Medicine through Time (Paper 1) 4th June

- This topic is tested on Paper 1
- The exam lasts for 1 hour and 15 minutes
- There are 52 marks in total
- The exam is divided into Section A (25 minutes) and Section B (50 minutes)

History GCSE (9-1) Revision Guide

Ecclesfield School History Department

Name _____

History teacher _____

What do I need to know for these topics?

Middle Ages

Ideas: supernatural and religious	Red	Amber	Green
Rational explanation explanations for disease			
Approaches to prevention and treatment			
Approaches to caring for the sick			
The Black Death 1348-9			

Renaissance

	Red	Amber	Green
Ideas: Scientific approach			
Transmission of ideas			
Continuity in prevention, treatment and care			
Change in care and treatment			
Vesalius			
Harvey			

C.1700-c.1900 (18th and 19th Century)

	Red	Amber	Green
Germ Theory and microbes			
Improvements in hospital care			
Anaesthetic and antiseptics			
Approaches to prevention of disease			
Jenner and vaccination			
John Snow and Cholera			

C1900- present: Modern Britain

	Red	Amber	Green
Ideas: genetics and lifestyles			
improvements in diagnosis			
Change in care and treatment			
Preventing disease			
Development of penicillin			
Fight against lung cancer			

The Middle Ages

Ideas: Supernatural and religious

The Christian Church dominated medieval society. Supernatural ideas were common and this affected people's beliefs about the causes of illness.

God and the Church

The Church taught that God made them ill because he was either displeased with them or was testing their faith. This was believed and meant that few new ideas about the causes of disease appeared.

The Church discouraged dissection and in general did not approve of people challenging ideas and authority.

Unlike most people, monks and priests could read and write. Most large collection of books was kept in monasteries.

The Church promoted the ideas of Galen as his beliefs fitted Christian beliefs that the body had a soul and that all parts had been created by God to work together.

Many hospitals were housed in monasteries and nunneries.

Astrology

The alignment of planets and stars was thought to cause some diseases. Astrology was used to help diagnose what was wrong with a patient. Use of astrology wasn't new in 1250 but it increased during the Black Death when the Church became more accepting.

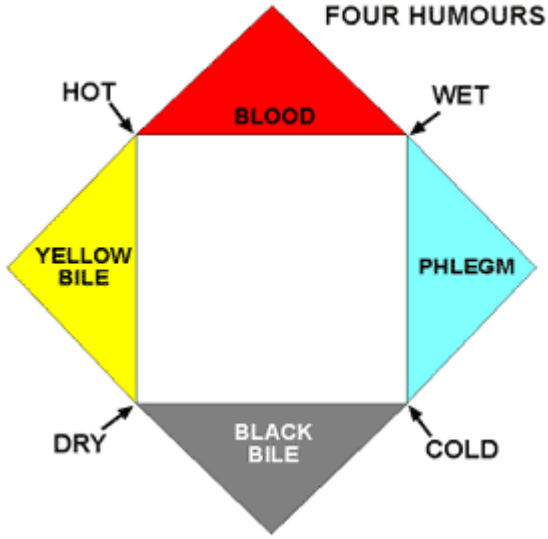
Rational explanations for disease

The Greek idea of "Natural Medicine"

What does ''natural medicine" mean?

- It means diseases have a "natural" cause and therefore natural treatments need to be applied. (The opposite to "supernatural" obviously!)
- It meant rejected "the Gods" as the cause (or cure) for diseases.

1. THE FOUR HUMOURS - (not actually invented by Hippocrates but he is most famous for putting the idea forward and encouraging his students to use it). It really is the "BIG IDEA" of the Greeks.

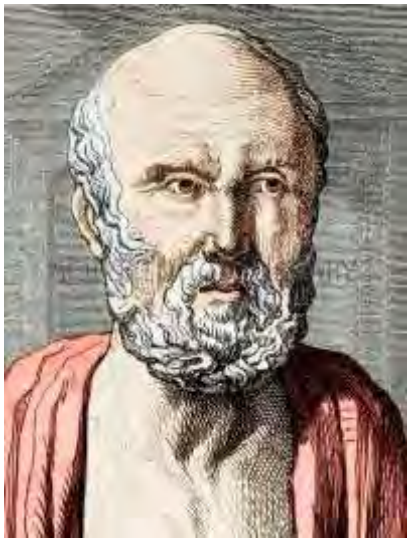


So what was it?

- The body has 4 "humours"(or fluids) that must be kept **in balance** for good health.
- The four humours are blood, phlegm, black bile and yellow bile.
- Illness is explained as the humours being **out of balance** (too much of one humour, too little of another etc.)
- Treatments included **blood letting** to get rid of excess bloods, **purging** with herbal medicines to get rid of "bile" by making you vomit or clearing the bowels (to put it nicely).
  Hot baths etc. to bring up phlegm etc.
- The humours were associated with the seasons (e.g. in the SPRING the hot moist season, you got an excess of blood - the hot, moist humour).
- Hippocrates stressed the use of OPPOSITES (hot dry food in the winter (the cold, moist season) and vice versa - hot and cold baths, vigorous exercise to bring up the temperature etc.).

What else did Hippocrates do?

He wrote the Hippocratic collection of books
He dismissed the ideas that Gods caused disease
He wrote the Hippocratic Oath where doctors swore to respect life and prevent harm
He believed in clinical observation and recording



Miasma

Another theory about the cause of disease was that it was transmitted by 'bad air. This was related to God because bad smells indicated sin. This theory continued well into the 19th century.

Who was Galen - why was he so important?

He was Greek by birth and became the most famous doctor in Rome in the 2nd Century AD.

He had experience treating GLADIATORS and worked for two Emperors.

He is famous and important for many reasons

- He did lots of work on ANATOMY (carrying out **dissections** (mainly on animals) but possibly human dissection as well at Alexandria)

- He proved that the **brain** controlled speech and that arteries carried blood.

- He was a great teacher - he told his students to **dissect humans** if possible - or animals 'close' to humans.

- He made **mistakes** - as Vesalius was to show centuries later.

- He added to Hippocrates work on the '4 humours' and **developed the idea of opposites. This shows how he led to the development of medicine.**

- He wrote 60 books on anatomy, the four humours, opposites, his own observations. These books were used, virtually unchallenged for 1500 years!

- He stressed how well designed the Human body was and that a **'Divine Creator'** must have been behind it. This **fitted in well with Christian ideas** and helps explain why his books were popular for so long.

Approaches to prevention and treatment

Methods to prevent illness

Traditional remedies

The most common remedies were traditional ones made with herbs, which were drunk, sniffed or bathed in. Remedies also included different foods to rebalance the humours and ointments to apply to the skin. They were made at home or mixed and sold by an apothecary.

Religious treatments

- Praying
- Fasting
- Going on pilgrimage
- Paying for a special Mass to be said

Supernatural treatments

Supernatural treatments included specific ideas for certain illnesses, such as hanging a magpie's beak around your neck to cure toothache.

Approaches to caring for the sick

Who treated the sick?

Barber-surgeons
- No training.
- Carried out bloodletting, pulling teeth and lancing boils. Also cut hair!
- Did basic surgery such as amputating limbs (very low success rate).
- Cost less than a physician.

Care in the home
- Most ill people throughout this period were treated at home by a female family member.
- The village 'wise woman', often the Lady of the Manor, would also tend to people in their homes for free.

Apothecaries
- Received training but no medical qualifications.
- Mixed medicines and ointments based on their own knowledge or directions of a physician.
- Cost money (but less than a physician).

Physicians
- Medically trained at university and passed exams.
- Diagnosed illnesses and gave treatments, or sent patients to the apothecary or barber-surgeon.
- Expensive, so mainly used by the wealthy.
- Very few of them, with women physicians incredibly rare.

What physicians did

1. Commonly, physicians observed a patient's symptoms and checked their pulse, skin colour and urine (for both colour and taste!).
2. They consulted urine charts in their vademecum (handbook).
3. They then consulted zodiac charts to help diagnose the illness and to work out the best time to treat the patient.
4. They then either treated patients themselves (though this was rare), or sent them to a barber-surgeon or apothecary.

Hospitals

Usually, people with infectious diseases or incurable conditions were not admitted.

Many hospitals were places where travellers and pilgrims stayed on their journeys.

Patients and their surroundings were kept very clean.

Hospitals were places of recuperation rather than places where patients were treated for disease.

The number increased during the Middle Ages.

Patients were given fresh food and plenty of rest.

Many were run by the Church, so the emphasis was on God and healing souls.

Some hospitals were built for specific infectious diseases.

THE BLACK DEATH

The main points here are what did people believe caused the Black Death. What did they do about it?

They had various explanations

- Most commonly - a 'punishment from God'
- Some blamed bad airs - poisonous clouds arising from fissures in the earth.
- The alignment of planets
- Poison - spread by the rich, the poor, Jews.
- Imbalance of the humours

They dealt with it in various ways

- Flagellants - religious fanatics whipping themselves
- Protecting themselves from 'bad airs' by setting up barriers of 'good airs 'with candles, incense etc.
- Isolating themselves
- Persecuting minority groups they thought were responsible for spreading the diseases - Jews etc.

- The usual treatments, bleeding, purging, herbal remedies.
- Carrying charms etc.
- Many people just gave up - they were going to get the Black Death anyway - so why not enjoy life while they still could?

DID ANYTHING GET BETTER IN THE MIDDLE AGES?

Yes

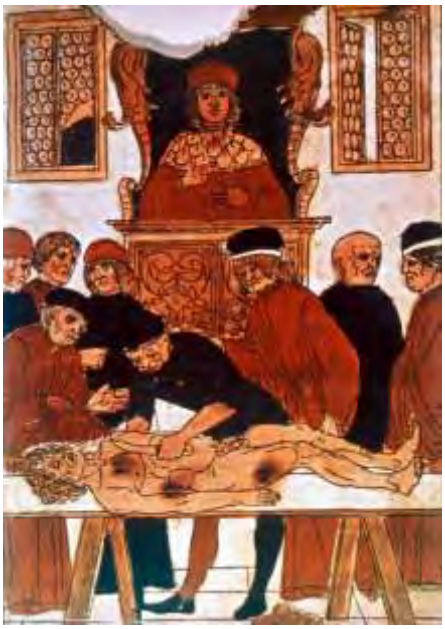
In the later Middle Ages (after about 1200 AD)

- Medical schools re-opened
- The works of Galen and Hippocrates were given more importance.
- A limited number of Human dissections were allowed (the bodies of criminals).
- Town conditions showed some improvement thanks to various rules and regulations.

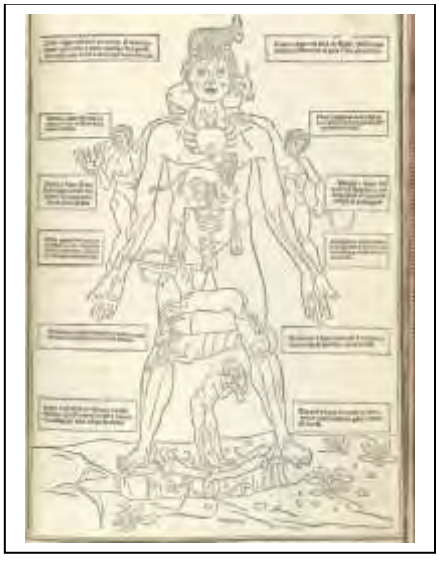
Anything else then about the middle ages?

Yes the medical schools.

- Teaching was inadequate and repetitious
- There was little chance for new ideas to be discovered.
- The "master" would sit in a high chair and read from the books of Galen while a demonstrator pointed to parts of the anatomy. (see right)



Explanation of diseases and treatments.



- Pretty much the same as the Greeks, the 4 humours, bleeding, use of opposites etc.
- Astrology The Zodiac man carried by doctors gave guidance on when and where to bled a patient (see left)
- Urine charts were used to aid diagnosis

Middle Ages- Test yourself!

1. In what ways did the Christian Church help and hinder medicine?

2. Give four reasons why Ancient explanations and ideas for disease dominated medicine in the Middle Ages?

3. Explain why people believed keeping clean would help them stay healthy.

4. List examples of people and conditions that would have been treated by each of the following: physicians, barber-surgeons, apothecaries, hospitals and home.

5. How did people try to treat the Black Death? What did people believe caused the Black Death?

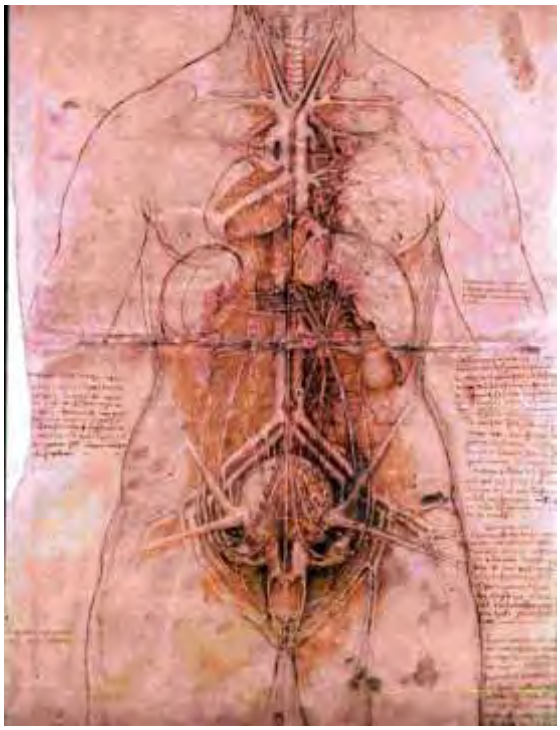
THE BIG AGE OF ADVANCEMENT IN MEDICINE, THOUGH, CAME WITH:

THE RENAISSANCE

This was the "RE-BIRTH" of knowledge. It began around 1500 AD, in Europe and was centred on ITALY to begin with.

The main points about "Medicine and the Renaissance"

- People rediscovered the knowledge of the ancient world.
- People begun to question what had come before and began seeking new answers.
- Doctors looked to rational as opposed to supernatural explanations.
- Technology had a hand - "printing" led to spread of ideas. The invention of mechanical pumps with valves gave clues to the working of the blood circulatory system.
- The impact of renaissance 'artists' like 'Leonardo Da Vinci' with their highly detailed and realistic drawing of the human body.(see right)
- Many more dissections were carried out.



Changes and Continuity in the ideas on causes of disease

CHANGE	CONTINUITY
Fewer people believed in supernatural causes of disease. This main change was the reduced power of the Church and a new scientific approach was adopted.	• Miasma theory- especially during epidemics. • The Theory of the Four Humours was an accepted explanation for disease, although by 1700 very few physicians believed in it.

During this period, new religious ideas challenged the authority of the Catholic Church. People were still religious but more open to accepting scientific approaches, rather than believing it was God who caused illness.

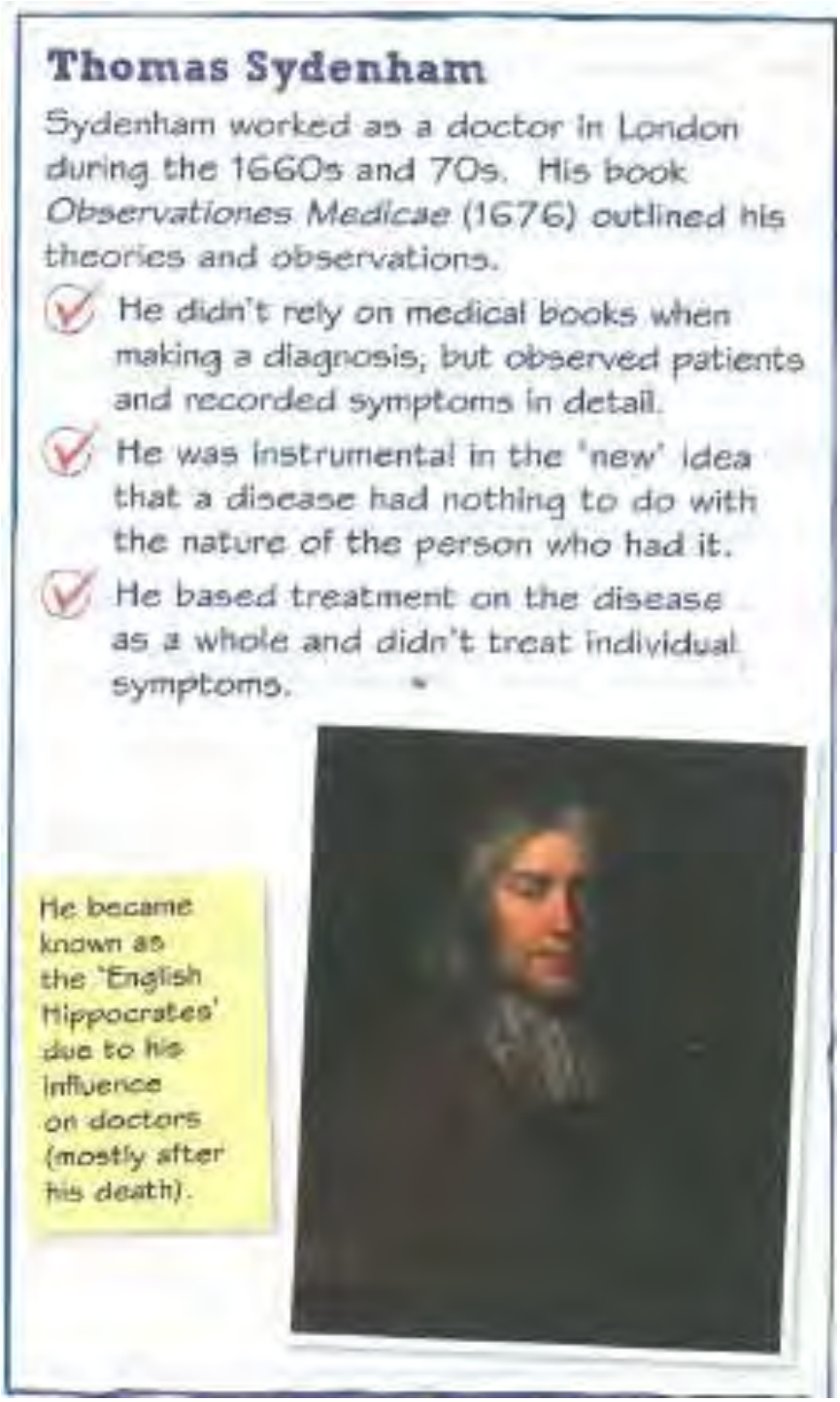
The work of Thomas Sydenham and the Royal Society

In this period:

- Fewer people believed in astrology and stopped using astrology charts for diagnosing and timing illness.
- Physicians realized urine was not a good indicator of disease and stopped using urine charts for diagnosis.
- Physicians carried out more observations on their patients, rather than relying on the patients explaining their symptoms.

Printing Press

- Invented by Gutenberg in 1440
- By 1500 there were hundreds of printing presses across Europe
- It meant exact copies of texts could be produced quickly.
- It meant books and ideas could be shared faster across a wider area.
- It reduced the Church's control of ideas, as it could not prevent the publication of ideas it did not approve of.



The Royal Society aimed to further scientific understanding by carrying out and recording the results of experiments, sharing scientific knowledge and encouraging new theories and ideas. It sponsored scientists to enable them to carry out research.

From 1665, the Royal Society published a journal called Philosophical Transactions, in which scientists could share their work and ideas. This meant a doctor could challenge and build on other's research.

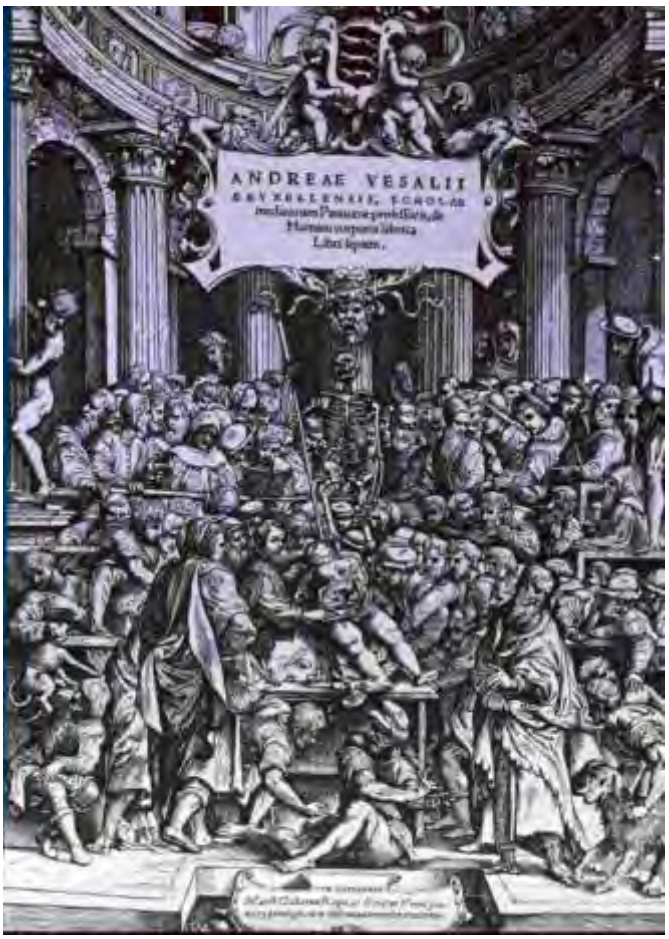
King Charles II granted the Royal Society a Royal Charter. He was interested in science and this approval helped the society gain credibility.

There are two great figures in the history of Medicine during this period –<u>Vesalius and Harvey.</u>

WHY <u>VESALIUS</u> IS SO IMPORTANT

- He **challenged Galen's ideas** about anatomy
- He carried out **dissections with humans** and he got his students to do the same
- He **proved Galen wrong** on several points, that the human jaw had two bones not one
- That sinews attached themselves to bones differently in humans and animals
- That the blood did not pass through the septum in the heart
- He was professor of anatomy at **Padua** (greatest of the medical schools) at an astonishingly young age
- His ideas were opposed by many doctors who could not bring themselves to admit that Galen might be wrong.

- He received backing from the Emperor Charles V of Spain for the publication of his Great Anatomical book "**The Fabric of the Human Body**" (title page on right**)**



- Published in 1542, this became the greatest anatomical text yet published and replaced Galen's work.
- He used the very latest technology; the best printing presses and woodcut techniques in the production of his book.

Below; Detail from the title page showing Vesalius himself carrying out a dissection.

WHY <u>HARVEY</u> IS SO IMPORTANT?

- He discovered the complete notion of **blood circulation**
- He showed that blood circulated **in one direction**, that the heart was a **pump**
- He showed the difference between arteries and veins and showed that blood

vessels had **'one-way' valves**

- He **disproved Galen's theory that blood was manufactured in the liver** by demonstrating the amount of blood that passed through the circulatory system in a given amount of time

<u>So</u> - were "Renaissance" ideas taken up quickly by doctors and surgeons throughout Europe?

• Not really - all three faced obstacles.

E.g. Vesalius

- Many doctors opposed him because he challenged the great 'Galen' who's ideas had survived for 1400 years

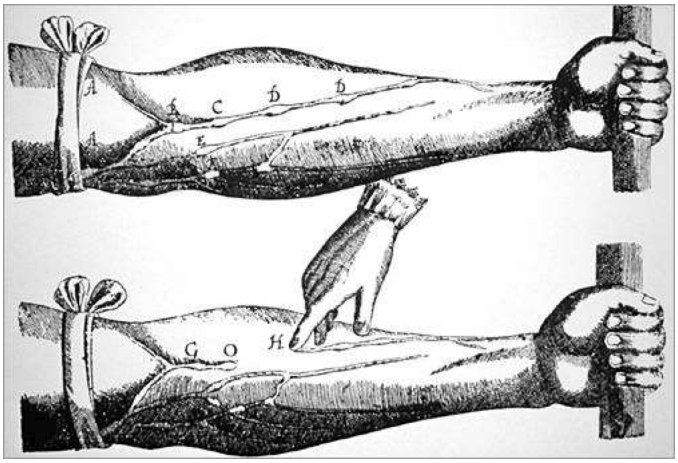
- Doctors were not used to new ideas or doing anatomical work themselves - they were just not trained to do so!
- He was so <u>young!</u> only 29 when his great book was published

E.g. Pare

- Fare's "ligatures" did stop bleeding after amputation - but the ligatures themselves carried infection into the wound and patients died from this (antiseptics weren't discovered until 300 years later!)
- (Once again) - Many doctors preferred the "tried and trusted" method of cauterising even if it was inhumane.

E.g. Harvey

- (Yet again!) He challenged Galen's theories and doctors didn't like it!
- His work was great in 'theory' but didn't have that much practical use to surgeons



Change and continuity in prevention, treatment and care

Change	**Continuity/ Lack of change**
• By 1500, hospitals were treating more sick people. Most had their own apothecary to mix medicines and physicians visited patients. • By 1536, the dissolution of the monasteries caused hospitals to close. Some free, charity funded hospitals were set up, but numbers remained low. • Pest houses began to appear, where people suffering from a particular disease could go. • More emphasis on removing miasma through draining swamps and removing rubbish. • New herbal remedies from newly discovered countries. • **The Theory of Transference** led people to try to rub objects on themselves to transfer the disease to the object. • Alchemy caused chemical cures using metals and minerals became popular.	• Herbal remedies • Bleeding and purging • Cleanliness • Superstitions and prayer • Healthy living **Lack of change** • Ideas were slow to be accepted. • There was no direct improvement in treating or preventing illness. • Discoveries did not improve the understanding of the causes of disease.

Don't forget the "Great Plague of London 1665'

Did people have the same reaction as they did to the Black Death in the C14th?

In some ways yes -

- A lot of people believed 'God' had sent the plague, the Lord Mayor ordered prayers to be said and of course red crosses and the words 'God have mercy upon us' had to be painted on the doors of plague houses
- Others blamed comets, movement of stars and planets
- Many people believed the plague was contagious (spread by close contact with infected persons)
- Others had the idea that the infection was "in the air" carried by "invisible creatures" which were breathed in or entered the body through the pares

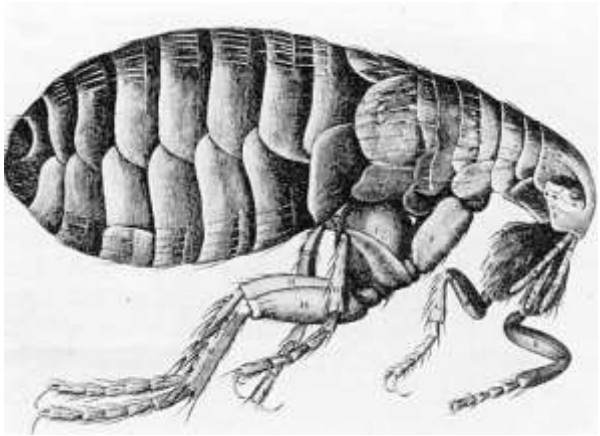
(Actually a good guess about the existence of germs but 200 years before the idea of germs was actually proved!)

Methods of prevention and care had similarities with past plagues as well

- Magical charms inscribed with the word ABRACADABRA
- Shutting up houses with the plague for a period of 2 days
- Carrying of 'posies' of sweet smelling spices to combat the bad air smells
- Keeping the streets clean and clearing the streets of dogs, cats and other animals who might be spreading the disease
- Keeping beggars out of the city
- Forbidding any activities that might encourage crowds to gather

(You could probably work out which methods of prevention might help and which would not for yourselves).

WHY DID THE PLAGUE DIE OUT THEN?



- Mainly the cold winter of 1665/6 which killed off the disease carrying fleas. (The real 'cause' of the plague was not found out for another 200 years!)

One more thing before moving on to the "Modern Age.

. **The death of Charles II 1685.**

This is interesting because the medical treatments given to the King by the "best doctors in the land (12 in all) was carefully recorded by one of them", Sir Charles Scarborough.

The range of treatments STILL seem primitive - a mixture of treatments based on the old Greek theory of the 4 humours, herbal remedies and downright superstition.

Examples of what was tried

- Blood letting - 'pints' of it, over and again!
- 'Purging of the bowels'
- Blistering of the head
- Herbal medicines including the "sacred tincture" and "spirit of Human Skull"
- The "Bezoar stone" (disproved by Pare a century before)

Unsurprisingly, Charles died!

Renaissance- Test yourself!

1. Write a sentence explaining what happened to belief in each of the following as a cause of disease during the Renaissance: Miasma, Theory of the Four Humours, God.

2. How did the invention of the printing press lead to developments in medicine?

3. Why were there few new treatments for disease in the period 1500-1700?

4. How does the work of Vesalius show differences between medicine in the Renaissance and Medieval times.

5. Can you list six prevention methods used to try to stop people from catching the Great Plague?

6. What factors led to Harvey making his discovery?

THE MODERN AGE - MEDICINE FROM THE 1790s TO THE PRESENT DAY

Medicine improved vastly in the 19th century in every field.
Here are UNDERLYING REASONS why there was such progress -

- Better understanding of the body - anatomists were learning for themselves now and had access to bodies of criminals to dissect! (Though some unscrupulous villains like "Burke and Hare" took to "grave-robbing" and then "murder" to provide doctors with "surprisingly fresh" corpses to dissect
  - for money of course!)
- The advance in the science of Chemistry - Greek theories of the "4 elements" and thus the 4 humours were disproved. Anaesthetic gases were produced
- Advances in Technology - especially the MICROSCOPE, but also things like steel instruments, hypodermic needles and thermometers

- Medical Training was widespread, scientific and highly regarded (even by the end of the 19th century for women!)
- Medicine became "big business" - millions of pounds was put into research for new remedies - many were useless - but some were breakthroughs
- Parliament - took an increasing interest in the "health of the nation" and passed laws about providing sewers, enforcing vaccinations etc.
- The vast growth of cities in the "industrial age" gave rise to new health problems that needed combating
- War - conducted in a larger scale than ever before gave rise to improvements on surgery and nursing
- Transport - trains, telegraph and the telephone led to much more rapid spread of ideas across the world

That is the basic situation - now a few details about "how disease was conquered"

SO - <u>What did people think caused disease?</u>

<u>Remember</u> - by the 1790s no one really knew what caused disease

- The 4 humours was out dated by now and only religious, fanatics blamed God for disease
- The most popular theories were "Bad-air" or "Miasmas" and "contagion"

• Around, the 1830s though - a 'new theory' was talked about "The Germ Theory" (at last!) - more about that later!

What were the worst diseases?

Familiarise yourself at this stage with the main killer diseases in the 19th century.

- Small pox
- Diphtheria
- Typhoid
- Typhus
- Flu

NB - These diseases were a lot worse in the 19th century because they were <u>all associated</u> with overcrowding, contaminated water supply and food and the filthy living conditions of the <u>Industrial towns and cities.</u>

How was infectious disease conquered?

A combination of factors

- The proving of the germ theory
- The discovery of vaccines and germ killing drugs ("magic bullets")
- Improvements in Public Health conditions

What is a vaccine?

Something introduced into the bloodstream that stimulates the body's natural defences against disease (the immune system) - usually a weakened form of the disease itself.

Who discovered them?

The first vaccine (against Smallpox) was discovered by <u>Dr. Edward Jenner</u> in 1796.

POINTS TO REMEMBER ABOUT JENNER AND THE SMALLPOX VACCINE

- He actually used 'cowpox' matter to vaccinate against smallpox
- He got the idea from his observations that milkmaids got cowpox but <u>never</u> smallpox
- He already knew about the more dangerous produce of 'inoculations' (using smallpox "matter" to prevent the disease)
- He proved his theory with a 'live test' on a healthy 8 year old boy called 'James Phipps'

• A big breakthrough then? So did everyone support him?

No! - There was lots of opposition! because.....

- People objected on moral/religious grounds - making out people would grow cows out of their bodies!
- Jenner couldn't explain <u>why</u> vaccination worked!
- Vaccination could be dangerous in the hands of careless doctors

Nevertheless in 1852 vaccination against Smallpox was made compulsory!

<u>KEY POINT</u> - It wasn't for over 80 years that another vaccine was developed!

Why did it take so long?

- Basically, because the smallpox vaccine was a "one-off, Jenner just acted on his observations, there was no theory as to how vaccines worked - not even a

knowledge of the existence of germs.

SO - new vaccines depended upon proving the

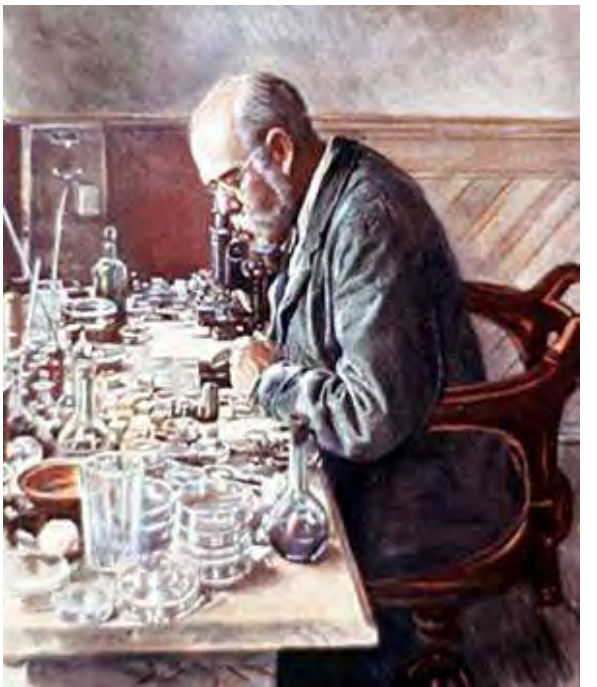
"Germ Theory"

The main man in proving this and developing future vaccines was, of course
LOUIS PASTEUR!
Hold on - what about the "germ theory" - how did that come about?

- **Technology** - especially the MICROSCOPE - only in the 1830s were microscopes capable of seeing germs finally developed (Joseph Lister made the first such microscope)
- **Doctors and scientists** (Pasteur was actually a CHEMIST) now observed micro-organisms - especially in putrid and diseased organic matter
- For a while some people claimed 'micro-organisms' were "spontaneously-generated" - being a by-product of disease and putrefaction rather than the cause
- To prove the "germ theory" it would be necessary to show that micro-organisms are everywhere (especially in the air) and didn't just "generate"

THIS IS WHERE PASTEUR MAKES HIS MARK!
How Pasteur got involved!

- In the 1850s Pasteur used his microscope to observe micro-organisms growing (or germinating) in vats of alcohol that were going bad.
- He showed the brewers how to kill the micro organisms by heating the liquid (a process still used today and called PASTEURISATION)
- He theorised that if micro organisms caused organic liquids to "go bad" then they were probably the cause of disease too
- In 1861, he proved that micro-organisms lived in the air with his experiment using sealed flasks. He published his results in the paper "The Germ Theory"
- He then went on to prove that for the first time that a particular micro



organism caused a disease in silk-worm

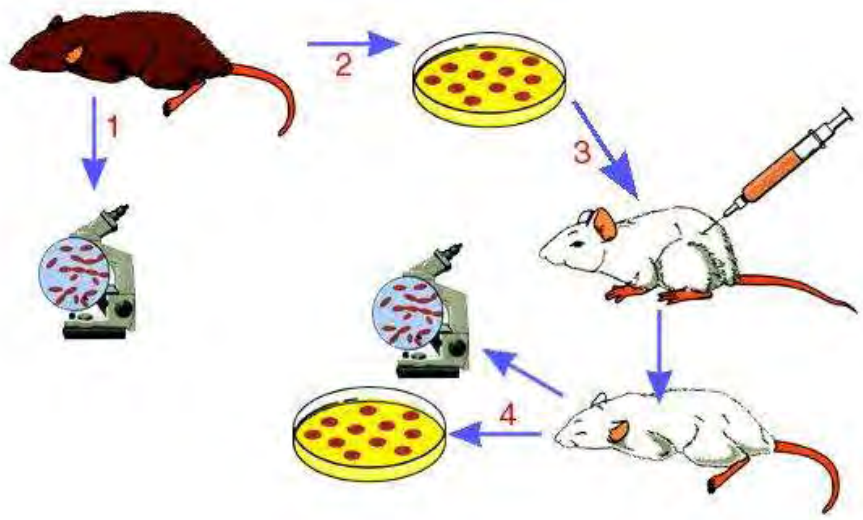
Still a long way from 'human' diseases and even further from producing a vaccine, though!

Here is where ROBERT KOCH steps in

- He was a German doctor who took up Pasteur's theory and began the hunt for specific germs that caused specific human diseases - He thus began the science of BACTERIOLOGY
- He developed CAREFUL SCIENTIFIC METHODS to hunt down germs between 1875-18 84

- Injecting 'germ cultures' into a series of animals to isolate the bacteria
- Developing a 'growth culture' for germs to grow on based on gelatine and potatoes
- Using cameras with microscopes to photograph germs
- Using chemical dyes to stain 'invisible' microbes

Between 1878 and 1883, he and his team positively identified the germs that cured Anthrax, Tuberculosis and Cholera
Other teams using his methods discovered the germs that caused other killer diseases e.g. Typhus, Tetanus, Pneumonia, Meningitis and finally The Plague



KEY POINT-KOCH'S SUCCESS SPURRED ON PASTEUR TO REDOUBLE HIS EFFORTS TO DISCOVER <u>ACTUAL VACCINES</u>

In 1879 came the breakthrough - a vaccine for ***<u>Chicken cholera.</u>***

- This happened partly by accident, old germs, left exposed to the air over the holidays were accidentally injected into chickens and proved to provide IMMUNITY from the full strength disease
- Pasteur, thanks to chance, <u>realised how vaccines worked</u> i.e. <u>Weakened Germs</u> (weakened for example by exposure to air) provide protection against disease

In following years Pasteur developed <u>two more</u> vaccines against diseases that affected Humans as well as animals.

<u>1881</u> - The Anthrax Vaccine

He proved his discovery by a public demonstration using 50 sheep (25 who were vaccinated and 25 who were not). As Pasteur predicted, the vaccinated animals survived. **Then in 1884 he developed the Rabies vaccine**

He proved its effectiveness on a boy called Joseph Meister, brought to him by his father, having been bitten by a rabid dog some days before. The disease having not yet taken hold. Pasteur risked treating him with his anti rabies vaccine. Thankfully for Joseph and Pasteur, he survived!

FROM VACCINATIONS TO CURES

Vaccines are <u>preventative</u> but they didn't cure. In the 1890s, a German doctor called **BEHRING** discovered **ANTI-TOXINS.** These are produced in the blood stream of animals to fight bacteria. He used these Anti-toxins from the blood of rabbits, to help cure **DIPHTHERIA.**

Reasons for the 1875 Public Health Act

Previously the government did not believe its role was to improve living standards and saw it as interfering in people's lives. They therefore preferred a 'hands off' policy **(laissez-faire**). During the 19th century, the attitude of government began to change due to several epidemics (e.g. cholera) and the increasing **scientific evidence** that these diseases were caused by poor living conditions. In addition, the increasing number of **men who could vote** influenced politicians. By 1875, people recognised that it was the government's responsibility to improve living conditions.

Fighting Cholera in London, 1854

Most people including the government believed cholera was caused by miasma; therefore, they tried to keep their homes and streets as clean as possibly.

The work of John Snow

- Snow was a popular and well-respected doctor and surgeon in London. He observed the cholera epidemic of 1848–49 and began work on his theory that cholera was spread through contaminated drinking water, not by miasma.
- When cholera broke out again in 1854 in Soho, where Snow lived, he mapped all the deaths and found a strong link to one water pump on Broad Street.
- He removed the handle from the pump so people couldn't collect water from it and the number of deaths fell dramatically.
- Later it was discovered that a cesspit close by was leaking waste into the well.
- In 1855, Snow presented his findings to the government.

The significance of John Snow's work

- Many cholera deaths in Soho were prevented after Snow stopped people using the Broad Street pump.
- Many did not believe Snow's theory. He had no scientific evidence to prove cholera was transmitted in water – the Germ Theory wouldn't emerge until 1861. Therefore, the government didn't act on Snow's recommendation to build a new sewer system for London.
- In the longer-term, Snow's work combined with other evidence (e.g. The Great Stink) and a new London sewer system was completed in 1875.
- Also, in the longer-term, Snow's work helped make the link between dirty water and disease, leading to the Public Health Act in 1875 when cities' authorities were finally forced to provide clean water.

18th and 19th century- Test yourself!

1. Explain three factors that led to the development of Germ Theory.
2. Explain two reasons why the Public Health Act of 1875 was important.
3. Explain the factors that led to the success of the smallpox vaccination in reducing cases of the disease.
4. Give two ways in which John Snow was significant and two ways in which his significance was limited.

In the twentieth century, Magic Bullets were discovered. These chemicals hunted and killed bacteria in the blood stream.

<u>The first Magic Bullet</u> was SALVERSAN 606,

Developed by **PAUL <u>EHRLICH</u>** in Germany in 1905 to cure SYPHILIS

He was part of Robert Koch's research team and experimented with
chemical dyes and then ARSENIC compounds
He was very methodical and tried 605 unsuccessful variations before finding
606 that worked!
It was thanks to **Dr. Hata,** his Japanese assistant who double-checked 606
that the cure wasn't missed!

The 2nd Magic Bullet

- Was PRONTOSIL - developed in 1932 by Gehardt Domagk which worked well against bacteria causing blood poisoning
- The first live test was on his own daughter, Hildegarde, who was dying of blood poisoning, she was saved - of course!
- Drugs called SULPHONAMIDES (of which Prontosil was one) were developed in the 1930s to cure scarlet fever, gonorrhoea and pneumonia

The most famous of all the 20th Century "Magic Bullets" was, of course, PENICILLIN

<u>Key Point</u>

It was developed in <u>two stages</u>

1. Discovery and initial work by Alexander Fleming (1928-29)

2. Development into a mass manufactured drug by Howard Florey and Ernst Chain (193 9-44)

A question often asked is which stage of development was more important?
Who deserves the credit?

This is a matter of individual judgement.

The case for and against Fleming:

For

- He discovered the penicillin mould on a culture dish in 1928
- He observed it's actions in killing bacteria in the culture dish
- He wrote articles about the action of penicillin and that it might be useful in medicine. It was these articles that were read by Florey and Chain

Against

- He wasn't actually the first to notice penicillin, back in 1880 Joseph Lister had used the mould
- The penicillin mould grew on the culture dish entirely by accident
- He didn't go on to develop penicillin into a drug that could actually be used

The case for and against 'Florey and Chain'

For

- They picked up on Fleming's articles and gathered together a team of scientists to develop the drug
- They refined the mould into a useable drug and carried out tests on mice and, in 1941, conducted a human trial
- Florey flew to America in 1941 and persuaded the huge American drugs companies to mass produce penicillin

Against

- Without Fleming's work they would never have got started
- The outbreak of World War 2 was a major factor without which there wouldn't have been the imperative to develop the drug nor the financial

backing of the U.S. government to ensure mass production

Whoever was most responsible, a lot of factors came together to enable penicillin to develop:

- Chance
- Scientific experiment
- Careful observation
- Technology
- Industry
- Government support
- War

Penicillin was widely used by 1943 and saved the lives of 10s of 1000s of allied soldiers.

After the war it became available for civilians - it became known as the first ANTIBIOTIC.

Since Penicillin

Many 1000s of antibiotics have been developed that all work in the same way - killing germs in the body. BUT - there are still problems.

- Over-use of antibiotics has led to drug resistant "super-bugs"
- A wide range of diseases cannot be treated by anti-biotics - there are diseases caused by VIRUSES - such as Flu. AIDS and the Cold!

There have been other treatments against disease developed in the past 50 years to bring up to date e.g.

- Drugs based on hormones
- Genetic engineering - manipulating the genes of DNA to prevent inherited diseases
- Radiation therapy against cancer

SURGERY IN THE 19TH CENTURY- anaesthetics and antiseptics

There were 3 basic problems not yet solved in 1800. They were ***pain, infection***

and blood loss.

The problem of PAIN was difficult for surgery

- Patients struggled
- Some died from heart attacks
- Surgeons had to work extremely quickly
- Deep operations were impossible

The problem was solved by the development of ANAESTHETICS!

First up - "Laughing Gas" or "Nitrous Oxide" discovered to be useful by HUMPHREY DAVY in 1799. Used widely by dentists, but not strong enough for surgeons.

Next up - ETHER, first used in 1846 for a neck tumour operation in the USA by Dr. Warren and Dr. Morton, then in 1847, by J. R. Listen in London for a leg amputation.

Problems with Ether

- Lung irritation - caused coughing in the patient
- It was inflammable!

Third up - CHLOROFORM

Famously discovered by James Simpson of Edinburgh in 1847 who had; taken to experimenting with chemical gases and inhaling them!

- Chloroform used widely for childbirth
- Opposed by many male doctors on religious grounds (women should have pain in childbirth, it was Gods punishment for the sin of Eve!)

- Opposed by others as an untested and potentially dangerous substance. Some patients did die from chloroform

Widely accepted when Queen Victoria herself had chloroform for the delivery of her eighth child in 1857!

***RIGHT* - Painless surgery at last! That should lead to great improvements then.**

Actually not - the 1850s and 1860s saw a great rise in surgical deaths - the so-called "**BLACK AGE OF SURGERY**"

Why was this?

- Doctors, using anaesthetics no longer had to work so quickly
- They also attempted new operations much deeper inside the body.

THIS LED TO MUCH GREATER INCIDENCE OF INFECTION AND DEATH AFTER OPERATIONS!

INFECTION had to be conquered next.

Sources of infection in the 19th Century operating rooms were everywhere:

- On surgeon's coats
- On surgical instruments
- On the (wooden) operating table
- In the air.

In Austria, in the 1840s, a doctor called Semmilweiss was fanatical about surgeons washing their hands and keeping hospitals clean, but at the time, he was disregarded as mentally unstable!

The real breakthrough was **JOSEPH LISTER AND ANTISEPTICS (1865)**

Key Facts

- Lister knew of PASTEUR'S PROOF OF THE GERM THEORY in 1861
- He knew of the use of the chemical CARBOLIC ACID used to clean sewers in Carlisle
- His father had been a pioneer of the improved microscope and he studied germs himself
- So in 1865 he used CARBOLIC ACID spray to prevent infection of wounds during operations
- His first successful operation was on a boy of 11 knocked down outside his hospital who had a compound fracture of the leg.

Another great breakthrough, but as was always the case, there was opposition.

Reasons for opposition to 'Carbolic Acid Spray'

- Lister seen as a 'fanatic' or else arrogant
- He didn't give public displays of his achievements
- Carbolic spray caused irritation of the eyes and skin
- It added expense to operations
- It slowed operations down
- Many surgeons didn't 'believe' the germ theory

Nevertheless, his ideas gradually became accepted.

ASEPTIC techniques became more widespread by the end of the century (Removing germs from the operating theatre).
i.e.

- Operating theatres and hospitals rigorously cleaned
- 1887 - 'steam-sterilising' of instruments introduced
- 1894 - 'rubber gloves' introduced

BLOOD LOSS - The last problem to overcome

- Transfusions had been tried in the 1800s but patients often died, no one knew why!
- Breakthrough came in 1901, scientists discovered the different BLOOD GROUPS
- Then during the 1st World War a method of storing blood by separating the red blood cells from the PLASMA

ANY OTHER MAJOR SURGICAL ADVANCE?

YES - **X-rays!** - **Wilhelm Roentgen,** a German scientist, discovered them in 1895.

- Roentgen was experimenting with 'Cathode Ray' tubes and called them 'X'' rays because he didn't know what they were
- 'Women' objected to X rays as they thought men could use them to see underneath their clothing!
- X rays proved invaluable for the wounded soldiers of World War 1, bullets and shrapnel could be located deep inside the body.

BRINGING SURGERY UP TO DATE

Warfare - Especially World Wars 1 and 2 led to great improvements

WW1 X rays band blood transfusions were widely used for the first time The millions of wounded gave surgeons the chance to try new techniques e.g. SKIN GRAFTS, BRAIN SURGERY and new techniques for broken bones. Great advances made in artificial limbs, deep infections caused by battle wounds led to 'Gas Gangrene'. Surgeons learned to cut away-infected tissue and soaked the wound in saline solution.

WW2 Saw the development of plastic surgery for burn wounds. Improvements in dealing with shrapnel wounds from bomb blasts. AND te widespread use of PENICILLIN for the first time in 1944.

Since World War Two, huge advances in surgery have been made.

For Example

- Improved anaesthetics including injection of anaesthetics into the bloodstream - developed by Helmuth Wesse in the 1950s.

- **Spare part and transplant** surgery, here are a few key 'firsts'

1954 - First kidney transplant
1950 - Replacements hip joints
1957 - First coronary bypass operation
1961 - First successful heart 'pace-maker'
1963 - First liver transplant
1968 - World's first HEART TRANSPLANT by Professor Christian Barnard of South Africa (see right)
1982 - First heart/lung transplant.

Very recent advances include

'Keyhole Surgery' - using small incisions - miniaturised surgical instruments and fibre-optics. **The ENDOSCOPE** is a flexible tube with a camera that can see inside the body. It can be fitted with instruments to conduct surgery by remote control!

Microsurgery Makes possible the rejoining of nerves and tiny blood vessels for the first time. The first 'head transplant' should be possible soon (it has been done with monkeys!)

Laser-surgery Used in eye operations, sealing blood vessels etc.

Medical Training, Medicines, Hospitals and Nursing

This section concentrates on the 19th Century when most changes came about.

Doctors and Training

- Most trained as 'apprentices' - attending lectures and walking round hospital wards with experienced doctors and surgeons. Until the late 19th Century they were all male - even 'midwives' were male!
- In 1852 the 'Medical Registration Act', the government required all doctors to be registered to one of the colleges of Physicians, Surgeons or apothecaries. Only males were accepted.
- The big story about Medical training in the 19th century was the story of how women first became doctors.

Why was it so difficult for women to become doctors?

Many reasons -

- Women were less well educated - few ever got to university
- Medicine was a 'closed profession' - women were refused admittance to medical schools
- In built male prejudice in a male dominated world

- Women were thought to be too faint-hearted and delicate to deal with blood and disease
- Women were thought to be intellectually incapable
- Male patients would not accept women doctors
- A woman's role was thought to be 'in the home'.

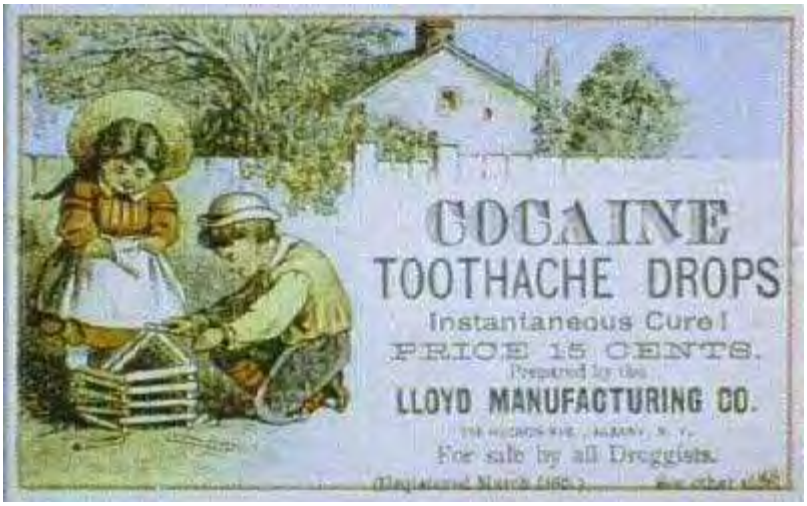
Medicines

Throughout most of the 19th Century, there were no controls whatsoever on the sale of medicines. **'Quack'** doctors supplied all sorts of so-called 'PATENT MEDICINES' and 'CURE-ALLS'.

- Cures were claimed for a vast range of diseases
- Any ingredients could be put in - some were very dangerous and caused illness and death. Not to mention addictive such as the toothache cure below!
- Vast fortunes were made

- They were available everywhere and widely advertised in the newspapers

KEY POINT- PEOPLE TURNED TO PATENT MEDICINES BECAUSE QUALIFIED DOCTORS COULD NOT CURE MANY ILLNESSES!



Things did change though

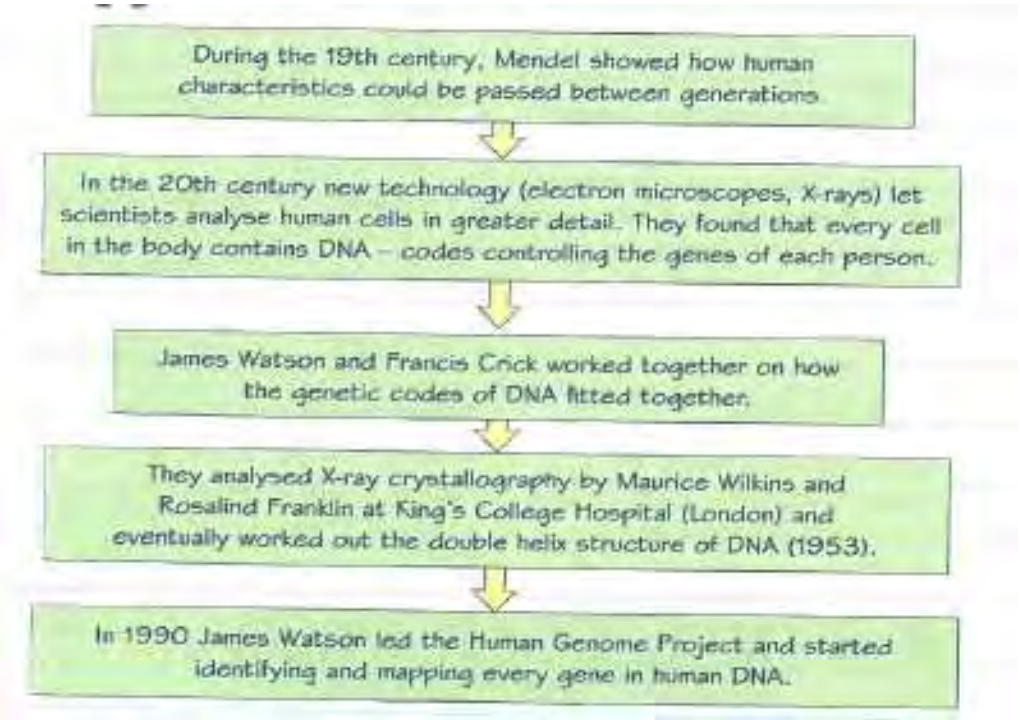
- In the 1880s the government brought medicines under legal control
- The first effective chemical medicines were being produced in the 1880s,,

ASPIRIN was developed at this time

- By 1900 companies like **BOOTS** were mass producing effective drugs

By 1900, the correct cause of many diseases had been discovered and the knowledge had been used to produce effective vaccines to prevent certain diseases. By the 20th century, new searches were on…

Genetics and life styles

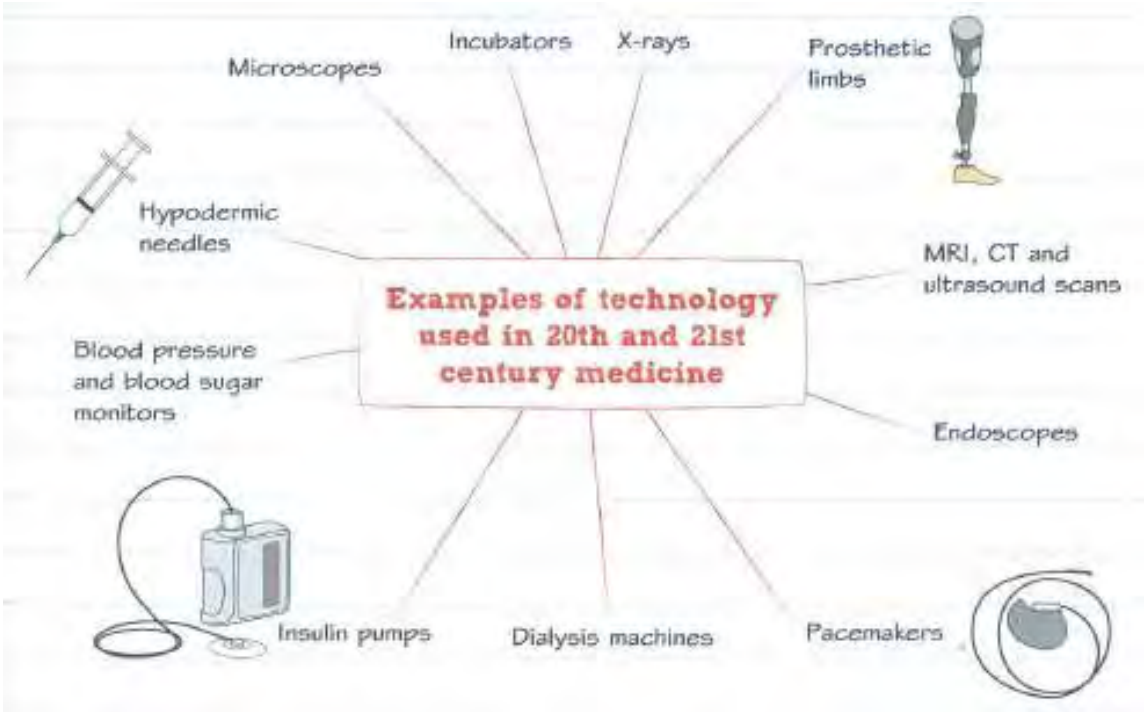


So what has the discovery of DNA and the work of the Human Genome Project led to?

- ✓ Better understanding of some genetic conditions, e.g. Down's syndrome
- ✓ Predicting if a person is at a higher risk of developing some cancers
- ✓ Stem cells can be grown into different cells

However, we still do not have a cure or effective treatment for most genetic conditions and we have no way to prevent them.

What medical technological advancements were there in the 20th and 21st century?



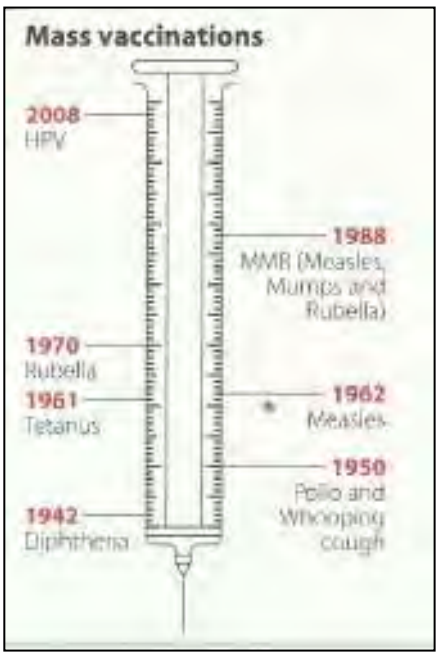
Preventing disease in the 20th century

The NHS

- Since 1948, taxes have funded healthcare, such as:
- Seeing a GP
- Hospital care and operations
- Health visitors
- Ambulances/ emergency treatment
- Health care for the elderly

The NHS improved healthcare for so many people because it was free.

COMPULSORY VACCINATIONS



Although many vaccines have successfully prevented some diseases in the late 19th and early 20th centuries, people had to pay to receive them and many people could not afford this.
In 1938, 3000 people died from diphtheria, which led to a government funded immunisation programme. Many others have followed this.

Lifestyle campaigns

Since 1948, the government has funded publicity to raise awareness of illnesses and dangers to health, such as smoking and binge-drinking, with some success: the 1980s 'AIDS: don't die of ignorance' campaign reduced cases of HIV infection.

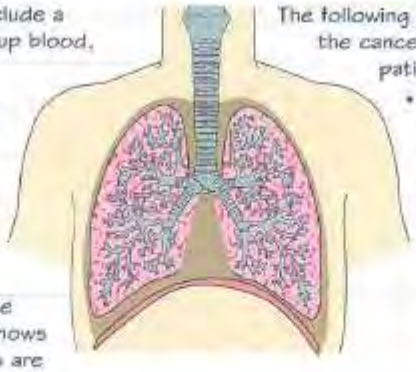
More recently, events and initiatives such as the Change4Life campaign, have encouraged healthy behaviour to prevent disease.

Lung Cancer

The 20th century saw a huge rise in the number of lung cancer cases. Today it is the second most common cancer in the UK and has a poor survival rate compared to other cancers. The majority of cases are caused by smoking or passive smoking.

Diagnosis

Symptoms of lung cancer include a persistent cough, coughing up blood, breathlessness, tiredness, unexplained weight loss and repeated chest infections, but these can be symptoms of many other conditions, too, and the cancer is often very developed when symptoms show up. If lung cancer is suspected, most patients are given a CT scan and if this shows a mass, a sample of the cells are collected and tested.



Treatment

The following are treatments that can cure the cancer or prolong the life of the patient.

- Surgery to remove the tumour or carry out a lung transplant.
- Radiotherapy to try to shrink the tumour or prevent its growth.
- Chemotherapy to try to shrink the tumour, or prevent the cancer returning.

Prevention

The UK government has tried various methods to reduce the number of people smoking, to prevent them developing lung cancer.

- TV advertising for cigarettes was banned in 1965, and for cigars and tobacco in 1991. All forms of advertising have since been banned.
- Tax on tobacco products is regularly increased to make smoking more expensive and to encourage people to stop.
- In England in 2007, smoking was banned in public places where people worked and this ban was extended in 2015 to cars carrying under-18s.
- In 2007, the legal age for buying tobacco products was raised from 16 to 18.
- Various campaigns have been funded to educate people about the risks of smoking, to encourage them to stop or not to start.
- Today, shops are not allowed to publically display tobacco products.
- Cigarette packaging became standardised in May 2016, all cigarettes are sold in green packets and with graphic warnings of the dangers, whatever the brand.

Hospitals and Nursing

Hospitals in the early 19th Century were places where

- Surgery was carried out and patients recovered from surgery
- Medicine was taught to 'trainees' by experienced doctors and surgeons
- People came to die!
- Nursing was pretty awful!

- ***Why was nursing of a poor standard and who improved it then?***

- Nursing was not regarded as a very important profession
- It was thought to be a definite 'no-no' for "genteel" educated ladies of the middle classes
- Nurses were ill-educated, poorly paid and of low status. It was said that only women who could not get a job as a household servant would consider nursing.

NURSING WAS TRANSFORMED BY FLORENCE NIGHTINGALE

Here are the key points to remember about her story.

- She was untypical - the daughter of a wealthy banker who turned her back on marriage and raising a family
- She became a 'hospital visitor' and was appalled at nursing standards
- Despite family disapproval she trained as a nurse in Germany 1851
- In 1854 she took a group of nurses to the CRIMEA in Russia, where Britain was fighting a war
- She transformed the military hospital at SCUTARI insisting on absolute cleanliness, nourishing food, proper equipment and a caring attitude
- She became a national heroine and was called THE LADY WITH THE LAMP
- She returned to Britain and transformed nursing in hospitals
- In 1860 she published her great book on nursing called "Notes for Nursing"
- She also set up the first "Nightingale Training School" for nurses
- She helped design better hospitals
- In 1907 at the grand old age of 87 she was awarded "THE ORDER OF MERIT"

The British army hospital at Scutari, before and after the arrival of Florence Nightingale and her team of nurses

c1900-Present- Test yourself!

1. Give three examples of ways in which hospitals had improved by the end of the 19th century.
2. Why was surgery more successful by 1900?
3. Explain the role of Fleming, Florey and Chain in the development of penicillin.
4. Give three reasons why the discovery of DNA is important for medicine.
5. Give three methods used to diagnose illness in the period 1900 to the present day.
6. Describe the factors that made the advances in treatments since 1900 possible.
7. Give reasons why, on average, people live much longer in Britain today than in 1900.
8. How has the government tried to prevent lung cancer?