The History of Health and Medicine

Medicine and the Industrial Revolution 1750–1900
What we will learn in this presentation:

- What the Industrial Revolution was.
- How industrialization affected standards of health.
- How industrialization affected medical progress.
- How our understanding of the causes of disease improved.
- How surgery improved.
- What the system of medical care in Britain was like.
- The role women played in medicine in this period.
An age of revolutions

'Revolution' means a period of rapid change. Britain between 1750–1900 experienced an **Industrial Revolution** because there was rapid change in the way industry was organized.

Click to match the other revolutions that can be said to have happened in this period with their meanings.

start
Industrialization affected medicine in many ways.

**Communications** developed, allowing ideas to be exchanged more quickly. Both the telegraph and the railways developed during this time.

New factories and better **technology** could produce more sophisticated medical implements, such as fine syringe needles, or powerful lenses for microscopes.

**Wars** with France and in the Crimea led to improved surgical procedures and nursing care.
Progress in science led to many medical discoveries which were beyond understanding before. Doctors moved away from Galen’s ideas and looked for **scientific reasons** for illness.

Another important effect of industrialization was that many people moved to **towns** to work.

Industrial towns were overcrowded and people lived in cramped, quickly-built, poor-quality housing. Health was badly affected as **infectious diseases** spread rapidly.

Can you think of any diseases which affected people living in towns in the 19th century?
Killer diseases of industrial towns

Can you unscramble the names of these infectious diseases by dragging the letters into the correct positions?

Click start for the first of ten anagrams.

Correct answers are in the notes below (click on View, Notes Page).
Why did disease flourish in industrial towns?

- **Housing** was overcrowded (often 10 people in one room) and often damp.
- There was little **sanitation**.
- Lack of **fresh water** – water was often contaminated with sewage.
- Poor **diet** and pollution, and long working hours in factories weakened people’s resistance to diseases.

Why don’t people in Britain suffer from these diseases today?
In our society, babies are vaccinated to stop them catching diseases. But until the 19th century, vaccination was not known.

Until then, the only method available to prevent smallpox, one of the deadly diseases, was inoculation.

Inoculation had been introduced to Britain by Lady Wortley Montague, who had seen ‘smallpox parties’ in Turkey.

Please come to my

Smallpox Party

on March 15th 1790

Have a mild dose of smallpox now and get long-term immunity from the disease!
Inoculation gave a mild dose of smallpox, with the aim being long-term immunity to the disease.

“…the old woman comes with a nutshell … of smallpox, and rips open [a vein] and puts into the vein as much smallpox matter as can lie upon the head of her needle.”

This method was often effective but it could have a terrible side-effect: what do you think this was?
Edward Jenner (1749–1823) trained as a doctor in London. He set up practice in Gloucestershire and, like other doctors, offered smallpox inoculation to his patients.

Jenner was surprised to find that many people refused the inoculation.

According to local folklore, those who had had cowpox (a cattle disease passed on to dairymaids and other farm workers) never caught smallpox.

Jenner wondered whether inoculating patients with cowpox would give them immunity against smallpox. It would be less dangerous than inoculating them with smallpox matter, because cowpox was only a mild illness.
Click start to find out how Jenner conducted his experiments.
The impact of Jenner’s findings

Jenner sent his findings to the Royal Society but many were opposed to his idea and the society refused to publish his work.

Using his own money he published the work himself in 1798 and it was read by many people all over the world.

At last his work was recognized and the government gave him large amounts of money to open and run a vaccination clinic in London.

Around the world, the smallpox vaccination was used to protect people against the deadly disease. In 1852, smallpox vaccination became compulsory in Britain. It is now wiped out as a disease.
Vaccination – contributing factors

Read the information about Jenner's work and decide which factor was at work. Then drag the statements to the correct positions in the table.

start
A major feature of the history of medicine before the 19th century was the lack of understanding of the causes of disease.

Without that knowledge, attempts at the prevention and treatment of disease were based on superstition and guesswork.

In the 1850s, however, one man was to make a major breakthrough in the discovery of what caused disease – Louis Pasteur, a French scientist.
Pasteur trained as a chemist in Paris and then developed an interest in biology.

He worked at Lille University, in the heart of an industrial area. There he specialized in fermentation. He investigated why vats of beer kept going bad at a local brewery.

Pasteur discovered it was because of micro-organisms in the beer.

He called these germs because they were germinating, or growing. His theory was that these germs were causing the decay.
Click start to find out more about Pasteur's experiments.
Pasteur was not the first to discover microorganisms, but he was helped hugely by the powerful **microscope** lenses developed in the 19th century, which could magnify 1,000 times without distortion.

Pasteur’s ideas were ridiculed by some scientists and he knew he had to have undisputed proof. He carried out a number of carefully planned and recorded experiments.

**Next you will learn how Pasteur carried out his experiments. Think how individual genius and technology helped the discovery of the germ theory.**
To prove that micro-organisms lived in the air, Pasteur collected air in sterile flasks in Paris. He found that bacteria grew in the flasks.
By repeating this experiment in different places he found that the air in some places, like Paris, had far more microorganisms in it than places without so many people or so much pollution.

Air from Paris

Air from a less polluted area
Pasteur applied his theory of decay by micro-organisms in beer to the **cause of disease** in humans.

If bacteria could cause beer to go bad, then presumably they could make animals and humans ill.

He looked at the French silk industry, which was suffering because of a disease attacking silkworms. Pasteur identified the bacteria which was causing the disease.

He also proved that bacteria could be killed by heating a liquid in a flask which he then sealed. It remained fresh. Today we have **pasteurized milk** – heated to kill harmful bacteria.
Robert Koch

Robert Koch was a German doctor who built on Pasteur’s germ theory. During the late 1870s he identified the bacteria which caused anthrax, a disease in cattle, sheep and sometimes humans.

He achieved this by meticulous experiments and research. He injected the bacteria that he thought caused anthrax into 20 generations of mice. All the mice caught the disease and the bacteria he isolated in the last generation were the same as those that he had started with.
Koch’s achievements

Koch used the painstaking method of experiment in his work. Using the same process, his team of scientists identified the bacteria causing cholera and tuberculosis.

He also developed a medium for growing the bacteria and a method of staining them so that they could be identified and classified.

What were Koch’s main contributions to medical development?
There was great competition between Koch and Pasteur, not just scientifically, but also because of Germany’s defeat of France in the Franco-Prussian war of 1871.

How might the rivalry between Pasteur and Koch have been both good and bad for the progress of medicine?
Summary – the causes of disease

Select from list produced a vaccine against smallpox, but could not explain how it worked. Select from list discovered the link between germs and disease, and invented methods of identifying the bacteria for different diseases.

In 80 years they revolutionized the theories of the cause of diseases. Yet how could they use their ideas to combat disease?
Pasteur continued his search for vaccines by trial and error.

He was asked to look at chicken cholera, because it was devastating French farming.

He isolated the chicken cholera bacteria and injected chickens with different strengths of it, without success. His laboratory closed for the holidays in the summer of 1879.
A lucky chance

Pasteur was now to have a bit of luck. Some chicken cholera bacteria were left out, exposed to the air. The bacteria were weakened severely and when injected into chickens had no effect.

When subsequently injected with new bacteria (which should have killed them) the chickens suffered no ill effects. Pasteur had found a vaccine against chicken cholera.

Apart from helping the French farming industry, why was Pasteur’s discovery so important?
By 1881, Pasteur and his team had developed a vaccine for **anthrax**.

To prove it worked, he vaccinated 25 sheep with a weak strain of the disease.
Two weeks later he injected both the vaccinated and unvaccinated sheep with the full strength bacteria.
The 25 vaccinated sheep remained fit and well, whereas the unprotected 25 sheep all died.
Koch criticized Pasteur’s methods, but in spite of this Pasteur achieved international acclaim for his discoveries.

Two years later he had developed a vaccine for rabies, a terrible disease in dogs. A bite from a rabid dogs was fatal to humans.
Doctors now knew that once the bacteria causing a disease had been identified, a vaccine could be searched for. By the end of the 19th century the causes of the following diseases had been identified:

- smallpox
- TB
- cholera
- typhus
- tetanus
- pneumonia
- meningitis
- plague
- diphtheria
- and dysentery.

All of these were killer diseases against which there had previously been no protection.
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<thead>
<tr>
<th>Date</th>
<th>Person</th>
<th>Discovery</th>
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<tbody>
<tr>
<td>1798</td>
<td>Edward Jenner</td>
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<td>1850–60</td>
<td>Louis Pasteur</td>
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<td>1860s</td>
<td>Robert Koch</td>
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<td>1880s</td>
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The germ theory of disease
In this section we will consider how surgery developed in the 19th century. Was it due to individual genius, advances in science and technology, or both?
Before the 19th century, surgery was very dangerous and had a low success rate. There were three reasons for this:

- **No antiseptics**: Cauterization was used to stop bleeding, but blood could not be replaced in the way it is today.
- **No blood transfusions**: Operations; assistants had to hold the patient down while the surgeon worked very quickly.
- **Analgesia** (pain relief) was not available.
Surgery without anaesthesia had to be fast. Napoleon’s surgeon amputated 200 limbs in 24 hours at the Battle of Borodino in 1812.

During the 18th and 19th centuries, scientists experimented with the properties of chemicals and the effect they had on humans. In 1799 Humphrey Davy (who later invented the safety lamp for miners) discovered that pain could be reduced by using laughing gas.

Ether was later found to put patients to sleep, and was used successfully as an anaesthetic. However, it could cause the patient to cough or vomit, not ideal when a surgeon is cutting them with a knife! It was also highly inflammable.
In 1847, a breakthrough was made by James Simpson, a professor at Edinburgh University. He and several assistants tested several different chemicals at his home. In the process a bottle of chloroform was knocked over and when Mrs Simpson entered the room she found them all asleep.

Simpson was so excited with the effects of chloroform that he used it on 30 patients that week.
Chloroform in practice

Now operations could be performed at a sensible speed, and more intricate operations could be attempted. Yet many were fiercely opposed to pain relief.

Some feared side effects from the new anaesthetic, and an overdose could kill. Others objected to pain relief during childbirth, claiming that pain was sent by God.

In 1853, however, **Queen Victoria** was given chloroform during the birth of her eighth child. Her approval of it was enough to silence the critics and put it into general use.
For generations, surgeons had gone from one operation to the next without washing their hands or wearing masks or gowns or overalls. Infection was the cause of many post surgical deaths, with gangrene being very common.

A far higher proportion of women who gave birth in hospitals died of infection than those who gave birth at home.
Joseph Lister was a surgeon who had studied Pasteur’s work with interest. He thought that the high death rate of surgical patients might be caused by the micro-organisms in the air.

Lister experimented by spraying wounds with carbolic spray to kill the microbes. He found his patients healed without developing gangrene.

There was opposition to his ideas by other surgeons. Complaints included:

- antiseptics cost money
- Lister’s methods extended surgery time
- many did not accept the germ theory.
The acceptance of antiseptic procedures

In 1878 Koch identified the bacteria which caused *septicaemia* (blood poisoning). Within a few years Lister’s antiseptic procedures were finally in place in most operating theatres.

These procedures included:

- meticulous cleaning of hospitals and theatres
- steam-sterilization of all instruments
- use of sterilized rubber gloves.

Lister also applied his antiseptic idea to *ligatures*, used to tie blood vessels. He used catgut which could be sterilized and would be less likely to cause infection.
Although Lister had improved the use of ligatures, it was still not possible at the end of the 19th century to replace lost blood through blood transfusions.

Not only did doctors not know how to stop blood clotting, but when they did manage transfusion the patient often died, which they could not explain. In the 20th century it was discovered that there were different blood groups.
Read each statement and decide whether it applies to surgery in 1840, surgery in 1900, or surgery in 1840 and 1900.
1) Which of the following do you regard as the most important figure in the development of surgery at this time: Pasteur, Simpson or Lister? Explain why and give examples.

2) Which factor do you think was the most important in the development of surgery in the 19th century?
Doctors trained as apprentices, usually under a senior doctor or surgeon. They learnt by observation, lectures and some practical experience. They studied the drugs and remedies used to treat most illnesses.

Once trained they could become a **general practitioner** (GP). They charged their patients for their services, but most did not charge the very poorest. They also acted as midwives.
Dispensaries opened up where poorer people could buy medicines. By the 1840s, nearly 50% of the population got treatments from them.

Others still went to apothecaries (chemists), which kept a huge array of remedies.

People could also visit quack doctors, often at travelling fairs or markets. They sold their own ‘cure all’ medicines.
Women and medicine

Women continued to treat their families’ ailments using handed-down remedies.

In 1852, all doctors had to join one of the Colleges of Physicians, Surgeons or Apothecaries under the Medical Registration Act. Women were not allowed to join.

Some women, however, did fight to be allowed to become doctors. Some made huge breakthroughs, such as Elizabeth Garrett Anderson who became the first British woman doctor. She had to qualify in France as she was not allowed to in this country, despite coming first in the exams she sat alongside her male colleagues.
While they couldn’t become doctors, women were still regarded as natural nurses. They tended to come from the middle classes, it being seen as too lowly a job for wealthier women.

One such woman was Florence Nightingale (1820–1910). Her upper-class upbringing had groomed her for marriage to a rich man, not a career. Florence, however, believed that God was expecting her to be a nurse.
Florence Nightingale in the Crimea

Nightingale visited many hospitals to learn about nursing and was appalled by the conditions of the buildings, the nurses and their level of care.

In 1854, the government asked her to go to the Crimea to help at the army hospitals set up to treat the wounded in the war between Russia and Britain. The conditions were awful; half the soldiers had died in the hospitals.
Florence Nightingale’s reforms

Nightingale transformed the Crimean hospitals in six months. She insisted on good food for her patients, clean airy wards, boiled sheets and taught her team of nurses professional nursing practise.

When the army refused to pay for what she said she needed, she bought it herself. Her improvements reduced the death rate amongst her injured soldiers from 50% to 3%. She gained the nickname ‘Lady with the Lamp’.

On her return to England, Nightingale worked to improve conditions in British hospitals. She set up a training school for nurses. Her influence on the nursing profession continues today.
1) We have seen real progress in medicine during the 19th century. What do you think was the most important reason for this progress? Explain your answer fully.

2) Which factor do you think was the most influential?

3) Do you think the term ‘Medical Revolution’ can be applied to the progress of medicine and health between 1750 and 1900?
Can you match the 19th-century medical pioneer with their achievement?

Press start to begin.