

# Social insect histology from the nineteenth century: The magnificent pioneer sections of Charles Janet

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## Abstract

Charles Janet (1849–1932) was the leading pioneer in the histological description of the internal anatomy of social insects, in particular of ants and wasps. Because many of the original Janet sections still exist, this article is able to illustrate the amazing skills through some selected pictures taken from this more than a century old material, and thus to pay tribute to this French founder of insect morphology.

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## 1. Introduction

In the history of social insect research, the first microscopical approach dates back to Francesco Stelluti in the 17th century, who described the structures of the honeybee using Galileo's newly built microscope (Baccetti, 1986). Other microscopical descriptions of the honeybee followed within a few decades with the works by Robert Hooke and Jan Swammerdam (Cobb, 2002). The excellent work of these and other researchers was based on the precise and skilful dissection work. A new dimension in the morphological study, however, was introduced with the development of histological sectioning techniques. Today's knowledge on the internal anatomy of social insects without any doubt finds a most solid basis in the extraordinary sectioning work of Charles Janet that started at the end of the 19th century (Billen, 1994).

## 2. Janet's life and career (Berland, 1932; Casevitz-Weulersse, 1988)

Charles Janet (Fig. 1) was born in Paris on 28 June 1849. He grew up in the village of Saint-Vit near Besançon in the Doubs Department, and obtained a degree as “engineer of arts and manufactures”. From childhood, he developed a pronounced interest for insects, with ants and wasps his favourites (his brother Armand was to become a renowned lepidopterist). After a few jobs in industrial companies, he started in 1877 a life-long career at a broom factory, J. Dupont & Cie, located in Beauvais, northern France.

In 1895, he stopped his work as engineer in the factory, and became a member of the Council, which gave him more time to spend on his beloved insects. With an engineer's precision, he described the development of a hornet nest from its very beginning (Janet, 1895), and was the very first to report on the liquid food exchange between adult and larval wasps (Janet, 1895, 1903), years before the term trophallaxis was coined for the phenomenon by Wheeler (1918). His behavioural observations also made him famous for the construction of artificial plaster ant nests (Janet, 1897b), later named after him, which attracted a great deal of attention at the 1900

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Fig. 1. Charles Janet in 1899 at the age of 50 (Archives de la Société Entomologique de France).

World Exposition in Paris. We equally remember Janet for his reports on the biology of social parasites and commensals in ant nests (Janet, 1897a). In 1900, he obtained the degree of “docteur ès Sciences” at the University of Paris (Janet, 1900).

Janet’s reputation was permanently established by his high-precision descriptions of the internal structure of social insects, with special focus on ants and wasps. Among other studies, he conducted a very detailed description of the internal petiolar anatomy (Janet, 1894a), and discovered the process of histolysis of the flight muscles in founding ant queens (Janet, 1907). His detailed and precise descriptions of the exocrine system were of invaluable help for the identification of the anatomical origin when the first pheromonal substances were discovered (Wilson, 1959, 1962; Wilson and Bossert, 1963). His histological work on the exocrine system of ants, especially of *Myrmica rubra*, also included the description of some previously unknown glands, such as the antennal base gland (Janet, 1894b), the pygidial gland and the gonostylar glands (Janet, 1898a), the prothoracic gland (Janet, 1907) and, in males, the penial ring gland (Janet, 1898a). Not only the glands themselves attracted Janet’s attention, he also studied the anatomical organization of their discharge mechanism (Janet, 1898b), as usually provided with very detailed and precise accurate illustrations (Fig. 2). The accuracy of this work was confirmed by later studies that were done with far more advanced techniques and equipment (Billen, 1982; Schoeters and Billen, 1996). It is unlikely that much of the early work on pheromones could have been accomplished without Janet’s research published half a century earlier.

In 1911, his entomological work came to an end, with 64 papers published during 19 years (Casevitz-Weulersse, 1988). He remained very active in research afterwards, but turned his attention to geology. Among other distinctions, Charles Janet was President of the French Zoological Society in 1899, and became honorary member of the French

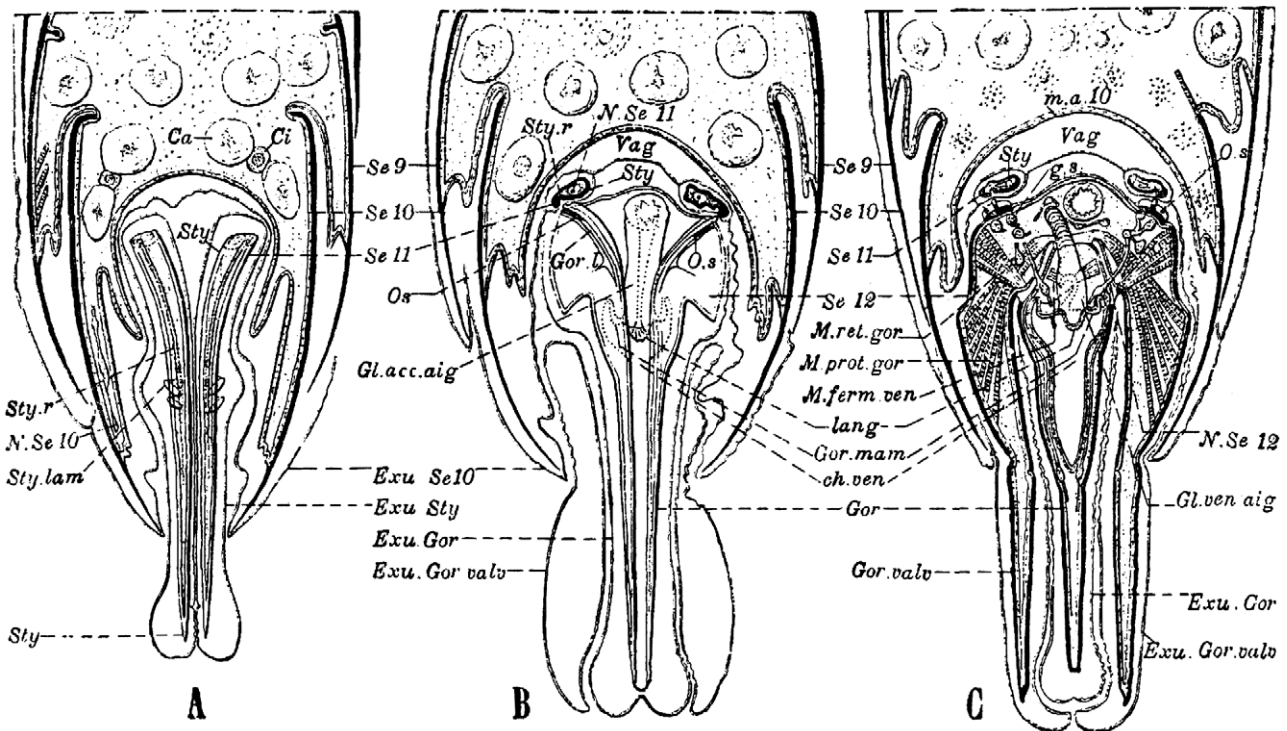


Fig. 2. Example of Janet’s detailed drawings, showing the anatomical organization in the region of the sting base of a *Myrmica rubra* worker (from Janet, 1898b).

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