a similar destructive process involving complement, termed haemolysis, in which foreign red blood corpuscles are lysed following exposure to immune serum.

The most brilliant and widespread use of all complement fixation tests was the Wassermann reaction for the occurrence of syphilitic infection at some time in the patient's life, which was described by August von Wassermann working in Robert Koch's laboratory in Berlin in 1906.

In 1900, Bordet's elder daughter developed whooping cough. He had observed small, Gram-negative feebly-staining colo-bacilli in the girl's sputum in the early stages of the disease but had been unable to culture them on any of the then available media. He had

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no better success with subsequent cases until 1906, when his son developed the disease. He now showed that the organism was present in vast numbers in the specimens from the early coughing bouts, but rapidly disappeared thereafter; the infected patients developing a complement-fixing antibody to the organism. Bordet then demonstrated that the organism produced an endotoxin that, in small doses, gave rise to petechial haemorrhages, dyspnoea and pleural effusions, as well as necrosis at the injection site. He also demonstrated that a killed vaccine had some effect in reducing the incidence and severity of the disease.

In 1906, in collaboration with his assistant, Octave Gengou, he isolated the organism of whooping cough, *Bordetella pertussis*, in pure culture. The following year, Bordet was promoted Professor of Bacteriology in the Université Libre de Bruxelles.

Bordet lived and worked in Brussels during the German occupation of most of the country during the First World War (1914–18). During these difficult times, news reached him in March 1916 that he had been elected a Foreign Member of the Royal Society in London, a rare and much prized honour.

In 1919, the Nobel Prize in Physiology or Medicine was awarded to him for his discoveries related to immunity.

Bordet was to live through the second occupation of Belgium during the Second World War from 1940 until liberation in 1945. He died in Brussels in 1961 at the age of 90 years. An extraordinary scientist.

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