Definition: **Schwann, Theodor** from *Encyclopaedia of Brewing*

A German scientist (1810–1882), a pioneering cytologist and, with the Frenchman, Charles Cagniard-Latour and fellow German, Friedrich Trautgott Kützing, is credited with the discovery of the vital nature of yeast and its role in fermentation.

**Summary Article: Schwann, Theodor Ambrose Hubert**

*From Encyclopedia of Life Sciences*

**abstract**

(1810-1882) German physiologist who established the cell as the elementary unit of living tissues and introduced new experimental methods into physiology.

**keywords**
cell theory
fermentation
pepsin
experimental physiology

Schwann (Figure 1) was born in the lower Rhine city of Neuss. His father was a goldsmith and printer whom Schwann occasionally assisted. Theodor Schwann was himself a gifted craftsman, already in his youth constructing and experimenting with electrical devices and microscopes. He was an introverted person, preoccupied with metaphysical and religious thoughts. Growing up in a religious Catholic environment he entered a Jesuit College in Cologne in 1826, intending to serve the church. He later changed his mind and in 1829 began premedical studies at the University of Bonn. One of his teachers there was the physiologist Johannes, whose influence would become crucial for Schwann's later career. After 2 years in Bonn, Schwann moved in 1831 to the University of Würzburg, where he spent 2 years and heard the lectures of the influential pathologist Johann Lukas Schoenlein. In 1833 Schwann went to Berlin to complete his medical studies. Johannes Müller had meanwhile been appointed Professor of Anatomy and Physiology at the University of Berlin and in 1834 Schwann submitted to him his doctoral dissertation, dealing with the necessity of atmospheric air for embryonic development. Müller convinced Schwann to devote himself to research and offered him a position as his assistant at the 'anatomical museum' of the university. It was there, in the very short period of 1835-1838, that Schwann arrived at most of his scientific discoveries. See also Muller, J P (Johannes)

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From the start, Schwann aimed at introducing new experimental methods into physiology. Schwann’s major accomplishment was his successful explanation of life processes in terms of causal agents, without having recourse to vital forces. At the time, practically all life scientists were still considering physiological and pathological processes as being in one way or another the manifestations of an underlying life force. Schwann believed that if one could construct the right experimental setting, it should be possible to discern specific agents for specific physiological phenomena, and to show strict causal relations between the agent and its effect. One of his first investigations, in 1835, was an attempt to discover the ‘laws of muscle activity’. For this he constructed an experimental apparatus which enabled him to measure the extent to which a frog’s muscle contracted under a given electrical stimulus. Next he managed to define (in 1836) the agent of stomach digestion - he termed it pepsin - without actually being able to observe it or identify it chemically. Similarly he was able to show, in 1837, that fermentation is a microbiological process brought about by yeast and that putrefaction, too, is brought about by living microscopic organisms (then termed ‘infusoria’). This he did by demonstrating that when vessels containing organic infusions were first heated and then provided only with preheated air, no putrefaction took place and no microorganisms appeared in the infusion. From this he concluded that the agents of putrefaction were germs (‘Keime’) of microscopic organisms. This last discovery was of utmost importance, as putrefaction was assumed at the time to be a spontaneous process, i.e. the decomposition of organic bodies in the absence of the life force. By redefining this process, Schwann practically banished the life force from physiology. Furthermore, Schwann’s experiment was a major blow to the then widely held belief in spontaneous generation. See also Bacterial Fermentation

Although the cellular structure of plant tissues was quite an established fact at the time, no clear view prevailed as to the microscopical structure of animal tissues. In October 1837, over lunch, Schwann was informed by the botanist Matthias Schleiden about his latest investigations into the development of plant cells. Inspired by these ideas, Schwann attempted a similar endeavour for animal tissues. In the treatise Microscopical Researches into the Accordance in the Structure and Growth of Animals and
Plants (1839), Schwann was able to show how the cellular scheme fitted a whole series of animal tissues, including the connective tissue, nerves, muscles, the feather of the raven and the ovum. For Schwann, cells were not only structural units, but first and foremost the manifestation of force-exerting agents. Thus Schwann believed that cells are generated out of an amorphous generative substance - he termed it Cytoblastem. Within this substance the nuclei were assumed to form, and around the nuclei the cells, in turn, were supposed to build up. Thus in Schwann's theory cell formation is a process akin to crystallization; the recognition of division as the sole way of cell proliferation had to await the work of Rudolf Virchow and Robert Remak, some two decades later. It is important to note that Schwann assumed cells to be the units not only of tissue formation, but also of tissue nutrition. Schwann introduced the concept (and terminology) of 'metabolic processes' and attributed a 'metabolic force' to the cell, thus making cells into the chief agents of physiological processes. See also History of Cell Biology, Schleiden, Matthias Jacob, Virchow, Rudolf Carl, and Remak, Robert

Schwann's work had an immediate impact on the development of microscopical anatomy, and his physiological methodology had a direct influence on the younger generation of Johannes Müller's disciples - notably on Herman Helmholtz and Emil Du Bois-Reymond. See also Du Bois-Reymond, Emil Heinrich

Immediately after publishing his work on cells, Schwann moved to Belgium, where he was offered a position at the Catholic University of Louvain. This was, in fact, also the end of his scientific career. In 1849 Schwann was appointed Professor of Anatomy at the University of Liege, where he stayed until his retirement in 1879. An active teacher in both Belgian universities, Schwann hardly pursued further research in that period. In his later years he became more and more obsessed with religion, and wrote several metaphysical works which were never published. He also remained a passionate craftsman and devoted much time and effort to the design and construction of a portable respiratory apparatus. Schwann remained a bachelor throughout his life.

Further Reading


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