4 Some relevant elements from the history of medicine

From ancient times astonishing evidence has been known of logical insights into infection routes and preventative measures to protect the well being. So, for example, round corners are found in Sumerian houses (Mesopotamia culture), in which no dirt can gather. The Indian prince Asoka declared laws for the optimal function of hospitals in the third century BC. Clothes and instruments of surgeons had to be boiled out and put away cleanly and the surgeons must speak as little as possible during an operation.

After this classic antiquity, a regression is seen in the insights and technology in our regions. The medieval period can be considered as a standstill, or even deterioration in medical matters. Gradually Western Europe gets into contact with the main stream of medical thinking. Even the classic medical sources were rediscovered again through Arabic and Jewish medicine.

The ever more intensive contacts of (in the past rather isolated) Western Europe with the rest of the world also gives the pathogens new chances; Europe had probably already been a few times introduced to the plague, but it really became pandemic in the fourteenth century**.**

From 1346 on the disease spread rapidly over the area around the Mediterranean Sea. Italy received the full blow in 1348. For the next few years it is the turn of our country (however in lesser extent) and the rest of North West Europe. Everyone was busy with the search of the cause, or with preventive measures, such as running away**.** A quarter of the population was killed; one of three persons living in regions where the plague was prevalent.

Descriptions from that time tell accurately the level of knowledge e about the epidemiology of infectious diseases. Although the style of argumentation is sometimes reasonable, it can still be said that efficient insights were rarely brought up. Bits of the description of the plague in Firenze (Florence) by no less than Giovanni de Boccacio in the Introduction to his Decamerone (1352) follow below:

The Pestilence in Florence 1348

…… No human wisdom or foresight had any value: enormous amounts of refuse and manure were removed from the city by appointed officials, the sick were barred from entering the city, and many instructions were given to preserve health; …..

…… Because of all these things, and many others that were similar or even worse, diverse fears and imaginings were born in those left alive, and all of them took recourse to the most cruel precaution: to avoid and run away from the sick and their things; by doing this, each person believed they could preserve their health. Others were of the opinion that they should live moderately and guard against all excess; by this means they would avoid infection. Having withdrawn, living separate from everybody else, they settled down and locked themselves in, where no sick person or any other living person could come, ……

…… One citizen avoided another, everybody neglected their neighbours and rarely or never visited their parents and relatives unless from a distance; the ordeal had so withered the hearts of men and women that brother abandoned brother, and the uncle abandoned his nephew and the sister her brother and many times, wives abandoned their husbands, and, what is even more incredible and cruel, mothers and fathers abandoned their children and would refuse to visit them…..

…… And there were some men and women of such vulgar mind, that most of them were not accustomed to service, and did nothing other than serve things whenever the sick person asked and watch while they died; and the wages of this service was often death……

Intro to Decamerone (1352)

In the mediaeval times and still far into the nineteenth century, the living conditions and the ecological circumstances in cities were often pitiful. The authorities didn't turn a blind eye to that and began to introduce rules, sanctions and punishments. A few passages from the legal books of the town of Haarlem follow below:

From shortly before 1500 an epidemic of syphilis (lues) started raging in Europe, probably directly imported by Columbus after his first trip to America (1492-3). There WAS heavy speculation of the origin and nature of the disease**;** one gave names to the disease of countries with which they lived at odds or were at war with. Mentioned are: English/French/Spanish/Neapolitan.

Van vercken bi der straten te gaen.

Item so wie vercken bi der straten laet gaen, sel gelden van elken verken II scellinge, uutgeset beren of sogen, die moghen geringhet op die strate gaen sonder verboernisse; diet an brengt sel hebben een derdendel van der boete (Keurboek van 8 april 1390).

Van die miss of slijc in die Spaerne

Item so wie mische, slic, vegelquaet of desgelijcs in die Spaerne of in die grafften of beke droege (dede) bi dage, verboert tien scellinge ende een dusent stiens ende diet bi nachte dede, verboert een pont ende twie dusent stiens (Keurboek van 8 april 1390) (Source: Hui11).

Smells

Only castles and monasteries had proper drains. Dung heaps in towns were a continual cause of complaint and Edward III said that York stank worse than any town he knew. Butchers, poulterers, in Winchester and London, fishmongers in Chester, and cooks in Southampton fouled the streets with animal refuse. The water used by seven dyers of Nottingham stank (1395). The fumes of coal caused repeated complaints in London (1307 and 1371) and drove Queen Eleanor from Nottingham Castle in 1257. Town authorities did their best, and at least the countryside was nearer and the crowded acres of town fewer than they were in the first half of the nineteenth century. In the home the smell of onions and garlic would have been more often apparent than now. The first Sanitation act, in 1388, forbade river pollution.

Liber Albus (The White Book of the City of London 1419)

Titles of the chapters:

That the Streets and Lanes shall be cleansed of all impediment from dung and chips, and of all other impediment…

That no Stall shall be more than two feet and a half in breadth, and that it shall be moveable and flexible.

That all Streets and Lanes leading towards the Thames from the King's Highways shall be kept clean.

That no one shall throw dung into the King's Highway, or before the house of his neighbour.

That each person shall make clean of filth the front of his house, under penalty of half a mark.

That chips founds in the street shall be at the disposal of the Alderman.

That Penthouses that are too low shall be removed.

Ordinance that no dung shall lie in the Streets and Lanes of the City.

That Penthouses, Gutters, and Jettees shall be so high that folks can ride beneath them, and at least nine feet in height.

That no Hoards, Palings, or Steps to Cellars, shall be made in the streets, without view of the Mayor aqnd Aldermen.

That all who have dung, chips, or other refuse before their doors, shall remove the same.

That no Officer shall take [for city purposes] a cart that serves for carrying such refuse…

That the Scavagers shall have power to survey the Pavements and that all filth in the Streets shall be removed.

Etc. Etc.

(Source: W.O. Hassall: How they lived. Oxford: Blackwell, 1962)

Disease or Pocks. An Italian monk and doctor, Fracastoro, had a theory in which an infective agent, transmitted directly from human to human, explains the epidemic. He brought this to the general public by writing a play about a shepherd-boy that gets seduced and gets the disease. Syphilis is his name. This, at the beginning of the Renaissance, was the first logical argument of an infectious disease.

About three hundred and twenty-five years ago, on the 6th of September 1674 and the 9TH OF October 1676, Anthoni van Leeuwenhoek wrote to the Royal Society in London of his discovery of bacteria and many more letters followed. The water of the canals in Delft and in the lakes around Delft were swarming with these animal species ('74). He also found them in pepper water ('76). This discovery followed from an investigation to find out whether the sharpness of pepper is caused by little ends that prick into the tongue and intestine.

Nobody, not even Van Leeuwenhoek, dared to connect these animals to illness. He who tries to place himself in the medical science of that time, will understand that something like that would have been considered as childish fantasies.

Waterbloei in de Berkelse Plassen bij Delft
"..... dese voorverhaelde diertgens bestonden uijt verscheijde couleuren, als eenige wit-achtigh ende doorschijnende, andere uijt groene seer glinsterende schibbetgens, andere weder int midden groen en voor en achter wit .... en ik oordele dat eenige van dese diert-gens meer als duijsentmael kleijnder waren als de kleijnste diertgens die ick tot noch toe op de korst van de kaes, int tarwenmeel, in de schimmel, ende etc. heb gesien."
(9 september 1674; brief no. 6)

Bacterien in tandslijm
"Wat mij belangt ik oordeel van mijn selven (hoewel ik myn mont soo reynig als ik hier-voren heb verhaalt) datter soveel menschen niet leven in onse vereenigde Nederlanden, als ik heden levende dieren in myn mont draag .... ik imagineerde wel 1000 levende dier-kens te sien in een quantiteyt materie die niet groter was als een honderste part van een santgroote."
(17 september 1683; brief no. 36)

This was still the case in the first half of the nineteenth century (1800-1850).
The medical scientists of the time deducted from miasma theories the explanation of epidemics of infectious illnesses. Miasma (conditions predisposing for infections) was linked to the position of the stars and planets, ground water level, evaporations of swamps, decomposing matter and things like that.

In 1850 The Epidemiological Society was set up in London, to study the distribution and patterns of diseases**.** It was not known whether certain diseases are contagious or not. Now we might think that this lack of insight was a testimony of stupidity, but we do thank our present insights from this kind of investigators. It is a remarkably difficult process to find out whether a widely spread disease, either suddenly occurring or not, is caused by food, toxic

compounds, climatologic circumstances, or microbes. In 1854, the London Doctor John Snow published his findings on a London cholera epidemic, during which within 10 days there were more then 500 fatal cases. He observed that nearly all of the patients around Broad Street used water from one and the same pump. The water – he argued - must contain the infecting agent. The brave epidemiologist insisted that the swindle be removed from the pump. Thirty years later Robert Koch, who travelled to Egypt and India to find the causal bacterium, microbiologically confirmed Snow's infecting agent theory.

From John Snow's "The Cholera near Golden Square" (1854):
"…… I suspected some contamination of the water of the much-frequented street-pump in Broad Street, near the end of Cambridge Street; but on examining the water, on the evening of the 3rd September, I found so little impurity in it of an organic nature, that I hesitated to come to a conclusion……"
"…… On proceeding to the spot, I found that nearly all the deaths had taken place within a short distance of the pump. There were only ten deaths in houses situated decidedly nearer to another street pump. In five of these cases the families of the deceased persons informed me that they always sent to the pump in Broad Street, as they preferred the water to that of the pump which was nearer……"
"……We must conclude from this outbreak that the quantity of morbid matter which is sufficient to produce cholera is inconceivably small,……"

Around the same time, a Hungarian doctor, Ignac Semmelweis, working in Vienna at the end of the forties, investigated the cause of puerperal fever. He discovered that there must be an infection that is transmitted by the hands of medical students and doctors to women during childbirth, which is coming from other child bearing women or from their mortal remains in the dissecting room. In that time it is common that one out of ten women and also a certain percentage of newborn died from this fever, especially when "care" had been given in a hospital.

The insights of Semmelweis were considered by most of the doctors as nonsense; they felt impugned in their abilities. In The Netherlands his remedy of thoroughly washing hands with a chloride acid dilution, was only imported half way through the eighties of the 19th century.

The German Robert Koch and the Frenchman Louis Pasteur are the founders of (medical) microbiology. Characteristically, when founding this discipline neither of them was part of the medical establishment of their time. Koch was a rural doctor from Pommern, who loved everything with microscopes. The microscopes had been much improved since Van Leeuwenhoek's time, and plenty of small 'animals' were seen. But a self respected doctor could not connect these to disease; such would have provided him with howls of derision from his highly placed colleagues. Koch for one, found the bacterium causing anthrax and proved experimentally its role in the feared illness. His fame was established by his discovery of the tubercle bacterium and his proof of its cause of the terrible 'consumption' (Morbus Koch).

Louis Pasteur was originally a chemical engineer. We now would call him a biochemist. His first investigations were on crystallization processes, from which he learned to use the microscope. After that he solved two big problems: infectious diseases in the silk worms of Lyon, and the quality problems with French beers, which made him convinced of the importance of micro-organisms. He as well performed research in anthrax, besides studies in rabies. He even succeeded in making vaccines against these diseases. The last one was an anti-virus vaccine (just like the one against the smallpox, that already existed in the eighteenth century), although no one had ever seen viruses.

Pasteur pressed to apply his rabies vaccine sooner than scheduled

But the press of events made him act sooner. On July 6, 1886, 9 year old Joseph Meister and his mother appeared at Pasteur's laboratory. Two days earlier the young boy had been bitten repeatedly by a rabid dog. He was so badly mauled that he could hardly walk. His mother appealed to Pasteur to treat her son. At the time Pasteur had treated about 40 dogs, most of which resisted rabies. Could he risk treating this youth who faced certain death? Pasteur, after consultation with physician colleagues, and much trepidation treated the youth. Despite Pasteur's fears, Meister made a perfect recovery and remained in fine health for the remainder of his life.

A few months later a second victim turned up. He was a young shepherd also bitten by a mad dog. Following reports of his successful treatments, the wild acclaim for Pasteur knew no bounds! Victims of dog and wolf bites from France, Russia, the United States poured into his laboratory for treatment. The newspapers and public followed these treatments and cures with intense interest. Pasteur became a hero and a legend. The Pasteur Institute funded by public and governmental subscriptions was built in Paris initially to treat victims of rabies who were coming to Pasteur's laboratory in increasing numbers.

In a tragic footnote to history, Joseph Meister, the first person publicly to receive the rabies vaccine, returned to the Pasteur Institute as an employee where he served for many years as Gatekeeper. In May 1940, 55 years after his treatment for rabies that made medical history, he was ordered by the German occupiers of Paris to open Pasteur's crypt. Rather than comply, Joseph Meister committed suicide!

These successes led to a great series of microbiological discoveries. Microbiology became so dominant that the doctors in their euphoria suspected a microbial cause behind every disease. This is why beri-beri (disease from vitamin B-deficiency) was long thought to be caused by a “beri-beri bacillus”. The medical biology further incorporated the words ‘epidemiology’ and ‘epidemic’. These however – which I repeat explicitly - do include non-infectious diseases as well.

Table: Some discoveries in the field of microbiology that were and are of interest for sanitary engineers. The larger organisms were identified first.

Year	Investigator	Causak organism	Disease
1852	Theodor Bilharz/ Cairo	Schistosoma (species)	* bilharzia * (schistosomiasis)
1875	Friedrich Loesch/ Berlin	Entamoeba histolytica	* amoebiasis *
1877	Patrick Manson/ London	Filaria bancrofti	* filariasis *
1880	Alphonse Laveran/ Paris	Plasmodium (species)	* malaria *
1880	Carl Joseph Ebert/ Zürich	Salmonella typhi	* typhoid *
1884	Robert Koch/ Berlin	Vibrio cholerae	* cholera *
1898	Kiyoshi Shiga/ Berlin (?)	Shigella (species)	* (bacillary) dysenteria *
1903	William Leishman/ Netly	Leishmania (species)	leishmaniasis (kala azar)

There were doctors who pleaded for public (general) hygiene before the scores of microbiological pathogens were known. Without knowing the exact causes of infectious diseases they suggested (like the Indian, Greek and Arabic medicine before them), that hygiene had a strong influence on the health of the individual and of a group. Hygienic insights lead to the introduction of facilities and the implementation of a healthy life style. They pleaded for good drinking water and sewage systems for the removal of waste, particularly faeces. We call them the Hygienists. In that time the role of the government was still very minor and there were not many public works. Most were done in the area of the Ministry of Water works. It involved a lot of energy to move the governments to produce costly facilities such as water works and sewerage. We have to realize that there was in that time only a small number of voters; the right to vote was connected to a minimum payment of tax. So it was a rather strong appeal for altruism of the rich to pay for the public facilities for everyone. The insights of Koch and the other investigators made it clear that the big plagues only can be suppressed by cutting the chains of infection in all layers of the population. Gradually a lot of money became available for clean water and sewerage, although not primarily because of strict medical reasons, which we find very common today.

In that time (1870-1871) it happened that dignified ladies from Amsterdam would go into the working class districts to plead the parents to get their children vaccinated against the smallpox. They realized very well that protection against an infection that is everywhere can only be effective with a good ‘herd immunity’. They were by no means the only people who worried about public hygiene. Albert, the consort of the British queen Victoria, for instance was very active in implementing a good sewage system. Many detailed technical drawings he has made to this end and some are still preserved. Unlucky he himself died from typhoid, a faeco-oral infection.

The historian Van Zon described how difficult the fight for better sanitation in The Netherlands has been. A few fragments from the summary of his thesis follow below:

The sun rises for free

"The most appalling unhygienic conditions could be found in the most densely populated and poorest parts of the towns. Here the streets were very narrow, mostly unpaved, with open sewers or without any possibility for draining household or rainwater… These circumstances were looked upon as a threat to public health. This view was mainly held by physicians… They constantly brought to attention, in many ways, that a change was needed…Their concern didn't inspire the authorities to make any fundamental changes

Only when there were epidemics or the fear of them, they found a willing ear with the authorities…They were blamed for being unaware of the financial consequences of their proposals and of not taking into account the limited financial means of the municipalities…Authorities, when notified of problems, as a rule were not pleased by the bearers of unpleasant messages… It seemed as if the municipal authorities considered hushing things up as the best policy and the best way to get rid of things.