*This podcast helps you to understand continuity and change in explanations of the cause of disease and illness, the influence in Britain of Pasteur’s Germ Theory, and Koch’s work on microbes.*

**Person 1:** The influence in Britain of Louis Pasteur’s Germ Theory was huge…

**Person 2:** What was the Germ Theory?

**Person 1:** Pasteur’s Germ Theory was published in 1861 and it stated that bacteria caused human disease. It greatly influenced medicine in Britain.

**Person 2:** Remember that bacteria are also known as germs or microbes.

**Person 1:** Oh, good point! For the first time doctors understood what caused disease, allowing for future medical improvements that revolutionised medicine.

**Person 2:** Revolutionised is a big statement – can you prove it? Remember the Germ Theory did not save a single life and, in the short term, people continued to believe in the miasma theory.

**Person 1:** I can prove it. Let’s start with Robert Koch. The Germ Theory allowed Koch and his research team to discover specific bacteria that caused individual diseases; first discovering anthrax bacteria in 1876, followed by tuberculosis in 1882.

**Person 2:** Tuberculosis, as in TB? … One of the biggest killers of British people at the time?

**Person 1:** Yes. Through Koch’s work and scientists that copied him individual bacteria of the biggest killers were identified including typhoid and cholera. But, more importantly, the discoveries persuaded people that miasma was not the cause of disease. Hence my original statement: ‘revolutionised medicine’.

**Person 2:** Ok, together they changed ideas about the causes of disease but this still didn’t save lives in Britain.

**Person 1:** Changing ideas about the cause of disease was huge!

**Person 2:** I agree but knowing individual bacteria and creating vaccinations is a big difference.

**Person 1:** But Pasteur did later make the link using Edward Jenner’s work on smallpox and by 1896 there was a vaccination for typhoid and in 1906 a vaccination for TB.

**Person 2:** But were they able to produce enough vaccines to use with the British public?

**Person 1:** No. They could not mass produce vaccines. Nevertheless, I stand by my statement ‘revolution in medicine’ as within 40 years Britain had knowledge of germs, individual bacteria and the knowledge to create vaccinations. Pasteur’s theory also had a positive impact on surgery. Pasteur made the link that was bacteria in the air and Joseph Lister developed it to link bacteria in the air to infections in open wounds. Through experiments with carbolic acid he was able to reduce death rates from 46% to just 15% in 6 years.

**Person 2:** But the Germ Theory wasn’t revolutionary for everyone in the late nineteenth century. The impact on poor and working people’s health in Britain was not significant. They still treated everyday illness and major sickness with home remedies that had a lot in common with medieval remedies and if they didn’t work they used patent medicines.

**Person 1:** I accept your point that impact of Pasteur’s and Koch’s work did not have major short-term impact in relation to directly saving lives or people’s health in Britain. However, they did have a revolutionary impact in discovering bacteria and vaccinations for the biggest killers, not forgetting the spectacular impact in surgery.

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*This podcast helps you to understand the work of Edward Jenner and the development of vaccination.*

Edward Jenner made a significant contribution to medicine when he created the technique vaccination, commonplace today, but in the late 1700s it was a huge medical breakthrough and the first step in preventing disease. In the words of Thomas Jefferson, President of the USA at the time to Jenner: ‘Medicine has never before produced any single improvement of such utility … mankind can never forget that you have lived.’

Jenner was an experienced country doctor in Gloucestershire who knew, as many did, that milkmaids who caught cowpox never contracted the frightening and often deadly disease smallpox. But unlike other doctors he conducted scientific experiments to prove it.

Jenner successfully experimented on 23 people; the most famous was on a healthy 8-year-old boy called James Phipps on 14th May 1796. He inserted cowpox matter from a local milkmaid’s hand, Sarah Nelmes’, into Phipps, via two cuts half an inch long. He then observed and recorded Phipps’ reaction noting on the seventh day he complained of uneasiness and on the ninth was restless but by day ten was perfectly well. Phipps was immune to the deadly disease and to confirm it, he was inoculated twice and no disease followed.

Jenner’s approach was so successful that in 1798 he published a book describing how to prevent smallpox by infecting people with cowpox and in it he called his method vaccination, because the Latin word for cow is *vacca*. His book was widely read and Parliament gave him £30,000 to open a vaccination clinic in London. His technique proved popular and by 1803, American doctors were using it and in 1805 Napoleon had all of his soldiers vaccinated. The British government made vaccination against smallpox compulsory in 1852 and fined people not vaccinating their children from 1871.

Jenner had discovered a method of preventing people catching one of the biggest killers and saving thousands of people suffering from small pox. His work is also significant as he was the first immuniser who encouraged future doctors, including Pasteur, to use scientific methodology to solve medical problems.

However, it must be noted that he faced a lot of opposition, including from the Royal Society and other doctors. The government were even forced to change the law and in 1887 parents could legally refuse to have their child vaccinated. Also his discovery was a ‘one off’ made through chance. Jenner never knew exactly how vaccination worked; he didn’t even know bacteria caused disease.

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*This podcast helps you to understand fighting cholera in London, 1854, attempts to prevent its spread, the significance of Snow, and the Broad Street pump.*

**Person 1:** In 1854 Britain faced another cholera epidemic with over 20,000 deaths. The 1848 Public Health Act had made little impact.

**Person 2:** Not surprising as it was voluntary and the government still had a laissez-faire attitude towards public health.

**Person 1:** True, and as cholera kept recurring people desperately searched for solutions – these included: getting rid of miasmas by smoking or burning tar, as well as praying and wearing lucky charms.

**Person 2:** But again, not surprisingly; the concept of bacteria causing disease was unknown and the miasma theory had been believed for a long time.

**Person 1:** Yes, but, in 1849, John Snow had challenged this idea in a book stating that people caught cholera from water they used for washing and drinking and not bad air. But doctors just mocked him …

**Person 2:** But did he have concrete evidence? … It’s not surprising his work was largely ignored.

**Person 1:** Ok, I accept that doctors were not going to change their minds quickly and evidence is vital. But luckily for the people of Britain Snow never gave up and, in 1854, he became the lone hero. He took cholera on and won with a pump handle!

**Person 2:** Just a pump handle?

**Person 1:** Yes, just a pump handle. In 1854 there was a huge outbreak in Broad Street, London. Within ten days 500 people had died of cholera. Snow noted the high concentration of deaths and mapped them, quickly proving that most of the deaths were local to the water pump.

**Person 2:** So he has the evidence what did he do next?

**Person 1:** He wrote a report ‘On the Mode of Communication of Cholera’ and insisted the pump handle was removed so people could never get water from it. With his map as evidence it was removed.

**Person 2:** Clever chap! I presume there were no more deaths and everyone called him a hero?

**Person 1:** Partly true… There were no more deaths and it was soon discovered that a cesspit, only a metre from the pump, was leaking into the drinking water. He now had evidence that clean water was vital in preventing cholera.

**Person 2:** So everyone believes him and a happy ending?

**Person 1:** Not quite, many scientists still clung to the miasma theory and the government did not act until 1875.

**Person 2:** No way…!

**Person 1:** It’s true – there was another cholera outbreak in 1865, which killed 14,000 people. Remember, people did not want to pay higher taxes nor did they think the government should interfere, and Pasteur’s Germ theory was still a few years away.

**Person 2:** So, in the short term, his impact was mainly local and it was many years until his work was nationally recognised and acted upon.

**Person 1:** That’s correct.

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*This podcast helps you to understand improvements in hospital care and the influence of Nightingale.*

**Questioner:** So, I hear you are an expert on Florence Nightingale and can teach me a thing or two... Let’s start with who was Florence Nightingale?

**Interviewee:** She is widely documented as the heroine of hospital reform.

**Questioner:** What was her background?

**Interviewee:** Nightingale came from a wealthy family who did not support her desire to train as a nurse. Nevertheless, she pursued a career in nursing. She trained in Germany, then worked as a nurse and became Superintendent of Nurses in Harley Street, London. When the Crimea War broke out in 1854 she led 38 nurses in an army hospital in Scutari.

**Questioner:** What was the condition of the army hospital?

**Interviewee:** Oh, it was dirty and lacked basic supplies including basins, soaps and towels on the wards.

**Questioner:** How did Nightingale improve conditions?

**Interviewee:** She started by cleaning the hospital and washing all the linen. She believed in the miasma theory and thought that bad smells had to be eliminated. She also cleaned the patients and organised the hospital.

**Questioner:** Did this have a positive impact?

**Interviewee:** It had a very positive impact. The death rate dramatically fell from 40% to 2%.

**Questioner:** Wow, did Nightingale’s work in the Crimea have an impact in Britain?

**Interviewee:** Nightingale had a very positive impact in Britain on her return. She raised money and set up her first Nightingale School for Nurses in 1860. Alongside this, she published two books, *Notes on Nursing*, 1859 and *Notes on Hospitals* in 1863. They provided the basics for training nurses and influenced hospital design. Nightingale focused on practical skills, predominately hygiene and cleanliness. This included clean water supplies, good drains, sewers and toilet facilities. She also concentrated on ensuring patients had good food supplies and access to fresh air.

**Questioner:** Was Nightingale the only reason for improvements in British hospitals?

**Interviewee:** Nightingale was not the only reason for improvements. First, the role of the government was important. New laws had been passed to enforce public health improvements – two main Acts were the Public Health Act 1875 and building separate infirmaries for workhouses in 1867. At the same time new asylums and fever hospitals were built. The second factor was improvements in technology, especially new engineering techniques. Finally, changes in surgery; aseptic surgery required better trained nurses as operations became more complex.

**Questioner:** Did everyone experience a positive change in hospital care in Britain?

**Interviewee:** No, experience depended on wealth. The very wealthy never went to hospitals, they paid a doctor to treat and operate on them at home. Working people paid a weekly subscription to cottage hospitals where doctors volunteered their time. If the poor and disabled became ill, they were forced in to workhouses run by Poor Law Unions.

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*This podcast helps you to understand the impact of anaesthetics and antiseptics on surgery.*

To appreciate the dramatic developments in surgery during the nineteenth century, it is important you understand the starting point. The full horrors are well documented but, to put it simply, it was pain, pus and blood.

The first problem was pain. The only way surgeons could help patients deal with pain was to work fast, but this sometimes led to more being amputated than expected, including patient’s testicles and an assistant’s fingers, so speed was not the answer. With advancements in medicine and developments in chemistry surgeons searched for an effective anaesthetic.

The discovery was made one evening in 1847 by James Simpson, Professor of Midwifery at Edinburgh University. As his colleagues sat down to dinner and just before they ate, Simpson poured chloroform in everyone’s tumblers and they inhaled it. Within minutes they were all under the table, much to his wife’s alarm.

Chloroform had been identified as an effective anaesthetic and within days it was used during childbirth. Within a year, John Snow created an inhaler to regulate doses, as too much killed patients. Yet not all welcomed it, some doctors believed that pain-free operations were unnatural!

Despite this important discovery, the number of patients dying from surgery increased. Chloroform had solved the issue of pain and given surgeons more time for complex operations but these led to deeper infections and greater blood loss.

The problem of infection was serious. Surgeons were unaware of the link between bacteria and infections, so they operated wearing pus-stained clothes and did not wash their hands or equipment.

It was Joseph Lister who made the vital link between bacteria in the air, as identified by Pasteur, and infections in wounds. He solved the problem of infection through curiosity, experimentation and knowledge of Carlisle’s sewage treatment. In 1864, Lister read an account of the use of carbolic acid on sewage to destroy parasites and it prompted the idea of treating open wounds with carbolic acid. He experimented, applying carbolic acid directly to wounds and covering them with carbolic soaked bandages. Lister discovered they healed without gangrene developing. In 1867, he published his findings and made carbolic acid a vital part of surgery. The impact was spectacular. Between 1864 and 1866 the death rate for 35 amputations was 46% and this dramatically reduced to 15% between 1867 and 1870 for 40 operations. Antiseptic surgery was established and quickly led to aseptic surgery.

With two major problems solved, pain and infection, more complex operations became possible with the first heart operation in 1896. However, blood loss was still a major issue and would not be answered until the twentieth century.

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*This podcast helps you to understand new approaches to prevention: the development and use of vaccinations, and the Public Health Act 1875.*

**Person 1:** I understand there was a major new approach to illness during the eighteenth and nineteenth centuries. Please can you tell me more?

**Person 2:** Yes, prevention became one of the key ways to address illnesses and happened in two ways: first, the development of vaccinations and, second, the creation of laws directly addressing public health.

**Person 1:** So, people became interested in preventing illness not just treating it… I know Edward Jenner made a vaccination for smallpox but what happened next?

**Person 2:** The government made vaccination against smallpox compulsory during the 1850s. It was the first significant step in prevention and the government becoming directly involved in people’s health. But it was met with resistance.

**Person 1:** Why?

**Person 2:** One of the main reasons was it was seen as an attack on personal liberty. The outcry was so great that in 1887 parents could refuse to have their children vaccinated.

**Person 1:** Wow, that is a major outcry. But surely new vaccinations quickly followed and people started to value them?

**Person 2:** No, they did not. Jenner created the first vaccination but was unable to offer an explanation of how it worked. It was not until Koch made the first identification of an individual bacterium and Pasteur developed it into a human vaccine for rabies in 1885 that scientists had the knowledge to produce vaccines for diseases. Even at this point it was not possible to mass produce vaccinations, so their use was limited. However, it was an important step forward in the prevention of disease.

**Person 1:** OK, so I now understand the development of vaccinations. Please can you explain how changes in the law helped to prevent illness?

**Person 2:** Since the 1600s living and working conditions in urban areas had become worse as Britain went through the industrial revolution. With a booming population and rapid growth of factories, little, if any, thought was given to public health. The government held a laissez-faire attitude believing they should not interfere.

**Person 1:** So what changed their minds? Why was the Public Health Act 1875 introduced?

**Person 2:** There are three main reasons. First, the work of John Snow in 1854. People learned that dirty water was dangerous. Second, Louis Pasteur’s Germ Theory, 1861 – and, finally, the government needed votes. In 1867 working men were given the franchise for the first time and numbers doubled when in 1884 men in rural areas were included.

**Person 1:** What were the details of the Public Health Act 1875?

**Person 2:** It made it compulsory for local councils to improve sewers and drainage, provide fresh water supplies and to appoint Medical Officers and sanitary inspectors to inspect public health facilities.

**Person 1:** Thank you! I now understand the history of the development of vaccinations and the role of the Public Health Act 1875 in preventing illness.

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