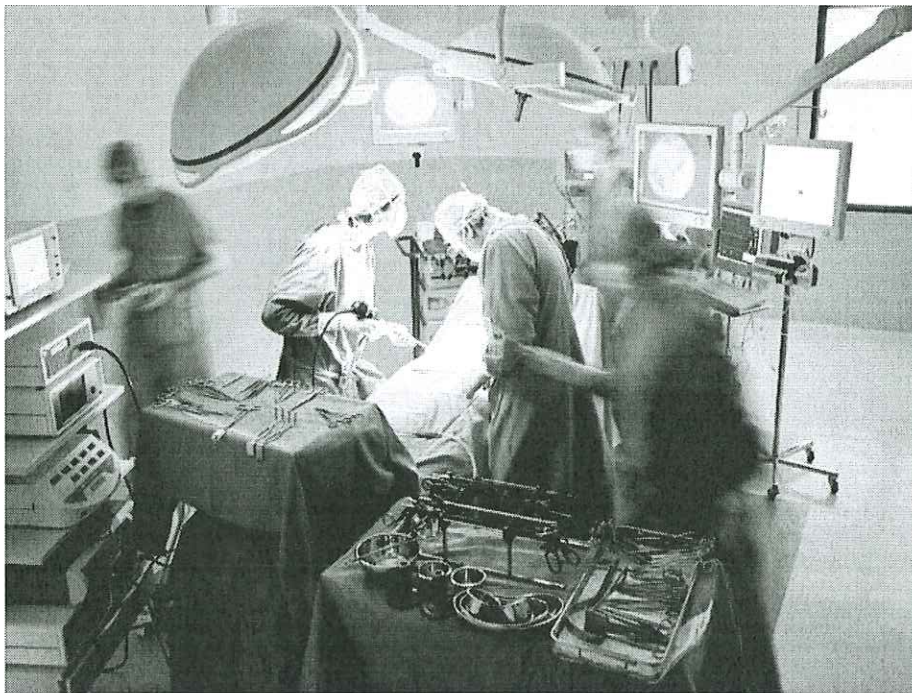


Theme 4:

Modern Medicine, c.1900-present



Background

- By 1900 life expectancy was starting to increase, but was still only around 50.
- Most families still could not afford to see a doctor.
- There was now a wider acceptance of Pasteur's germ theory.
- Ideas about miasma and the Four Humours were no longer believed – medicine was now firmly rooted in science.
- The old "laissez-faire" attitude to public health was dying out.

Ideas about Causes of Disease

• Genetics

Scientists realised that microbes did not cause all disease – some people were born with illnesses or conditions which were **hereditary** (passed on from parents).

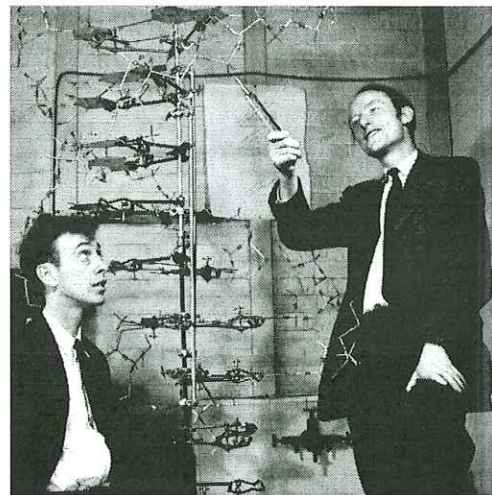
By 1900 a German scientist called Mendel had theorised that genes come in pairs (**the fundamental laws of inheritance**), but microscopes weren't powerful enough to identify gene pairs.

Scientists thought that a substance in human cells passed on information from one person to the next – this was how certain characteristics were passed from parents to children.

In **1953**, Cambridge scientists **James Watson** and **Francis Crick** identified this substance as DNA. They discovered that DNA is shaped as a double helix.

Crick and Watson didn't do it alone – their structure of DNA was based on close-up x-ray images produced by **Rosalind Franklin** and **Maurice Wilkins**.

Knowing the structure of DNA was important to medicine, because scientists could now identify the parts that caused hereditary diseases.



In **1990**, scientists led by James Watson launched the **Human Genome Project** to identify the complete set (over 3 billion pairs) of DNA which makes up human beings. It took hundreds of scientists from 18 countries over ten years to complete. Scientists can now use this 'blueprint' to look for mistakes or mismatches in the DNA of people with hereditary diseases.

For example, scientists have identified a gene that is sometimes present in breast cancer sufferers. People can get tested for this gene, and may choose to have a mastectomy to prevent the disease.

• Lifestyle and health

Over the 20th century, people gained a better understanding of how lifestyle choices affect health.

Smoking became more popular from the 1920s, especially amongst young people.

Doctors now know that smoking can cause conditions such as **cancer, high blood pressure, heart disease and tooth decay.**

People are now strongly advised not to smoke.

Diet is also important. We now know that sugar and fat should be eaten in moderation, because they can lead to **diabetes and heart disease,** and too much alcohol can damage the liver.



Other lifestyle factors which influence health include **unprotected sex and drug taking,** and the modern fashion of **tanning,** which leads to skin cancer.

• Diagnosis

Modern technology means that doctors no longer have to use surgery to diagnose all diseases.

These are some of the common technologies used to make a diagnosis:

<i>Technology</i>	<i>First used</i>	<i>Used for</i>
Blood pressure monitors	1880s	Diagnosing high and low blood pressure.
X-rays	1890s	Help to see inside the human body without surgery.
ECGs	1900s	Uses electrical impulses to track heart activity.
Endoscopes	1900s	A camera on the end of a thin, flexible tube, often used to investigate digestive symptoms.
Blood tests	1930s	Testing for conditions without the need for invasive surgery.
Ultrasound scans (sonograms)	1940s	Diagnosing things like gall and kidney stones, by using sound waves to create a picture.
Blood sugar monitoring	1960s	Allows diabetes sufferers to monitor blood sugar levels regularly.
CT scans	1970s	A more advanced form of x-rays, used to diagnose tumour and growths.
MRI scans	1970s	Diagnosing soft tissue injuries by using radio waves and magnets to create an internal image of the body.



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- Word which describes a disease passed from parent to child.
- Human _____, launched in 1990 to map the complete set of DNA which makes up human beings.
- A camera used to look inside the body.
- A scan which uses sound waves to create a picture of inside the body.
- Mendel theorised that all genes were in pairs – he called this the fundamental laws of _____.
- A preventative procedure for breast cancer.
- Scientist who discovered DNA with Francis Crick.
- The name given to DNA's shape: double _____.
- First used in the 1890s, these allow us to see inside the body without using surgery.
- Socially popular from the 1920s onwards, this can cause lung cancer and other illnesses.
- Rosalind _____, a scientist whose x-ray photos helped in the discovery of DNA.
- A condition which can be caused by excessive sugar intake.

Approaches to Treatment

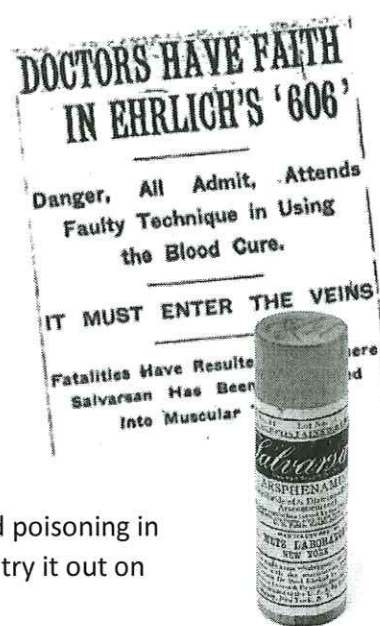
- Magic bullets

Magic bullets were **chemical cures** which attacked disease-causing microbes, while leaving the body unharmed.

Paul Ehrlich (a member of Robert Koch's research team) developed the first magic bullet in **1909**. He tested hundreds of arsenic compounds, and on the 606th attempt found one which cured syphilis. This became known as **Salvarsan 606**.

Unfortunately, Salvarsan 606 could also kill the patient, because arsenic is poisonous.

In **1932**, **Gerhard Domagk** discovered that **Prontosil** cured blood poisoning in mice. He found it worked on humans too after he was forced to try it out on his ill daughter.



• Antibiotics

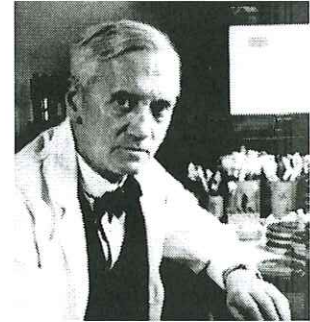
An **antibiotic** is a treatment that kills or limits the growth of bacteria in the body.

The first antibiotic was **penicillin**. Penicillin is different to magic bullets in that it is created using microorganisms, not chemicals. There were 3 stages in its development:

1

British doctor **Alexander Fleming** discovered penicillin **by chance** in **1928**. Penicillin spores had floated in through a window and landed on a petri dish of bacteria he had been growing. Fleming noticed that the penicillin mould had killed off the harmful bacteria in the dish.

However, Fleming didn't believe it could work to kill bacteria in living people, so he didn't push for further funding to experiment.



2

In **1940**, **Howard Florey** and **Ernst Chain** found that penicillin seemed to kill bacteria in infected mice.

However, it took a long time for them to grow enough penicillin to treat a human. By 1941 they had enough to try out on one person.

They experimented on a local policeman with septicaemia. The penicillin worked well – but they soon ran out of it, and the patient still died. Florey and Chain needed to somehow produce it on an **industrial scale**.



3

British companies wouldn't mass-produce penicillin at first because they were concentrating on the war effort, but in **1941** some American firms agreed to start production. **The US government saw its potential and gave funding to 21 companies**. In 1943, British companies also started to make penicillin.



In 1944, there was enough penicillin to treat all the Allied soldiers wounded in D-Day.

Fleming, Florey and Chain shared a Nobel Prize for their work in 1945.

Scientists have since been able to develop versions of penicillin to treat specific diseases. However, one problem is the development of **penicillin-resistant bacteria**, which means scientists are constantly working on new antibiotics.



- Modern drugs

Advances in science have allowed scientists to develop medicines which treat specific diseases.

Drugs trials now take several years - this slows progress, but makes them safer. A famous mistake was the use of **thalidomide** to treat morning sickness in the 1960s, which caused birth defects.

Mass production, the development of **capsule tablets** and the **hypodermic needle** have all made drugs more easily available.

- Surgery

The problem of **bleeding** during surgery was solved by **blood transfusions**. These were made possible after **Karl Landsteiner** identified the first **blood groups** in **1900**. **Blood banks** were first used in the First World War, where many soldiers were bleeding to death.

Successful **organ transplants** were first carried out in the 20th century, including the first kidney (1956), lung (1963), liver (1967) and heart (1967) transplants. These were made possible by modern techniques such as **keyhole surgery** and **robotic surgery**.

Since the **1930s**, **anaesthetics** have been injected rather than inhaled. This is much safer.

- The NHS

After WW2, people were keen to improve society. Many people who housed evacuees in the war were shocked by how unhealthy some city children were.



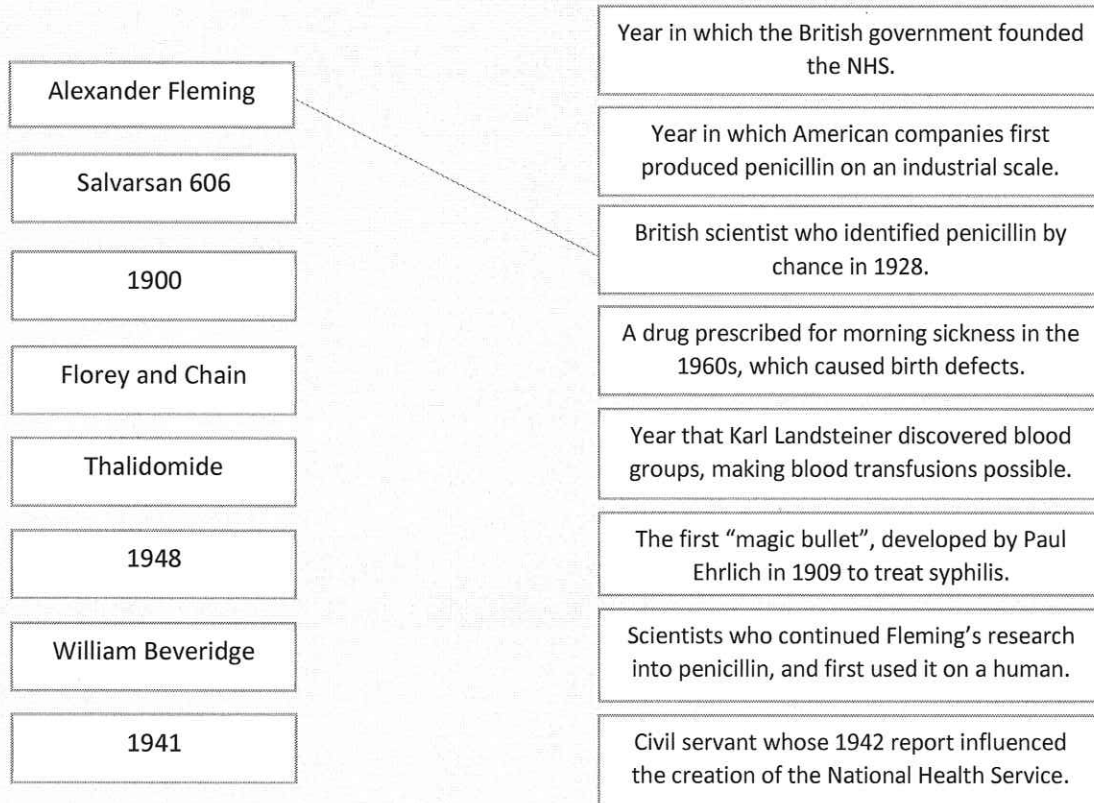
The NHS was launched by the government in **1948**. Its aim was to provide medical care to everybody that was **free at the point of delivery** – it was paid for by everybody through **National Insurance** contributions. It was overseen by Minister of Health **Aneurin Bevan**.

It was partly inspired by a 1942 report by **William Beveridge**, which identified “5 Evils” which needed to be eradicated from society.

The NHS took over existing hospitals and surgeries, but the government could not afford to update them initially. Therefore, in the short term **access to medical care improved** (because GPs and hospitals were now available to everyone) but the care itself did not.

The government made changes in the 1960s, including building more hospitals across the country, and introducing a **GP’s charter** in 1966, which improved standards in care.

Increased life expectancy and a **larger population** has created problems for the NHS, including longer waiting times and increasing costs.



Approaches to Prevention

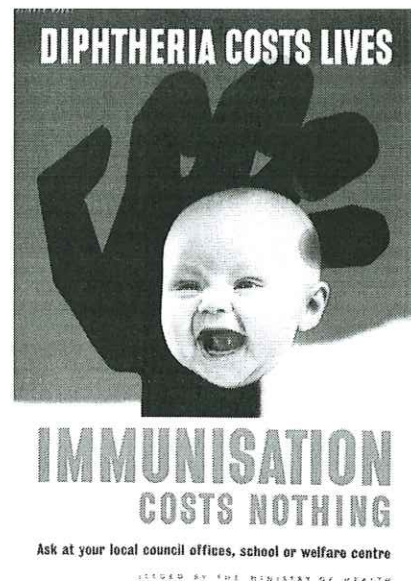
The government took significant action to improve public health in the 20th century. There was no longer a "laissez-faire" attitude.

- Mass vaccinations

The first government vaccination campaign was for **diphtheria** in **1942**. This was introduced because it was feared the cramped conditions in air-raid shelters during the war could lead to an epidemic. As a result, diphtheria cases plummeted.

Another significant vaccination was for **polio** in the 1950s. Take-up for the vaccination was slow at first, until England footballer Jeff Hall died of polio in 1959.

Because he was young, fit and famous, it showed that anyone could die from the disease. Demand became so high that extra supplies had to be flown in from America.



- Government legislation

The **Liberal** government of 1906-14 passed a series of **social reforms** which went some way to improving public health.

These included free school meals (1906), medical checks in schools (1907) and the National Insurance Act (1911), which gave assistance to ill workers.

One reason for the government's action was that during the Boer War (1899-1902) **a third** of army volunteers were rejected because of ill health. Clearly, poor health was common.

These measures went some way to improving access to medical care, although there were still many who couldn't afford to see a doctor.

Here are some other laws passed by government to make the country healthier:

- The **Clean Air Acts** of 1956 and 1968, introduced after bad episodes of **smog** in London.
- Dietary information must be displayed on food packaging.
- In 2007, smoking was made illegal in all enclosed workplaces.
- Cigarettes cannot be advertised, and their packaging must be plain.

- Government lifestyle campaigns

As well as direct legal intervention, the government also tries to prevent disease through **promoting a healthier lifestyle**:

- **Advertising campaigns**, which warn about the dangers of smoking, drugs, alcohol and unprotected sex.
- **Events** such as Stoptober, which encourages people to stop smoking.
- **Initiatives** which encourage healthier eating, such as Change4Life.

Name two examples of government intervention which did not exist before 1900.



Case Study: Fighting Lung Cancer in the 21st Century

Lung cancer is the UK's second most common cancer. In **1950**, the **British Medical Research Council** published a study which showed that the rise in lung cancer cases was linked to the rise in smoking.

- Diagnosing lung cancer

Lung cancer is **hard to treat** because it's usually advanced by the time it's detected. Previously, lung cancer was diagnosed using x-rays, but these were inaccurate.

New technology has made diagnosis easier and more reliable:

- **CT scans** give a detailed image of inside the body.
- Patients are injected with a **dye** to make the lungs show up on the scan.
- A **bronchoscope** (like an endoscope) is put into the lungs to collect a sample of the cells for testing.

- Treating lung cancer

There are many treatments available, made possible by modern technology:

- Removing all or part of the lung.
- Lung transplant.
- Radiotherapy (shrinking the tumour with radiation).
- Chemotherapy (shrinking the tumour with drugs).

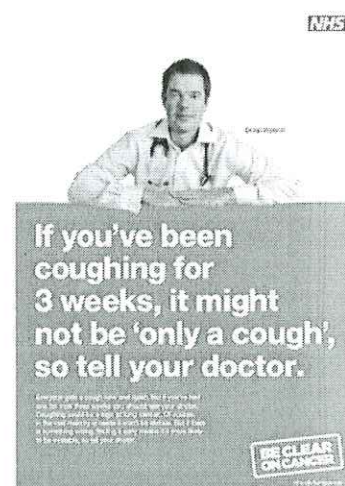
Scientists are also studying the **genes** of lung cancer sufferers in the hope of developing a **genetic treatment**.

- Preventing lung cancer

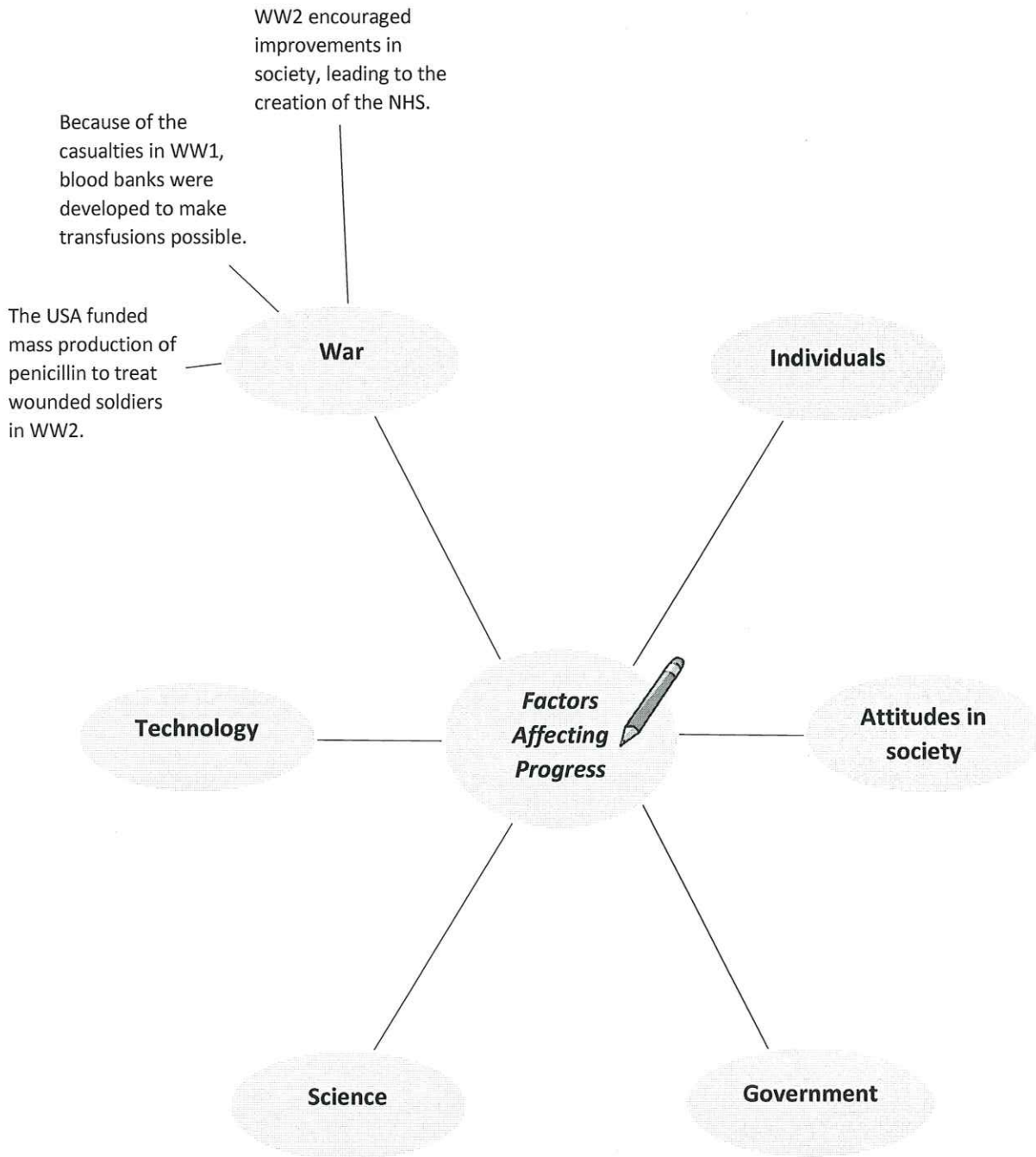
In 1985, smoking-related deaths cost the NHS £165m – but the government earned around £4bn from tobacco tax. It was a while before the government acted to discourage smoking.

Since then, the government has taken much more action to combat lung cancer:

- In **2005**, cigarette advertising was banned completely (it had been banned on TV since 1965).
- In **2007**, smoking was banned in all public workplaces.
- Also in **2007**, the legal age to buy tobacco was raised from 16 to 18.
- In **2015**, smoking was banned in cars carrying children.
- All cigarette products must be removed from display in shops.
- Anti-smoking advertising campaigns are produced, and the dangers of smoking taught in schools.
- Increased taxation of tobacco products, to make them more expensive.



What Factors Have Affected Progress Since 1900?



- 5. What was a “magic bullet”?**
- 6. How many attempts did it take Paul Ehrlich to develop the first “magic bullet”?**
- 7. What did Alexander Fleming discover by chance in 1928?**
- 8. How did Florey and Chain expand on Fleming’s earlier work?**
- 9. What led to the first mass-production of antibiotics in the 1940s?**
- 10. Why was Karl Landsteiner’s discovery of blood groups important for surgery?**
- 11. Give 2 ways in which surgery improved during the 20th century.**

12. When was the NHS founded?

13. Give 2 factors which influenced the creation of the NHS.

14. Name 2 ways in which the government now acts to prevent disease.

15. Why did cases of lung cancer rise significantly during the 20th century?

16. Explain 4 factors which have influenced medical progress since 1900.



Hippocrates

Period: Ancient Greece

Lived: 460 BC-370 BC

Known for:

- Theory of the Four Humours
- Hippocratic Oath
- "Father of Modern Medicine"



Galen

Period: Ancient Rome

Lived: 130 AD-216 AD

Known for:

- Theory of Opposites (an extension of Hippocrates' 4 Humours)
- Hundreds of books on anatomy



Andreas Vesalius

Period: Renaissance

Lived: 1514-1564

Known for:

- Work on anatomy, which disproved many of Galen's old theories
- *On the Fabric of the Human Body*, 1543



William Harvey

Period: Renaissance

Lived: 1578-1657

Known for:

- Discovery of blood circulation system, 1628
- Disproved Galen's theory that blood was made in the liver



Thomas Sydenham

Period: Renaissance

Lived: 1624-1689

Known for:

- Stressed the importance of observing and recording symptoms
- Argued that the Four Humours theory was wrong
- "English Hippocrates"



Antony van Leeuwenhoek

Period: Renaissance

Lived: 1632-1723

Known for:

- Observing "animalcules" (bacteria) through a microscope
- Improved the microscope
- "Father of Microbiology"



Henry VIII

Period: Renaissance

Lived: 1491-1547

Known for:

- King 1509-47
- Split from Catholic Church and closed the monasteries in the 1530s, leading to most hospitals closing



Charles II

Period: Renaissance

Lived: 1630-1685

Known for:

- King 1660-85
- Keen supporter of the Royal Society
- Died in 1685 after bleeding and purging failed to cure him

Paper 1 – Medicine Through Time, c.1250-present



Louis Pasteur

Period: 19th Century

Lived: 1822-1895

Known for:

- Germ theory, 1861
- Germ theory of infection, 1878
- Vaccines for chicken cholera, anthrax and rabies (1870s)
- Pasteurisation



Robert Koch

Period: 19th Century

Lived: 1843-1910

Known for:

- Expanded Pasteur's work by identifying the individual bacteria which cause diseases
- Identified anthrax (1876), TB (1882) and cholera (1883)



Edward Jenner

Period: 18th/19th Centuries

Lived: 1749-1823

Known for:

- Developed the first vaccination for smallpox in the 1790s
- Encouraged Parliament to develop vaccination further



James Simpson

Period: 19th Century

Lived: 1811-1870

Known for:

- Discovery of chloroform as an anaesthetic, 1847
- Helped to solve the problem of pain during surgery



Joseph Lister

Period: 19th Century

Lived: 1827-1912

Known for:

- Development of antiseptic surgery, beginning with carbolic acid in 1865
- Helped to solve problem of infection during surgery
- Based his ideas on Pasteur's germ theory work



Florence Nightingale

Period: 19th Century

Lived: 1820-1910

Known for:

- Nursing work during Crimean War (1854-6)
- *Notes on Nursing*, 1859
- School of Nursing (1860)
- Encouraged better hospital design and conditions



John Snow

Period: 19th Century

Lived: 1813-1858

Known for:

- Broad Street pump experiment (1854) which proved cholera was spread by dirty water
- Famous anaesthetist – gave Victoria chloroform in 1853



Edwin Chadwick

Period: 19th Century

Lived: 1800-1890

Known for:

- Wrote *On the Sanitary Conditions of the Labouring Classes* in 1842
- Encouraged more government action on public health

Paper 1 – Medicine Through Time, c.1250-present



Paul Ehrlich

Period: 19th/20th Centuries

Lived: 1854-1915

Known for:

- Worked as part of Robert Koch's research team
- Developed the first magic bullet, Salvarsan 606, in 1909



Karl Landsteiner

Period: 19th/20th Centuries

Lived: 1868-1943

Known for:

- Discovered the first blood groups in 1900
- Co-discovered the polio virus in 1909



Alexander Fleming

Period: 20th Century

Lived: 1881-1955

Known for:

- Discovery of the first antibiotic, penicillin, in 1928
- Shared a Nobel Prize with Florey and Chain, 1945



Howard Florey

Period: 20th Century

Lived: 1898-1968

Known for:

- Carried out the first human trials of penicillin in 1941, with Ernst Chain
- Persuaded companies in the US to start mass-producing penicillin



Ernst Chain

Period: 20th Century

Lived: 1906-1979

Known for:

- Carried out the first human trials of penicillin in 1941, with Howard Florey



William Beveridge

Period: 20th Century

Lived: 1879-1963

Known for:

- 1942 *Beveridge Report*, which created the basis for the welfare state
- Suggested the setting up of a national health service, paid for by taxes



Aneurin Bevan

Period: 20th Century

Lived: 1897-1960

Known for:

- Minister of Health (1945-51)
- Oversaw the establishment of the NHS in 1948



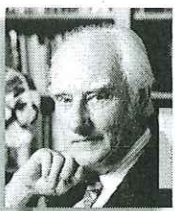
James Watson

Period: 20th Century

Lived: 1928-

Known for:

- Discovered the structure of DNA with Francis Crick, Rosalind Franklin and Maurice Wilkins, 1953
- Helped establish the Human Genome Project (1990)



Francis Crick

Period: 20th Century

Lived: 1916-2004

Known for:

- Discovered the structure of DNA with James Watson, Rosalind Franklin and Maurice Wilkins, 1953