

Hartog Jacob Hamburger Grand Dutch Physiologist

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Short title: Hartog Jacob Hamburger

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Introduction

In the middle of the 19th century physiology in the Netherlands reawakened after about one century of 'consolidation' (see ref. Lindeboom). At the then 4 Dutch universities professors of physiology were nominated and new physiological laboratories were opened. This revival resulted in high quality physiology teaching and research with a number of well-known professors. Physiology grew in quality and, by the end of the nineteenth century the third generation of Dutch physiologists was of international renown. The two best known professors around the turn of the twentieth century were Willem Einthoven in Leiden and Hartog Jacob Hamburger in Groningen, who both received their degree in Utrecht under F.C. Donders the first professor of physiology (nominated in 1847). Because so much has been written about Einthoven, I have chosen to pay attention to Hamburger as great Dutch physiologist with his chair in Groningen. I will introduce his two predecessors in Groningen first, than pay full attention to Hamburger and end with a few short remarks on his successor. Thus my review spans the period between 1851 and 1946.

Predecessors

Izaak VAN DEEN. Van Deen (1805-1869), was the son of Abraham Tiktin Izaäksen, and was born in Germany. The family soon moved to Copenhagen, where Izaak went to school, and also attended medical school in Copenhagen (medical degree in 1831). Subsequently the family moved to Groningen where his father became Chief Rabbi. This Danish background explains his name giving (van Deen means from Denmark). To obtain a medical license in the Netherlands he got his doctorate in Leiden in 1834 with a thesis on the nervous system.

While working in Zwolle, the Netherlands, he continued his experimental physiological work and published about the nervous system ¹. In 1851 he became professor extraordinarius in Groningen and ordinarius (chair and full professor) in 1857. He had to teach Physiology, Pharmacognosy, Pharmacodynamics, and Dietetics and gave special lectures on the nervous system, his main research interest. In 1866 he moved to a new laboratory for Physiology, and died in 1869.

1. van Deen I. *Over de voorste en achterste strengen van het ruggemerg. Tijdschrift van Natuurlijke geschiedenis en physiologie.* V, 1838-'39, 151-86, reprinted in *Opusc.* IV, 341-62.

Dirk (Derk) HUIZINGA. Huizinga (1840 - 1903) was born in Den Burg (island of Texel, North Holland) on October 16, 1840. He studied theology, medicine, and mathematics and physics, at the University of Groningen, and obtained his doctorate in science in 1867 with a dissertation entitled: *Enige opmerkingen over ozon* ("Some remarks about ozone").

In 1866 he became a teacher at a high school in Groningen and assisted Professor van Deen in performing research in physiological chemistry. He became professor of physiology at the University of Groningen, as successor of Professor van Deen in 1870,

and his inaugural lecture was entitled: *Over de ontwikkeling der nieuwere fysiologie* (“About developments of the newer physiology”). A large part of his work was published in the literary-oriented journal *De Gids* (“The Guide”). He also wrote about subjects like: *Een en ander over voeding* (“Some aspects about nutrition”), *Schetsen uit het leven* (“Images from life”) and books for grade school pupils. Many of his books were translated into German. He received an honorary doctorate from Leiden University in 1875, at the occasion of the 300th anniversary of that university. He retired for health reasons in 1901 and died in 1903. He was, in 1901, succeeded by Professor H.J. Hamburger. He was the father of the famous historian Johan Huizinga.

Hartog Jacob HAMBURGER (1859-1924)

Hartog Jacob Hamburgers was born in Alkmaar in the province of North Holland, on March 9, 1859 as son of David Hamburger and Rebecka Nias. Hamburger went to secondary school (called HBS) in Alkmaar, where he received his diploma in 1877. This secondary school type did, in contrast to graduates of the gymnasium (Latin school), not allow entrance to the university. He therefore studied two extra years to obtain a certificate that allowed him to attend university. In that period he already performed chemical experiments under J. Boeke director of his secondary school.

He started his studies in chemistry at the University of Utrecht in 1879 and defended his doctoral dissertation in science in an exceptionally short period, namely on June 4 1883. The dissertation was entitled: *De quantitative bepaling van ureum in urine* (“The quantitative determination of ureum in urine”). During the last two years of his study in chemistry he worked as an assistant to Professor F.C. Donders. It seems logical therefore that he started his medical education after obtaining his degree in chemistry. While working under Donders he wrote his dissertation in medicine and defended it on July 8, 1888. The dissertation was entitled *Staaftjesrood in monochromatisch licht* (“Rods-red in monochromatic light”). In 1889 he received his medical license.

He married Regina Cohen Gosschalk on April 1 1891, and they had two children, a boy and a girl.

In January 1888, the year of the defense of his medical dissertation, Hamburger succeeded H. Zwaardemaker as ‘teacher’ in physiology, histology, and general pathology and practical microscopy at the Rijksveeartsenijkundige School (State Veterinary School) at Utrecht. There he already earlier started a new direction in physiology, namely the physical chemistry approach. He proposed, in 1883, that osmosis, already known to exist in plant cells, also is present in mammalian cells and that both ‘types’ of osmoses are based on the same physico-chemical principles.

The general, main theme, of his research that always remained the leading direction in his whole carrier, was

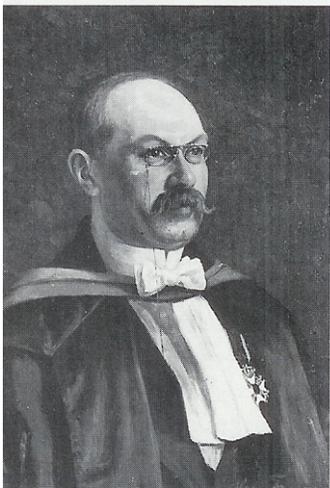


that physico-chemical principles play an important role in physiology and thereby also in medicine.

In 1892, at the second international physiological congress at Liege in 1892, he demonstrated that 'the law of isotony' plays a role in physiology, thereby convincingly showing the important role of the physico-chemical approach in physiology.

Hamburger had a heavy teaching load at the Veterinary School but yet he found time for research. He studied the effect the respiration on the size of the red blood cells, the origin of the lymph, resorption in the intestinal tract, and permeability of mammalian cells for anions. He was the first to describe his discovery of ion shift, namely that at high blood CO₂, chloride ions move from the plasma to the red blood cells. This is the so-called Hamburger shift of the blood. This theorem is not mentioned anymore as "Hamburger shift" in modern textbooks of physiology.

He also studied comparative pathology. While still at the veterinary school at Utrecht he started to work on his three volume book: *Osmotischer Druck und Ionenlehre in den medicinischen Wissenschaften*: ("Osmotic pressure and ion theory in medical sciences") (Wiesbaden, 1902-1904).



In 1901 Hamburger assumed the position of full professor ('ordinarius') of physiology and histology, at Groningen University as the successor of D. Huizinga. He presented his inaugural lecture, entitled *De physische scheikunde in hare beteekenis voor de geneeskundige wetenschappen* ("The physical chemistry in its role for medical sciences") on September 28 1901.

While at Groningen university he continued his research and studied fagocytosis and published this work in the book entitled *Physikalisch-chemische Untersuchungen über Phagozyten* (Wiesbaden, 1912). He also continued his research on what then became known as vital permeability, i.e., permeability changes of the cell membrane as

determined by the physiological condition (Hamburger shift) and this subsequently lead to further research on the permeability of the membrane of the glomerulus for glucose. Many of his pupils became professor: E. Laqueur, I. Snapper, W. Radsma, J. de Haan, R. Brinkman, S. van Creveld and E. Brouwer.

In 1911 he opened his new physiological laboratory, replacing the one built by van Deen in 1866. This laboratory was, for many years, considered as an example of modern research laboratories.

In 1913 he organized the 9th International Congress of Physiology at Groningen. In this context it is of interest to mention that the 1st Int Congress of Physiology was held at Basle, in 1889 and that the frequency of these meetings was less than every other year. Also the International Union of Physiological Societies, IUPS, did not yet

exist. The IUPS started only in 1953, and Professor Duyff head of Physiology at Leiden organized the 22nd IUPS (counting seems arbitrary here) meeting in Leiden in 1962.

National and international recognition of his research, while still at Utrecht, began around 1896. In that year he became member of the Koninklijke Nederlandse Akademie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences). He received honorary doctorates from the University of Aberdeen (Scotland, 1906), the Veterinary School (Utrecht, 1921) and the University of Padua (Italy, 1922). In 1908 he received, in memory of the 25th anniversary of his doctorate in chemistry, an international commemorative book, *Festband der biochemischen Zeitschrift, H.J. Hamburger gewidmet*, (“Commemorative volume of the biochemical journal honoring H.J. Hamburger”).

After the end of the first World War, although in poor health, he maintained the many contacts with physiologists all over the world.

Several foreign researchers joined his laboratory in Groningen. Among them was Albert von Szent-Györgyi who worked in the laboratory of Hamburger between 1920 and 1924, and discovered vitamin C. Unfortunately funding dried up with the death of Hamburger in 1924 and von Szent-Györgyi had to leave. Von Szent-Györgyi received the Nobel prize for physiology and medicine in 1937.

Hamburger visited the University of London in 1921, where he presented a talk entitled '*Discourse on permeability in physiology and pathology*' (*The Lancet* 99 (1921) II, 1039-1045). In 1922 he visited the United States of America for a series of lectures (14), three among them in the context of the so-called Charles E. Dohme Memorial Lectureship, entitled '*The increasing significance of permeability problems for the biological and medical sciences*' (*Bulletin of The Johns Hopkins Hospital* 34 (1923) 173-181). These lectures consisted of an overview of the work performed in the laboratory for physiology of Groningen University.

Hamburger published many papers, both in Dutch (het Nederlands Tijdschrift voor Geneeskunde (Netherlands Journal of Medicine, established 1857), and in German. He published more than 50 articles in the Nederlands Tijdschrift voor Geneeskunde with only one paper with a co-author. The main foreign journals he published in were : Virchows Archiv, (begun in 1847), Zeitschrift für Analytische Chemie (Dr. C.R Fresenius), now Fresenius' Journal of Analytical Chemistry, started in 1861, and the Klinische Wochenschrift, started in 1864 and presently, since 1922, the Journal of Molecular Medicine. Again only a few articles had a co-author.

It is interesting to note that he did not publish in the now classical journals of physiology, namely Pflügers Archiv (now European Journal of Physiology), established in 1868, the Journal of Physiology (Lond) from 1878, and the American Journal of Physiology, established in 1898.

Hamburger was Rector Magnificus of the University of Groningen in 1914, during the 300th anniversary of the university. He presented his commemorative speech on June

30. This speech was entitled *De oude en de moderne universiteit in wetenschap en maatschappij* (“The old and modern university in science and society”). His term of Rector Magnificus ended on September 21 1914, where he presented a lecture entitled *De toenemende beteekenis der chemie voor ons geneeskundig denken en handelen* (“The increasing importance of chemistry in medical science and treatment”).

Hamburger was not only involved in science but also was interested in societal aspects. He was vice-president of the society pledging to allow graduates of the secondary school HBS to enter the university, and not only students with a gymnasium (‘latin’ school’) diploma (Hamburger spent 2 extra years to obtain the papers allowing him entrance to the university). He pleaded for special schools (Universities) of veterinary medicine and agriculture. He also advised the Dutch government on nutrition and devised a curriculum that, by means of summer classes, made teaching on hygiene, and nutrition available for pupils of vocational schools.

Hamburger was an enthusiastic teacher and students liked his interesting lectures. He was a kind person who was always willing to advise his students. Through his personal relations with the students he had great influence on them.

Thanks to his enormous energy he managed to perform high quality research while much of his time was to be spent on teaching.

Hamburger died in 1924, and was succeeded by Buytendijk.

Frederik J.J. BUYTENDIJK. Buytendijk (born in 1887) succeeded Hamburger in 1925 (until 1946). Buytendijk was much less an experimental physiologist but more inclined to philosophical anthropology. Buytendijk became Professor of Psychology at Utrecht in 1946 and subsequently at Nijmegen. He died in 1974.

RELATION WITH THE NEDERLANDSE VERENIGING VOOR FYSIOLOGIE

The Nederlandse Vereniging voor Fysiologie (“Dutch Society of Physiology”) organizes a yearly congress for the Dutch physiological community. Part of the meeting is especially set aside for the young physiologists. Also the best doctoral dissertation in physiology is awarded with the Hamburger prize. The recipient gives a 45 minute lecture on the contents of her/his dissertation.

Literature

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