

18<sup>th</sup> / 19<sup>th</sup>

Century

Why was there so much change in this period?



# Germ Theory: Summary?

**1) 1861:** Germ Theory – Bacteria in the air turned things bad (working to find why beer was going sour). Pasteur wondered if this could make human beings ill. He proved his theory with the flask experiment. He still couldn't identify this bacteria for each illness.

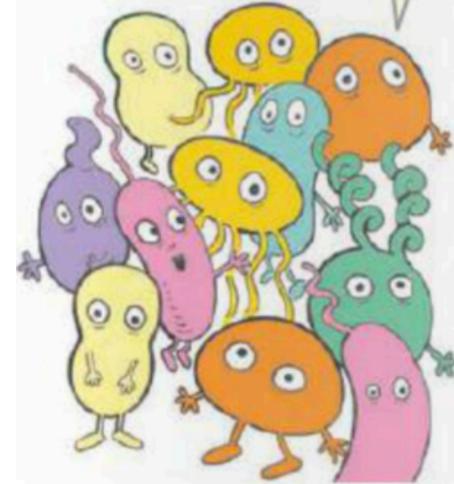
**2) 1865-76:** As long as he couldn't identify the specific bacteria, people still believed in Miasma as they could see waste in the streets and it made sense. During a Cholera outbreak he could see lots of bacteria in his microscope but could not work out which one cause the outbreak

**3) 1876:** Robert Koch made a breakthrough, they found the bacteria that caused anthrax on his agar jelly and better microscope.

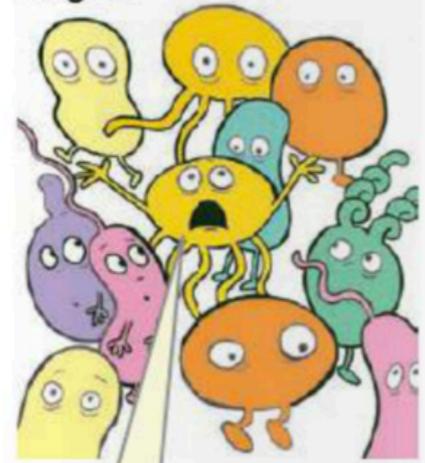
**4) 1876 onwards:** Koch and other scientists identified more bacteria leading to the development of many vaccines finally ending the belief in Miasma

Stage 2

It's OK. He knows we're here but he can't tell which of us is causing cholera.



Stage 3



You've got me! I give in. I'm the one that causes anthrax.

# Why is it so important?

## 1861: Germ Theory

*Bacteria in the air caused human disease. It took more experiments and some time to convince everyone. Pasteur proved his theory.*



## 1850's onwards:

*Pasteur's work reinforced the work and ideas of Florence Nightingale, although she maintained the Miasma theory until Pasteur's work*

## 1875: Public Health Act

*Followed a major change in Attitude from the Government following Pasteur's theory. The law made it compulsory for local councils to improve sewage and drainage as well as public health facilities – A direct link to Germ Theory*

## 1867: Lister - Antiseptics

*After reading Pasteur's Germ Theory, Lister experimented with carbolic acid to produce the first antiseptic. This greatly reduced the deaths from infection in surgery as well as more complex surgeries to take place. Some surgeons still didn't believe the Germ Theory.*

## 1882: Robert Koch

*Koch and his team used Pasteur's work to discover the bacteria that caused the individual diseases such as TB & Cholera. Once identified they could make more vaccines. Scientists since have copied Koch's techniques.*

## 1. Vaccinations:

1. Germ Theory put pressure on the government to enforce a compulsory smallpox vaccination.

## Mass use on the public...

*This is all good, but mass producing and using for the public would take a little while longer.*

## 2. 1870s & 1880s: Key illnesses' bacteria identified:

1882 – Typhoid    1883 – Cholera  
1886 – Pneumonia  
1887 – Meningitis    1894 – Plague  
1898 – Dysentery

## Key vaccines:

1896 – Typhoid  
1906 – TB  
1913 – Diphtheria  
1927 – Tetanus

3. Koch's work still didn't save lives by itself, he needed Pasteur to build on Jenner's work and turn the bacteria into vaccines. Pasteur made a vaccine for Chicken Cholera and Anthrax in sheep. He then moved onto humans and in 1885 made a vaccine for rabies.

## 2. Public Health

*Population increased due to the industrial revolution, cities grew and became overcrowded and ripe for disease.*

### *Cholera Outbreaks:*

*There had been several outbreaks by 1854 and no one knew why, The Germ Theory was still 7 years away. The Government passed a public health act in 1848 but it wasn't compulsory based on a lack of scientific evidence.*

## 1875 Public Health Act - compulsory

*At last, the government passed the 1875 Public Health Act making it compulsory to have clean water and clean living conditions, this was probably due to the fact there was scientific evidence by 1875 following the Germ Theory*

## Great Stink 1858:

*Snow's discovery and the Great Stink did make the government fund a sewer system in London to remove waste, still no compulsory public health act*

*John Snow in 1854 discovered the cause of Cholera was waterborne by taking the handle off the Broad St. pump, which put further pressure on the government. Still though, most people clung to the Miasma idea meaning Snow's impact was limited in the short term.*

## Germ Theory:

# Leading to Treatments

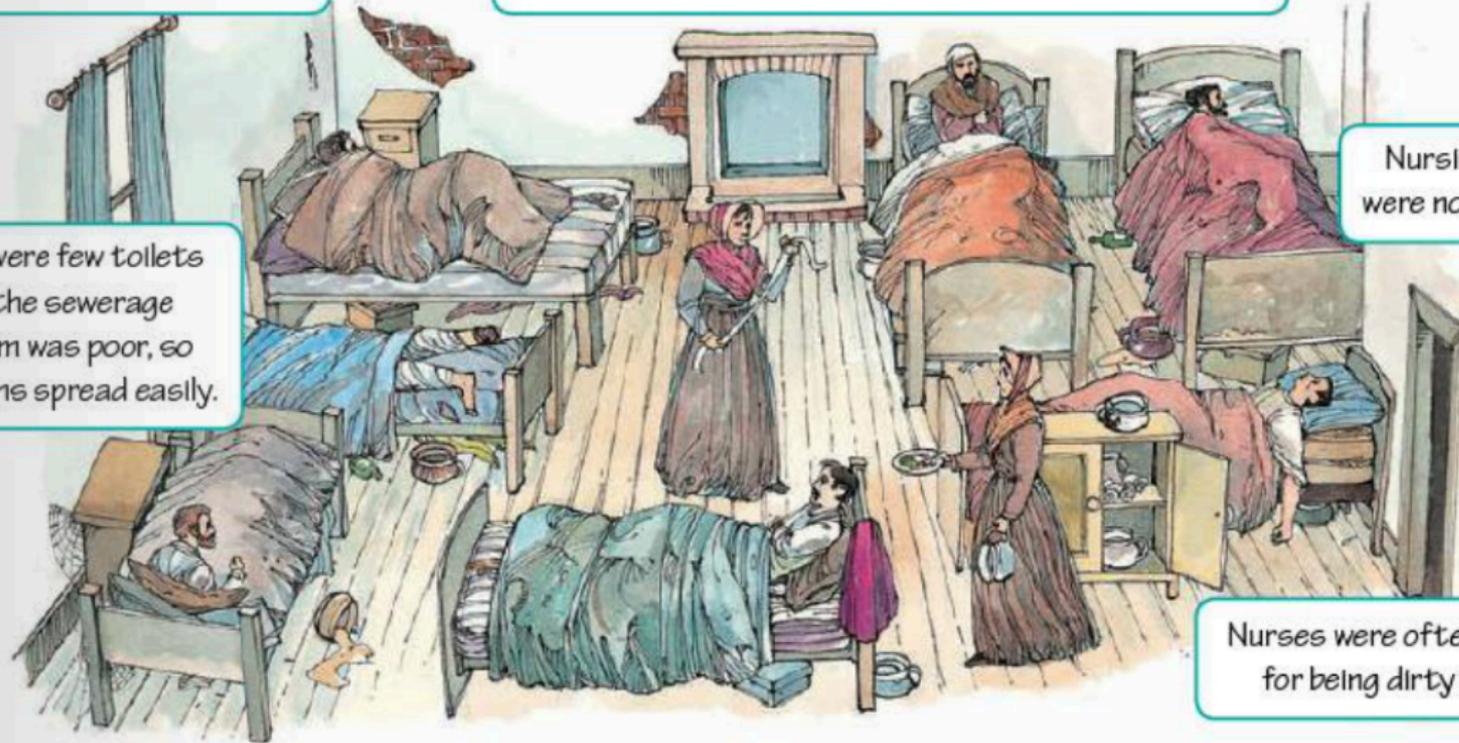
Cramped, stuffy wards helped infections to spread quickly.

Death rates from infection were high, because wards were not cleaned often enough or effectively enough.

There were few toilets and the sewerage system was poor, so infections spread easily.

Nursing staff were not trained.

Nurses were often criticised for being dirty or drunk.



## 1. Treatment and hospital care

Hospitals were places where people went to die as can be seen from the image above. Florence Nightingale had returned from the Crimea and was disgusted. She began improving hospitals and created a nursing profession reducing death rates from 40% to 2%

## Germ Theory:

# Leading to Treatments

*Nightingale's school for nurses was opened in 1860 following from her 'Notes on Nursing' in 1859. She then wrote 'Notes on hospitals in 1863.*



*Despite still believing the Miasma theory, refusing to read Pasteur's theory, she did know the importance of hygiene and keeping the hospitals clean and sanitised as well as having good ventilation.*

*Pasteur's work did impact medicine and surgery though, inevitably impacting on her hospitals.*



# Germ Theory: Leading to Treatments

## 2. Surgery – Anaesthetics & Antiseptic

*Pasteur's Germ Theory had a massive impact on surgery, particularly for infections...*

*James Simpson had dealt with the problem of pain in surgery with Chloroform, knocking the patient out. This led to more complex surgeries but also more deaths due to deeper infections as the patient was open to the air for longer. Pressure on was for a solution...*



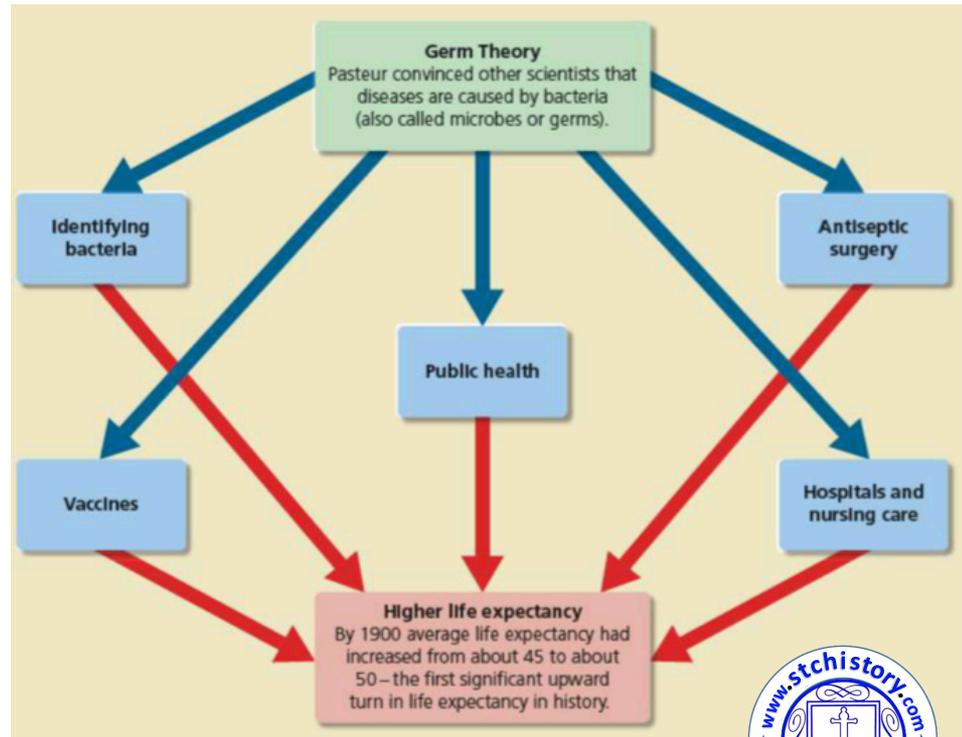
*Surgeon Joseph Lister was very interested in Louis Pasteur's Germ Theory and it inspired him to work on ways to deal with infection in surgery saying it is these germs getting into the wounds. He connected the smell of sewers to carbolic acid that was used to kill the bacteria causing the smell and used this acid in surgery, on tools and the patients. This led to an insistence on doctors and nurses washing hands, developing a spray, and inventing an antiseptic ligature (stitch), all because of the Germ Theory. Death rates from infection fell from 46% to just 15% by 1870*

# Germ Theory: The link to progress?

*Without Pasteur's theory, they wouldn't have known what caused disease, therefore impossible to develop treatments or preventions. Jenner's idea was important but it could not be explained until Louis Pasteur's Germ Theory.*

*By 1900, despite these massive breakthroughs, the people's health didn't dramatically improve. Towns were getting cleaner, surgery was getting better and there were more vaccinations being made - slowly.*

*Poor people couldn't afford treatment, the government didn't offer any assistance and so poor people were still relying on home remedies. Although, people were now more conscious of germs and trying to keep clean, for the poor, this was still a problem.*



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Why were there so many medical breakthroughs?



**A: Jenner:**

Followed advice from his teacher John Hunter to carry out his own experiments instead of relying on books leading to his cowpox theory and therefore the vaccination for smallpox

# SCIENCE

**C Jenner:**

James Simpson deliberately tested chemicals searching for an anaesthetic, resulting in his chloroform discovery

**D Jenner:**

Government gave Jenner £30,000 to develop his vaccinations, also making vaccination compulsory leading to a steep fall in smallpox cases

# TECHNOLOGY

**E Jenner:**

Jenner published his findings in 1798 spreading his ideas worldwide in the scientific journals so other Scientists could learn from each other. Eg Pasteur read Jenner's ideas, Lister then read Pasteur's etc...

# INDIVIDUALS

**B** The flushing toilet was an important late nineteenth-century invention. Instead of privies being emptied by hand and spade (and left rotting for days or weeks), the flushing system sent the waste instantly down into sewers. At first such toilets were only available to the rich but it was the beginning of a very important change. In addition in 1853 the government stopped taxing sales of soap so many more people could afford it, helping to kill germs (although no one knew this at the time!).



**F: Revolution in technology and engineering:**

Improved technology and engineering from the Industrial Revolution that had not been available 100 years earlier led to the building of the sewers in 1858, for example the use of steam powered machines.

**H: Lister's initiative:**

Scientists were learning about the impact of chemicals on the body, which encouraged Simpson's work

**G: John Snow's initiative:**

Dr. John Snow took it upon himself to investigate the Cholera deaths leading to his key findings and pointing to water being the cause. This led to pressure on the government.

**I: Medical equipment much more precise:**

The Industrial Revolution also led to an improvement in scientific and medical equipment like microscopes which allowed scientists to see bacteria better than they could 100 years earlier. Koch, Pasteur and Lister benefitted from this.

**J: Lister's initiative:**

Lister as well as Snow used his initiative linking the use of carbolic acid in the sewers to it's killing properties wondering if it was the germs causing the smell...

**K: Government Acts:**

Based on overwhelming evidence, the government was in a position to pass the Public Health Act of 1875



**ATTITUDES**

# How had society changed to make these breakthroughs possible

Healthier Longer Lives



Beginning of challenges to old ideas. Vesalius showed that Galen could be wrong about anatomy.



Development of scientific method – asking questions and testing hypotheses by observation and experiment. Harvey used this method to discover the circulation of the blood.



Doctors increasingly trained to use scientific method. Beginning of more professional training of doctors in hospital wards.



1500s Renaissance



1600s Scientific Revolution



1700s

# How had society changed to make these breakthroughs possible

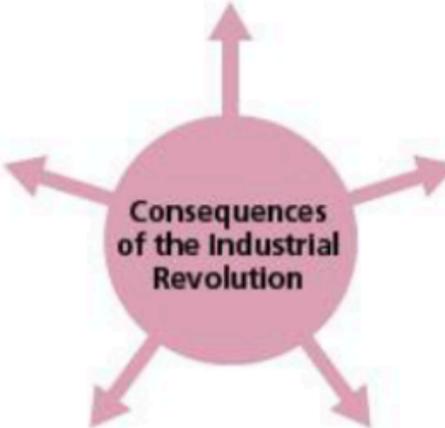
## Urbanisation

For the first time more people lived in towns than in the countryside. Conditions were often crowded and filthy, leading to devastating epidemics of disease. This increased demands for solutions.

## Communications

Communications were revolutionised. Trains allowed scientists and doctors to travel more quickly to attend conferences and learn from each other's ideas. News was reported more quickly, especially after the telegraph was developed in the 1850s, so details of scientific experiments could be reported in other countries on the next day. Scientific journals spread detailed accounts of new medical methods so they could be used worldwide.

## Consequences of the Industrial Revolution



## Political attitudes

In 1800 governments believed they should interfere in people's lives as little as possible. If people were unhealthy that was their business. By 1900 Parliament was making laws to improve people's health, forcing changes on people. This would have been unthinkable a century earlier.

## Technology

Industrialisation was not just about coal-mining and mills producing cloth and clothes from wool and cotton. Developments in steel-making helped produce a thin syringe needle that did not break; improvements in glass-making led to better microscope lenses and better thermometers.

## Changes in voting

In 1867 working men were able to vote for the first time. It was still only a minority of working men but a major change had taken place and, in 1884, the numbers were increased. Now politicians had to make changes to win the votes of working men and this led to major reforms aimed at improving health.

# London 1854:

Water supplies still came from wells or rivers into which sewers emptied. Only the wealthy had homes with toilets and piped water. Most people shared outside toilets and got their water from a pump in the street.

Toilets and cesspits were cleaned out by night-soil men and the waste was carried through streets on carts.

Hush, Victoria, it's only a graze. I'll bandage it with dropwort and comfrey.

Put honey on it. Mother said honey heals cuts and scrapes.

And that is how you amputate a leg. Using chloroform means the patient doesn't feel a thing.

Nonsense! If God meant surgery to be painless he would have made it painless.

Vaccination saves many children from smallpox. Dr Jenner was the greatest hero in medicine. I do hope science and experiments give us vaccinations against other diseases.

Roll up! Roll up! Buy the great 'Cure-all tonic'. Two spoonfuls will save you from cholera.

In 1848 the government passed a Public Health Act setting up a national Board of Health. It said:

- local taxes could be charged to improve water supply and sewers
- the Board of Health could force towns to improve water supply and sewerage if the local death-rate was very high
- local Boards of Health with Medical Officers could be set up.

Cholera has broken out around Broad Street. There's so much bad air in that part of London. Those houses are so filthy they make the air bad.

Hold your arm out. Bleeding does you good. And I've a good laxative that'll clear out your body.

It's consumption. He's been coughing all week.

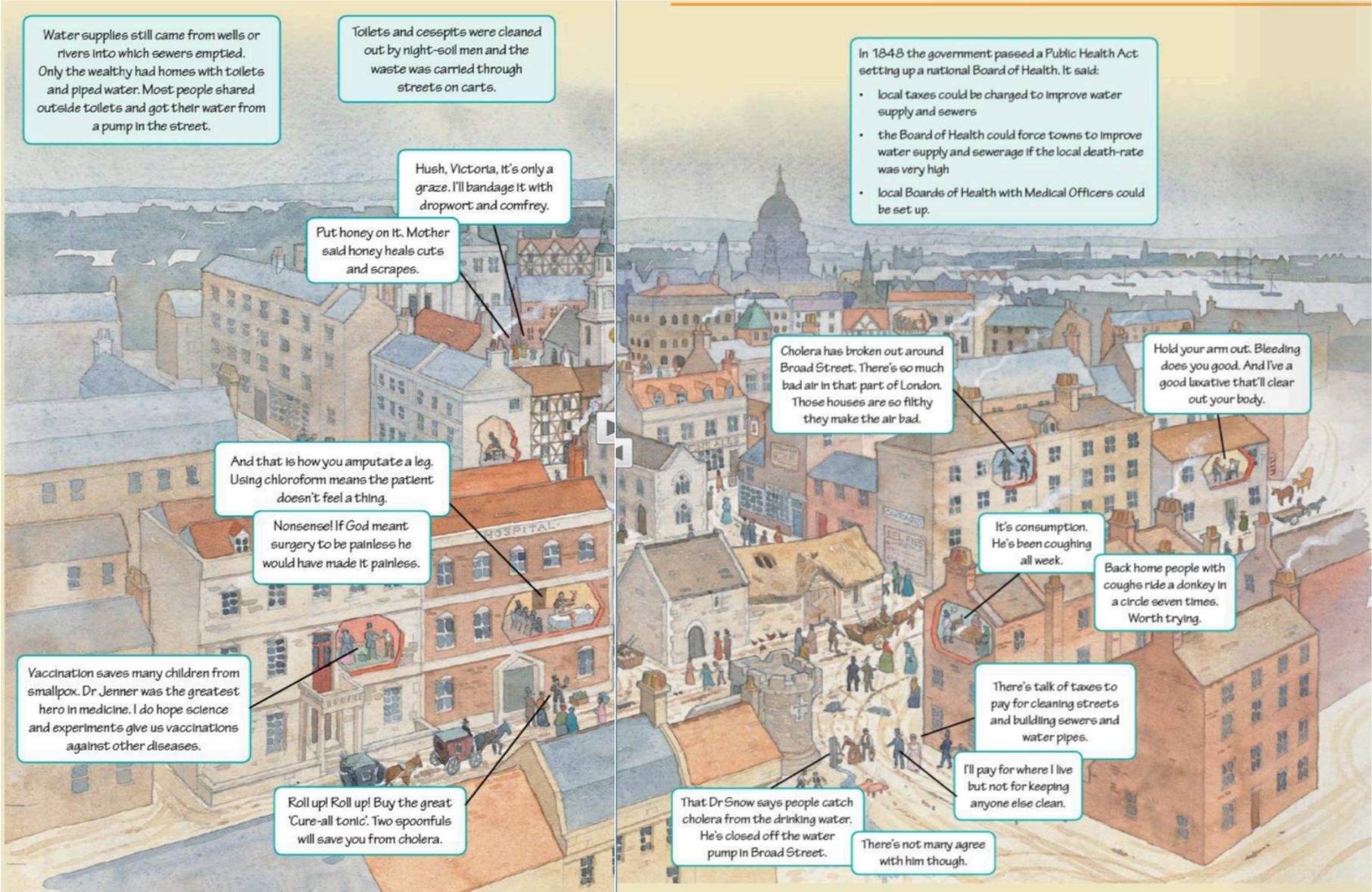
Back home people with coughs ride a donkey in a circle seven times. Worth trying.

There's talk of taxes to pay for cleaning streets and building sewers and water pipes.

I'll pay for where I live but not for keeping anyone else clean.

That Dr Snow says people catch cholera from the drinking water. He's closed off the water pump in Broad Street.

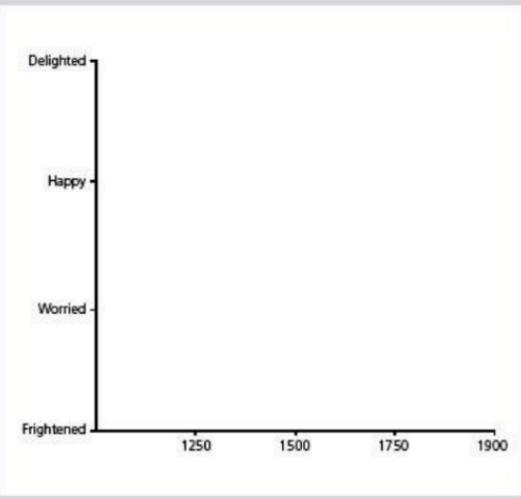
There's not many agree with him though.



# Revision ideas:

## 1 Revise the Big Story – with the help of a germ

After each chapter we have asked you to retell the Big Story. Here is a different way to do that – from the perspective of a germ! The task is to tell the story of medicine from the 1200s to 1900 from the perspective of a germ. First complete a living graph like the one opposite – when would you as a germ be happy, anxious, frightened, delighted by medical conditions and understanding? Then once you've completed the graph tell the story – and remember to explain why your feelings are changing.



## 2 Test yourself!

The more you think about what you have learned and **especially what you're not sure about**, the more chance you have of succeeding in your exam. So answer these questions and don't be surprised if you have seen some of them before.

1. When did Pasteur announce his germ theory? (If not the year, which decade?)	2. What discovery did Harvey make and in which century did he discover it?	3. Which method of preventing smallpox was used before vaccination?
4. List three ideas people had about the cause of disease in the Middle Ages.	5. List three kinds of treatment used between 1500 and 1700.	6. What was so important about the 1875 Public Health Act? (Mention two details to support your answer.)
7. Give two methods used to try to prevent cholera spreading in 1854 before John Snow's work.	8. What did James Simpson use as an effective anaesthetic and what was surgery's 'Black Period'?	9. What did John Snow do to stop cholera spreading in 1854?
10. Name three reasons why changes were taking place in medicine by 1700.	11. Where did Florence Nightingale go to help British soldiers?	12. When did the Black Death arrive in England and what percentage of people did it kill?
13. What was Joseph Lister's big breakthrough?	14. What did you find hardest to understand in this chapter? How are you going to help yourself understand it?	15. Name one thing that you learned in this chapter that surprised you or that you now think differently about. Explain why.

