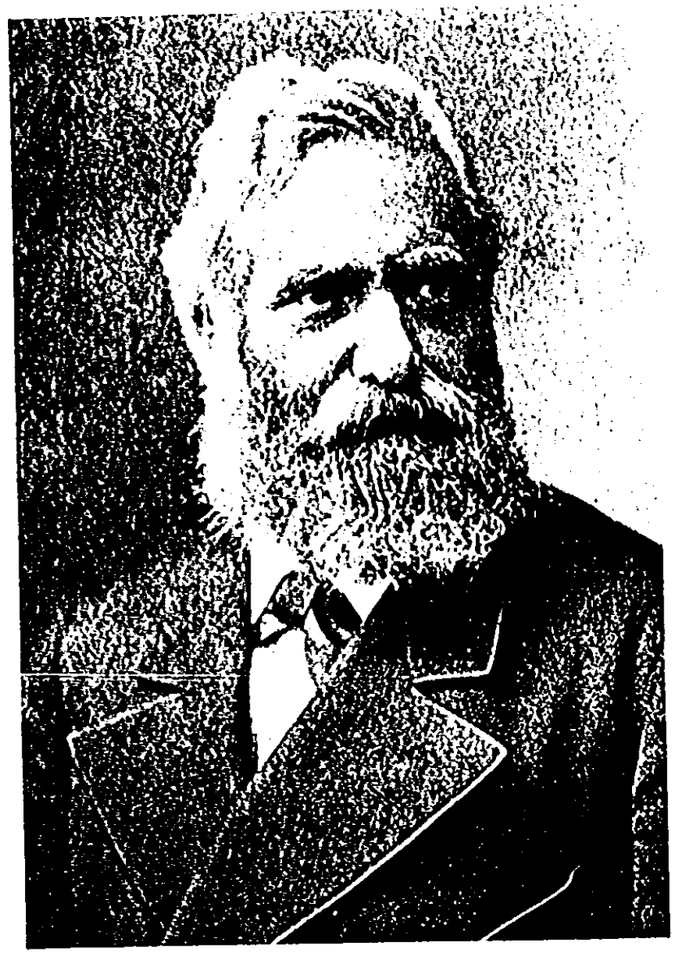

MAX VON PETTENKOFER
1818-1901

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## MAX VON PETTENKOFER, M.D.

1818-1901

FOLLOWING in the footsteps of Johann Peter Frank, whose teaching and writings had laid the foundations of the science of hygiene in Europe, there came the great pioneer of practical hygiene in Germany, Max von Pettenkofer. He was a man of strong character and personal charm, who would, no doubt, have made his mark in any profession; but by what a narrow margin he escaped being brought up as a peasant to work on the land, when his activities would have been turned in quite other directions than medicine, his early history reveals.

Born in the small village of Lichtenheim, near Neuburg, on the 8th of December 1818, just a few years before the death of Frank, Max von Pettenkofer was one of the eight children of a small farmer. His paternal grandfather had been customs official or toll-keeper in the village, and lived in the house allotted to him by the Government with its bit of ground, which he received on the union of Neuburg with Bavaria. He earned his living by the cultivation of the Danube fens, and it was a hard-working life, allowing little leisure for any kind of study. Of his four sons, the youngest, Max's father, was brought up to work the land, while his elder brothers received a more liberal education. One of them, Franz Pettenkofer, became Army Apothecary in the Russian

campaign and, in addition to making large profits while the war lasted, received, when it was over, the appointment of Court Apothecary in Munich in 1828, and lived in the official residence attached to his position. He was rich and childless, whereas his hard-working brother in Lichtenheim had little means with which to educate his family of eight except as peasants, and so the young Max, fortunately for the future of hygiene, was sent to Munich to be brought up by his uncle. He received his education at the Munich Gymnasium, obtaining a leaving certificate with distinction, and afterwards at the University. Guided by his uncle, he took up the study of the Natural Sciences, especially mineralogy and chemistry, with a view to his being apprenticed to pharmacy. And accordingly, in 1839, he became a pupil in the Royal Court Pharmacy, and was promoted within a year to the position of assistant at the remuneration of a florin a day.

So promising a beginning to his youthful career was, however, checked by the impetuousness of his sensitive nature. A quarrel with his uncle, in the course of which he received a box on the ears in the presence of other assistants in the office, caused him to throw up his post and embark upon a theatrical life at Regensburg. The stage, however, had few attractions for him; his performances met with a cold reception in the press, and after a few months, in spite of his reluctance to return to the Court Apothecary's house, he was persuaded by his cousin Helen Pettenkofer, whom he afterwards married, to come back to Munich, and in 1841 he took up his studies again at the University. He would gladly have devoted himself to chemistry and mineralogy,



but Franz Pettenkofer was anxious he should study medicine which offered a surer means of livelihood, since, by his theatrical adventures, he had, in his uncle's opinion, forfeited the chance of a post in the Court Pharmacy. Neither of them could then foresee that the young man was eventually to hold the chief appointment in this Department for over forty years. Applying himself to medicine, Max passed the examination for the apothecary's licence after the short period of two years in March 1843, and a few months later obtained his medical degree with a remarkable thesis, "Dissertation über die Micania Guaco," containing an account of a bitter substance he had extracted from the leaves of this plant, which produced a rapid pulse and profuse perspiration.

Pettenkofer now wished to study under Liebig, but was unable to get a place in the laboratory of this famous chemist at Giessen until the summer of 1844. In the meantime he went to Wurzburg. His remarkable aptitude for chemistry and physiology led him to the study of physiological chemistry, and his early work was devoted to the processes of metabolism, those chemical changes within the body associated with living matter. At Wurzburg, by the discovery of an acid in urine (hippuric acid) he established for the first time the influence of nourishment on the composition of the urine. He followed this up with an attempt to extract fat from sugar by means of sulphuric acid and gall; and although he was not successful in this, he made, in the course of carrying out the experiment, his celebrated discovery of the reaction of the violet dye upon gall, the bile-acid test, afterwards called by his name, and described by Garrison in his *History of Medicine* as one of

the earlier chemical investigations of importance to medicine. These experiments were described in Liebig's *Annual*. At Wurzburg also he began the researches, afterwards continued at Giessen, which led to the discovery of the substance called *creatine*, an organic base found in the juice of meat, hitherto unknown to chemists. This discovery made so deep an impression on Liebig, that he immediately undertook his own researches into meat, the results of which were published in 1847, and led to the production of Liebig's *Extract of Meat*. It is not generally known that Pettenkofer was the originator of this familiar food.

By his brilliant work at Giessen, Pettenkofer had won the esteem and friendship of his teachers, Liebig, Fuchs and Bischoff, and would gladly have stayed at work in the laboratory of the great chemist; but lack of means obliged him to leave what he described as this "inspiring scientific life" and to return to Munich. At Munich he approached the authorities in the hopes of obtaining an academic appointment in the University, but failing to do so, was driven to accept a post in the Mint at $1\frac{1}{2}$ florins a day. This turned him again from medicine. It was, however, a livelihood enabling him to marry, and in the end he had so adapted himself to the work in the Mint, discovering a method of treating gold chemically which proved of value in extracting the pure metal, that, when the prospect of an academic career at last presented itself, he preferred to remain in the Mint Office at a salary of 2000 florins a year and a free house. But Liebig and Fuchs, being reluctant that Science should lose so promising an investigator, intervened and, as a result of their representations



on his behalf, he was offered and accepted in 1847 the appointment of Extraordinary Professor of Pathological Chemistry in the University of Munich, a position which he held till his promotion to Ordinary Professor in 1853.

From this time onwards his energies were devoted to the cause of hygiene, and his services to science began to be publicly recognised. He was elected an Extraordinary Member of the Bavarian Academy of Sciences in 1846, a Member of the Council of Medicine in 1849, and in 1850 received the appointment of Chief of the Court Pharmacy and personal Apothecary to the Court, an office he retained till 1896.

Munich was at that time as insanitary as most large towns on the Continent, and the conditions under which its poorer population lived afforded only too good a breeding ground for the diseases which from time to time swept over Europe. Cholera had been introduced from Asia in 1831, and the year 1854 witnessed the third of the violent epidemics of this terrifying scourge. In addition, typhoid fever and typhus were continually breaking out, so that the city of Munich had little respite from either the one or the other pestilence. Pettenkofer with his boundless energy and resource was determined to trace, if it were humanly possible, these diseases to their source. At the time, Dr Snow's investigations into the sewerage systems of London and into the sources of water-supply, were meeting with considerable success in the prevention of cholera in the districts where new drainage had been introduced; and the severe epidemic of 1854 led Pettenkofer to undertake an elaborate inquiry into the supply of

drinking water in Munich in the parts of the town where cholera was most concentrated, for he believed that the water-supply was the means by which cholera and typhoid were conveyed. In the city there were several sources of supply, and by ascertaining from which source each house was served, either by means of the water-rate it paid (royal or municipal), or by personally inspecting the houses, Pettenkofer hoped to trace a connection between the water and the incidence of the disease. He failed, however, after the most careful inquiries, to prove any connection between the water distribution and the cholera cases. The same applied to his investigations into typhoid fever. He therefore concluded that in Munich, at all events, there was no ground for the belief that these diseases were due to defective drinking water.

The causes of cholera and typhoid, therefore, had to be sought elsewhere, and Pettenkofer next directed his attention to the soil and subsoil water around Munich. Extensive investigations were made; Pettenkofer-wells, by means of which the level of the subsoil water could be measured, were sunk, and records kept of the moisture in the soil at various periods including the seasons when epidemics were frequent. Pettenkofer's theory that the causative agent of cholera was nurtured in the soil when the soil contained the requisite amount of moisture for its growth, obtained a wide currency, and investigations along the same lines that he worked on in Munich were carried out by the Government of India. These researches were begun in 1856 and continued for the next twenty years. In his work entitled *Boden und Grundwasser in ihren Bezuchungen zu Cholera und Typhus*, he expounds his theory of



the development and spread of cholera and typhus according as the subsoil water rose or sank. According to this theory the necessary conditions for the spread of these diseases were, "the presence of the specific germ in the soil; a susceptible population predisposed to infection; and a soil saturated with organic matter, together with conditions of porosity affected by temperature and moisture or by the rise and fall of the ground-water." And although Pettenkofer was mistaken in the causes to which he attributed these diseases, nevertheless, the improvements made on his advice in the drainage system and the water-supply of Munich, practically rid the city of typhoid fever. In 1869, the year in which typhoid was first distinguished from other forms of fever, the death-rate in London from this disease was 34 per 100,000 inhabitants, compared with a death-rate in Munich of 149 per 100,000 inhabitants. By 1895, the death-rate in London was 14, while in Munich, where Pettenkofer had been working for forty years, it was only 3 per 100,000 inhabitants. Although the decrease in the mortality returns from this disease was ascribed in Munich to the purer water-supply from the Pettenkofer waterworks and other sources, the change was more probably due to the improvement in the drainage system. Porous cesspits, which had for centuries received the city drainage, had been replaced by order of the authorities in 1853 by those lined with cement, and thereby an immense improvement in the health conditions of the people was effected.

Pettenkofer's activities in experimental hygiene extended over a wide field. He was Chairman of the Royal Commission on Cholera in 1854, published

his first report on this subject in 1855, and another in 1857, while his investigations were continued into the ninth decade of the century. In 1856, being elected an ordinary member of the Academy of Sciences, he took his seat in that body as a chemist and not as a hygienist. 1858 saw the publication of his first strictly sanitarian work in the *Report on the Ventilation of Dwelling Houses*, and this, in an age when the importance of fresh air was held of no account, awoke public opinion to the need of reforms. In the same year he published the account of a method he devised for estimating the amount of carbon dioxide contained in air, one of his most extensively used discoveries. In 1861, in collaboration with his celebrated pupil, Voit, he was the first to estimate, by means of a specially devised respiration apparatus, the amount of proteins, fat, and carbohydrates broken down in the body, and with Voit he carried out many researches in dietetic chemistry. The hygiene of clothing, too, received his attention, and the connection of the soil around dwellings with the health of the inhabitants. To a certain extent he revived the old theory, so prevalent in Sydenham's day, of the dependence of contagion on atmospheric conditions and on the escape of poisonous gases from the ground. It was owing to Pettenkofer's powerful influence that the first Chair of Hygiene, of which he became the first occupant, was established in Munich University in 1866. He held this Chair for nearly thirty years, and during that time Munich became a centre of world-wide influence in hygiene, attracting pupils from all parts of Europe. It was his teaching which led Germany to adopt a system of medical government on scientific lines, to disinfect her towns, to supply her



people with clean drinking water, to establish Chairs of Hygiene in her universities, and to prepare the way for the great strides in sanitary science which the last quarter of the nineteenth century witnessed.

Pettenkofer's writings, like his work, dealt with every aspect of hygiene, and as this was a department new to medicine, his papers were not at first accepted by the medical journals, for, as the founder of a new branch of medicine in Germany, he encountered the opposition of his profession. To obtain the publicity he required, he founded with Voit, Buhl and Radlkofer, the *Zeitschrift für Biologie* in 1865, and continued to co-edit it till 1888. In 1882 he published with Ziemssen the *Handbuch der Hygiene*, and in 1883, with Hofmann and Forster, founded the *Archiv für Hygiene*. In these papers most of his works appeared. Being an excellent speaker, his addresses at sanitarian conferences were always listened to with deep interest. His speech was vigorous and fluent; he defended his ideas with indomitable energy and with all the conviction that his ardent belief in his teaching warranted. His influence as an authority in Hygiene was marked by the large number of distinguished men who came to hear him, not only from Germany, but also from abroad, and his genial, sociable nature made his house in Munich the meeting place of many celebrated scientists.

The erection of the magnificent Institute of Hygiene, begun in 1872 and finished in 1878, of which Pettenkofer was appointed Director, is a fitting monument to the work of this great pioneer in the city that he served so faithfully. Nothing could entice him from Munich, where his work in the cause of preventive medicine had begun. Neither

the Chair of Hygiene at the University of Vienna, which was offered to him in 1872, nor the first Directorship of the Imperial Institute of Hygiene in Berlin, where Bismarck tried to attract him in 1876, could tempt him away from Munich. His heart was with his work in that city, and he remained there as long as his physical strength lasted.

In 1883 he received the highest distinction obtainable in Prussia, the *Ordre pour le Mérite* in Science and Art, to which hereditary nobility is attached, and in 1899 he was appointed President of the Bavarian Academy of Sciences.

Although Pettenkofer lived to see the birth of the germ theory and the great advances in the science of bacteriology which were made in the eighties, he never accepted the discovery that infection was conveyed by bacteria, nor foresaw the new impulse it gave to the science of experimental hygiene. So opposed was he to the whole idea, that when Koch discovered the bacillus of cholera in 1883, Pettenkofer is said to have swallowed a culture of virulent bacilli in order to prove their harmlessness.

In 1890 he lost his wife and, when failing health obliged him to leave his work in 1894, he retired to his beautiful country home at Seeshaupt, where he could see from his garden the snow-clad Bavarian Alps, and receive his visitors whom he delighted to row over the lake. He was held in great veneration by his fellow-countrymen and by sanitarians all over the world, and many distinguished men came to see him here. But towards the end of his life, he suffered much from fits of mental depression. Death had depleted his family circle for, in addition to his wife, he lost his highly-gifted eldest son, his second son and a daughter, and



these tragic events deepened the mental gloom that enforced idleness after a crowded life had brought him. He became a prey to the thought that his mind was failing, and told his friend Voit that he would one day take his life. In January 1901, septic inflammation of the throat set in from which he only slowly recovered. The pain increased his depression of spirits; his condition seemed unbearable to him, and at the advanced age of eighty-three he ended his life with a revolver shot.

All Munich mourned the loss of one who was universally regarded with affection and esteem by reason of his long devoted service to the city.

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