Hippocrates made such an impression on medical history that his name is still very much associated with medicine today. All newly qualified doctors take what is called the ‘Hippocratic Oath’ and some see Hippocrates as the father of modern medicine even though he did most of his work some 430 years before the birth of Christ.

Greek doctors had started to look at the issue of poor health and disease by using a process of reasoning and observation. The most famous of these was Hippocrates. He is thought to have been born in Cos in 460 BC. In fact, we know very little about Hippocrates as a person but his fame was such that Plato and Aristotle wrote about him. While Hippocrates has found fame in medical history, there were other Ancient Greek doctors who were not so lucky.

Ancient Greek medical knowledge is demonstrated in what is known as the Hippocratic Collection. This is a collection of sixty medical books of which Hippocrates wrote just some. We do not know who wrote most of them but they cover a time span of 150 years so they could not have all been written by Hippocrates.

Hippocrates and other Greek doctors believed that the work done by a doctor should be kept separate from the work done by a priest. They believed that observation of a patient was a vital aspect of medical care. Ancient Greek doctors did examine their patients but Hippocrates wanted a more systematic period of observation and the recording of what was observed. Today, we would call this ‘clinical observation’. Such ideas have lead to Hippocrates being called the ‘Father of Medicine’.

The Hippocratic Collection gave Greek doctors detailed advice on what to do with their patients:

"First of all the doctor should look at the patient’s face. If he looks his usual self this is a good sign. If not, however, the following are bad signs – sharp nose, hollow eyes, cold ears, dry skin on the forehead, strange face colour such as green, black, red or lead coloured. If the face is like this at the beginning of the illness, the doctor must ask the patient if he has lost sleep, or had diarrhoea, or not eaten."

From "On forecasting diseases".
In the book "On Epidemics", doctors were told to note specific symptoms and what was observed on a day to day basis. By doing this they could make a natural history of an illness. Hippocrates and other doctors believed that by doing this they could forecast the development of the illness in future:

"I believe that it is an excellent thing for a physician to practice forecasting. He will carry out the treatment best if he knows beforehand from the present symptoms what will take place later."

From 'On forecasting diseases'

The ideas of Hippocrates and others spread in the eastern Mediterranean and others took to writing down what they saw with regards to illnesses. These writings have survived and have given historians a vast resource to study.

Hippocrates and other doctors worked on the assumption that all diseases had a natural cause rather than a supernatural one. Priests believed that an illness such as epilepsy was caused by the gods. Hippocrates believed that with all other illnesses it had a natural cause.

"Men believe only that it is a divine disease because of their ignorance and amazement."

From 'The Sacred Disease'.
Galen (c. 129–c. 200)

Greek physician and anatomist whose ideas dominated Western medicine for almost 1,500 years. Central to his thinking were the threefold circulation of the blood and the theory of humours (blood, phlegm, choler/yellow bile, and melancholy/black bile) that contributed to mental and physical state. His *On Anatomical Procedures*, a detailed description of animal dissections when work on human corpses was forbidden, became a standard text on anatomy when rediscovered in Western Europe in the 16th century. He remained the highest medical authority until Andreas *Vesalius* and William *Harvey* exposed the fundamental errors of his system.

Galen postulated a circulation system in which the liver produced the natural spirit, the heart the vital spirit, and the brain the animal spirit. He also wrote about philosophy and believed that Nature expressed a divine purpose, a belief that became increasingly popular with the rise of Christianity (Galen himself was not a Christian). This helped to account for the enormous influence of his ideas.

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Claudius Galen was a Greek physician who went to Rome and revived the ideas of Hippocrates and other Greek doctors. The Romans had shown little interest in the work of Hippocrates and it took Galen to push it forward in Rome.

Galen was born in 131 AD. He was a gifted intellect who studied at the famous medical school in Alexandria in Egypt. At the age of 28, Galen became the surgeon to a school of gladiators but in 161 AD he moved to Rome apparently with the sole intention of seeking fame and fortune. He certainly achieved his fame but for some Romans this became too much. As a Greek, many Romans viewed Galen with suspicion and in 166 AD, he was forced to flee the city. Two years later he went back to the city in response to an invitation by the emperor. With this protection, Galen remained in the city until his death, aged about 70, in 201 AD.

Galen revived the methods favoured by Hippocrates and other Greek doctors who lived at the time of Hippocrates. He put great emphasis on clinical observation – examining a patient very thoroughly and noting their symptoms. Galen also accepted the view that disease was the result of an imbalance between blood, phlegm, yellow bile and blood bile. Galen also believed in the healing power of nature and he developed treatments to restore the balance of the four humours. Galen believed in the use of opposites – if a man appeared to have a fever, he treated it with something cold; if a man appeared to have a cold, he would be treated with heat. People who were weak were given hard physical exercises to do to build up their muscles. People who had breathing problems due to a weak chest were given singing exercises.

Galen extended his knowledge of anatomy by dissecting pigs and apes and studying their bone structure and muscles. Galen was also interested in human anatomy but there is no evidence that he dissected human bodies – though rumours persisted that he did. In "On Anatomical Procedures", Galen advised his students to dissect apes but take whatever opportunities that existed to study the human body. Galen also studied how the body worked, concentrating on the movement of blood and the working of the nervous system. For the latter, he experimented with the spinal cords of pigs.

Galen’s influence was great. Protected by the emperors, he could work free from his jealous rivals in Rome. Galen also believed that his knowledge should be shared and he was a prodigious writer of books. These books were still being used in the Middle Ages and, for many medical students, they were the primary source of information on medicine.
Ancient Greece, as with Ancient Rome and Ancient Egypt, played an important part in medical history. The most famous of all Ancient Greek doctors was Hippocrates. By 1200 B.C., Ancient Greece was developing in all areas - trade, farming, warfare, sailing, craftsmanship etc. Their knowledge of medicine developed accordingly.

Gods dominated the lives of the Greeks. Natural occurrences were explained away by using gods. This, however, did not occur in medicine where Ancient Greek physicians tried to find a natural explanation as to why someone got ill and died.

The Greeks were practicing medicine 1000 years before the birth of Christ. In the 'Iliad' by Homer, injured soldiers were treated by doctors and the Greek leader in the tale, Menelaus, was treated for an arrow wound by a doctor-in-arms, Machaon.

However, not all Ancient Greeks turned to physicians when ill. Many still turned to the gods. The god Apollo was consulted at a temple in Delphi and by the sixth century B.C., many turned to the god Asclepios for help. Places called asclepeia were built for those in poor health. These were like temples and here people came to bathe, sleep and meditate. The poor were also allowed to beg for money in these buildings. Those who went to asclepeia were expected to leave offerings to Asclepios. The asclepeia were run by priests. Patients to asclepeia were encouraged to sleep as it was believed that during sleep they would be visited by Asclepios and his two daughters, Panacea and Hygeia. A visit by these three was expected to cure all ailments. Those who were not cured could stay at the asclepeia where they were. Written accounts have survived of those who were cured:

**Hermodicus of Lampsacus** was paralysed in the body. When he slept in the temple the god healed him and ordered him to bring to the temple as large a stone as he could. The man brought the stone which now lies before the abaton (where people slept).

During the period 600 B.C. to 400 B.C., the Ancient Greeks also made great advances in philosophy.
The Ancient Romans, like the Ancient Greeks and Ancient Egyptians, made a huge input into medicine and health, though their input was mainly concerned with public health schemes. Though the Roman ‘discoveries’ may not have been in the field of pure medicine, poor hygiene by people was a constant source of disease, so any improvement in public health was to have a major impact on society.

The Romans learned a great deal from the Ancient Greeks. They first came into contact with the Greeks in about 500 BC. By 146 B.C. part of Greece had become a province of the Roman Empire and by 27 B.C., the Romans were in control not only of Greece but of Greek-speaking lands around the Mediterranean. They used the ideas of the Greeks but they did not simply copy them. Greek ideas they found impractical they ignored and it seems that the Romans were more keen on things that would lead to the direct improvement of the quality of life of the people in their huge empire.

"The Greeks are famous for their cities and in this they aimed at beauty. The Romans excelled in those things which the Greeks took little interest in such as the building of roads, aqueducts and sewers."

Strabo – a Greek geographer.

Though Strabo may have been less than accurate, it does seem that the Romans were more practical especially as the Romans do seem to have been more interested in mathematics and solving practical problems.

"The Greeks held the geometer in the highest honour, and, to them, no-one came before mathematicians. But we Romans have established as the limit of this art, its usefulness in measuring and reckoning. The Romans have always shown more wisdom than the Greeks in all their inventions, or else improved what they took over from them, such things at least as they thought worthy of serious attention."

Cicero, Roman writer.

In the early years of the Roman Empire there were no people in what would be a separate medical profession. It was believed that each head of the household knew enough about herbal cures and medicine to treat illnesses in his household. The Roman writer Pliny wrote:
"Unwashed wool supplies very many remedies.....it is applied....with honey to old sores. Wounds it heals if dipped in wine or vinegar....yolks of eggs....are taken for dysentery with the ash of their shells, poppy juice and wine. It is recommended to bathe the eyes with a decoction of the liver and to apply the marrow to those that are painful or swollen."

As the Roman Empire expanded into Greece, many Greek doctors came to Italy and Rome. Some of these were prisoners of war and could be bought by wealthy Romans to work in a household. Many of these doctors became valuable additions to a household. It is known that a number of these men bought their freedom and set up their own practices in Rome itself. After 200 BC, more Greek doctors came to Rome but their success at the expense of Romans did generate some mistrust.

Pliny did not trust Greek doctors:

"I pass over many famous physicians men like Cassius, Calpetanus, Arruntius and Rubrius. 250,000 sesterces were their annual incomes from the emperors. There is no doubt that all these physicians in their hunt for popularity by means of some new idea, did not hesitate to buy it with our lives. Medicine changes everyday, and we are swept along on the puffs of clever brains of the Greeks.....as if thousands of people do not live without physicians – though not, of course, without medicine."

However, despite Pliny’s caution, many Greek physicians had the support of the emperors and the best known doctors were highly popular with the Roman public. Pliny wrote that when Thessalus walked around in public, he attracted greater crowds than any of the famous actors and chariot riders based in Rome.

The Romans and Public Health:

The Romans were great believers in a healthy mind equalling a healthy body. There was a belief that if you kept fit, you would be more able to combat an illness. Rather than spend money on a doctor, many Romans spent money on keeping fit.

"A person should put aside some part of the day for the care of his body. He should always make sure that he gets enough exercise especially before a meal."

Celsus.
The Romans did believe that illnesses had a natural cause and that bad health could be caused by bad water and sewage. Hence their desire to improve the public health system in the Roman Empire so that everyone in their empire benefited. – not just the rich. Those who worked for the Romans needed good health as did their soldiers. In this sense, the Romans were the first civilisation to introduce a programme of public health for everyone regardless of wealth.

Roman cities, villas and forts were built in what were considered healthy places. The Romans knew not only where to build but also where not to build:

"When building a house or farm especial care should be taken to place it at the foot of a wooded hill where it is exposed to health-giving winds. Care should be taken where there are swamps in the neighbourhood, because certain tiny creatures which cannot be seen by the eyes breed there. These float through the air and enter the body by the mouth and nose and cause serious disease." Marcus Varro.

"There should be no marshes near buildings, for marshes give off poisonous vapours during the hot period of the summer. At this time, they give birth to animals with mischief-making stings which fly at us in thick swarms."

Columella.

The Romans became practised at draining marshes to rid areas of malaria-carrying mosquitoes. Julius Caesar drained the Codetan Swamp and planted a forest in its place.

The Romans paid especial attention to the health of their soldiers as without these soldiers, the Roman Empire could collapse. Great emphasis was placed on soldiers having access to clean water and being able to keep fit. Commanders ordered their junior officers not to set up a camp too near a swamp and the drinking of swamp water was especially discouraged. Soldiers were moved around as it was believed that if they stayed too long in one place, they would start to suffer from the illnesses that might have existed in that area.

Clean water was very important to the Romans.

"We must take great care in searching for springs and, in selecting them, keeping in mind the health of the people."
Cities, towns and forts were built near springs. However, as Roman cities and towns grew, they needed to bring in water from further afield. As the population grew, so did the need for clean water. Trying to shift large volumes of water underground in pipes was not possible as lead pipes would be too weak and bronze pipes would be too expensive. The Romans could not make cast iron pipes as the techniques for doing this were not known to them. If water could not be brought via pipes, the Romans decided to bring it overland in what were conduits. When the water got to the city, it was fed off into smaller bronze or ceramic pipes. To get the water to flow at an even (and slow) pace, conduits were built on a slight slope. Valleys were crossed by using aqueducts. One of the most famous of these is the Pont du Gard aqueduct at Nimes in southern France. Where possible, the Romans did take water through tunnels but the hills needed to be relatively small for this to be successful.

Rome, as the capital of the empire, had to have an impressive water supply. The supply was designed by Julius Frontinus who was appointed Water Commissioner for Rome in 97 AD. The aqueducts that fed Rome carried an estimated 1000 million litres of water a day. Frontinus was clearly proud of his work but scathing of other well known engineering works:

"Compare such important engineering works carrying so much water with the idle pyramids and the useless though famous buildings of the Greeks."

"Water is brought into the city through aqueducts in such quantities that it is like a river flowing through the city. Almost every house has cisterns and water pipes and fountains."

Strabo, a Greek geographer.

Personal hygiene was also a major issue in the day-to-day life of Romans. Their famous baths played an important part in this.

The baths were used by both rich and poor. Most Roman settlements contained a public bath of some sort. In Britain the most famous are at Bath (then called Aquae Sulis by the Romans). The entrance fee for the baths were extremely small – usually about a quadrans (1/16th of a penny!). This extremely low price was to ensure that no-one did not bathe because it was too expensive.
From the writings of Seneca, we know that the Romans spent large sums of money building their baths. Seneca wrote about baths with walls covered in huge mirrors and marble with water coming out of silver taps! "And I'm talking only about the common people." (Seneca) The baths of the rich included waterfalls according to Seneca. Even people who were sick were encouraged to bathe as it was felt that this would help them to regain their good health.

Roman houses and streets also had toilets. Other civilisations had also used toilets but they had been the preserve of the rich and were essentially a sign of your wealth. By 315 AD, it is said that Rome as a city had 144 public toilets which were flushed clean by running water. All forts had toilets in them. To complement these toilets, the Romans also needed a sufficiently effective drainage system. Pliny, the writer, wrote that many Romans believed that Rome's sewers were the city's greatest achievement. Seven rivers were made to flow through the city's sewers and served to flush any sewage out of them. The importance of hygiene also extended as far as military hospitals which had drainage and sewage systems attached to them. Quite clearly, the Romans believed that an injured soldier would get back to health quicker recovering in a hygienic environment.
Medical knowledge in the Middle Ages must have appeared to have stood still. While the **Ancient Romans**, **Greeks** and **Egyptians** had pushed forward medical knowledge, after the demise of these civilisations, the momentum started by these people tended to stagnate and it did not develop at the same pace until the Seventeenth/Eighteenth Centuries. In Britain, as an example, most things linked to the Romans was destroyed – villas were covered up as the Ancient Britons believed that they contained ghosts and evil spirits. With this approach, it is not surprising that anything medical linked to the Romans fell into disuse in Britain.

By the 14th Century, universities had developed in Western Europe that could be classed as medical schools where students could study under a master physician. The University of Montpelier was one such university. Dissections of human bodies were carried out in these universities so anyone wanting to study medicine in the Middle Ages was not totally ignorant of facts about the human body. Public debates were also encouraged about medical issues and it is known that some medical schools encouraged students to actually challenge the ideas of Galen and Hippocrates. As a result of this refusal to take what Galen and Hippocrates had stated at face value some progress was made in the medical world during this time.

However, medicine became steeped in superstition and the Roman Catholic Church effectively dominated what direction the medical world took. Any views different from the established Roman Catholic Church view could veer towards heresy with the punishments that entailed. Therefore, when the Roman Catholic Church stated that illnesses were punishments from God and that those who were ill were so because they were sinners, few argued otherwise.

Medical practitioners were also still heavily influenced by Galen 1000 years after his death. Mondino's book on the anatomy, "Anathomia", still relied on observations made by Galen and other Greek writers of medicine.

### The diagnosis of disease

No-one knew what really caused diseases. For the Roman Catholic Church they were a punishment from God for sinful behaviour. However, some progress was made in certain areas.

The first authentic description of the symptoms of smallpox were recorded by Rhazes who lived from 860 to 932 AD. However, society was many centuries away from a cure.

Urine charts were also used to help physicians diagnose illnesses. Certain coloured urine indicated certain illnesses. Combined with a table of the planets, these gave physicians enough information to diagnose a disease. Once the disease had been diagnosed, a treatment was decided on.

Physicians still believed that an imbalance of humours played a major part in illnesses. When this happened:

> "Several kinds of medicine may be good such as diet, drink, hot bath (whence sweat is growing), with purging, vomiting and letting blood. These taken in due time, not overflowing each malady and infection is withstood." From a poem from the 11th Century.

Blood letting was a popular treatment for many diseases. Many diseases were thought to be caused by an excess of blood in the body and blood letting was seen as the obvious cure. When a large quantity of blood was required, the appropriate vein was cut. If only a small amount was needed, a leech would be used.

Diagnosis was also influenced by astrology. Medical charts informed physicians what not to do for people born under a certain star sign.
Some Greek and Muslim physicians believed that the moon and planets played an important part in good health and this belief was continued in the Middle Ages. They believed that the human body and the planets were made up of the same four elements (earth, fire, air and water). For the body to operate well, all four elements had to be in harmony with no imbalances. It was believed that the Moon had the greatest influence on fluids on Earth and that it was the Moon that had the ability to affect positively or negatively the four elements in your body. Where the Moon and planets were – and a knowledge of this - was considered important when making a diagnosis and deciding on a course of treatment. Physicians needed to know when to treat a patient and when not to and where the planets were determined this. A so-called Zodiac Chart also determined when blood letting should be done as it was believed by some that the Moon and planets determined this as well.

Remedies for diseases were still crude and based on herbs, potions or more drastic cures.

There were people in the time of the plague (the Black Death) who believed that they had sinned. They believed that the only way to show their true repentance was to inflict pain on themselves. These were the so-called flagellants who whipped themselves to show their love of God and their true sorry at being a sinner. Clearly, this was no cure for the plague.
Ancient Egyptian Medicine

The Ancient Egyptians, like the Ancient Greeks and Romans, have provided modern historians with a great deal of knowledge and evidence about their attitude towards medicine and the medical knowledge that they had. This evidence has come from the numerous papyruses found in archaeological searches.

Like prehistoric man, some of the beliefs of the Egyptians were based on myths and legend. However, their knowledge was also based on an increasing knowledge of the human anatomy and plain commonsense.

In Ancient Egypt, the treatment of illnesses was no longer carried out only by magicians and medicine men. We have evidence that people existed who were referred to physicians and doctors.

"It is seven days from yesterday since I saw my love,
And sickness has crept over me,
My limbs have become heavy,
I cannot feel my own body.
If the master-physicians come to me,
I gain no comfort from their remedies.
And the priest-magicians have no cures,
My sickness is not diagnosed.
My love is better by far for me than my remedies.
She is more important to me than all the books of medicine."

An Ancient Egyptian love poem written in about 1500 BC.

Archaeological digs have also found evidence of men titled physicians. The hieroglyphics on the door to the tomb of Irj described him as a physician at the court of the pharaohs. Irj lived about 1500 BC. He was described as a:

"palace doctor, superintendent of the court physicians, palace eye physician, palace physician of the belly and one who understands the internal fluids and who is guardian of the anus."

Physicians lived even earlier in Ancient Egypt. Imhotep was the physician to King Zozer and lived in about 2600 BC. Imhotep was considered so important that he was, after his death, was worshipped as a god of healing.

Almost all of our knowledge about Ancient Egyptian medical knowledge comes from the discoveries of papyrus documents. The very dry atmosphere in Egypt has meant that many of these documents have been very well preserved despite their age. Numerous papyrus documents have come from the era 1900 BC to 1500 BC. It is from these documents that we know that the Ancient Egyptians still believed that the supernatural caused some disease.

When there was no obvious reason for an illness, many Ancient Egypt doctors and priests believed that disease was caused by spiritual beings. When no-one could explain why someone had a disease, spells and magical potions were used to drive out the spirits.

Some of these spells were:

"These words are to be spoken over the sick person. 'O Spirit, male of female, who lurks hidden in my flesh and in my limbs, get out of my flesh. Get out of my limbs!' This was a remedy for a mother and child.

"Come! You who drives out evil things from my stomach and my limbs. He who drinks this shall be cured just as the gods above were cured."

This was added at the end of this cure: 'This spell is really excellent – successful many times.' It was meant to be said when drinking a remedy.

This was a remedy for people going bald:

"Fat of lion, fat of hippo, fat of cat, fat of crocodile, fat of ibex, fat of serpent,
are mixed together and the head of the bald person is anointed with them.

The Ancient Egyptians also had a god who would frighten away evil spirits – Bes.

Despite this use of remedies that come from a lack of knowledge, the Ancient Egyptians also developed their knowledge as a result of education. Ancient papyrus inform us that the Ancient Egyptians were discovering things about how the human body worked and they knew that the heart, pulse rates, blood and air were important to the workings of the human body. A heart that beat feebly told doctors that the patient had problems.

The Ancient Egyptians wrote down their knowledge and this is found on what is known as the Papyrus Ebers:

"46 vessels go from the heart to every limb, if a doctor places his hand or fingers on the back of the head, hands, stomach, arms or feet then he hears the heart. The heart speaks out of every limb."

The papyrus continues:

"There are 4 vessels to his nostrils, 2 give mucus and 2 give blood; there are 4 vessels in his forehead; there are 6 vessels that lead to the arms; there are 6 vessels that lead to the feet; there are 2 vessels to his testicles (and) it is they which give semen; there are 2 vessels to the buttocks."

The document actually gives names to organs such as the spleen, the heart, the anus, the lungs etc so they must have known that these exist. One papyrus, the Edwin Smith Papyrus, has a detailed description of the brain in it so this organ was also well researched by the standards of the time. It is probable that this knowledge came as a result of the practice the Ancient Egyptians had of embalming dead bodies.

The work of an embalmer was described in detail by Herodotus who was from Greece but was visiting Ancient Egypt in the 5th Century:

"First they take a crooked piece of metal and with it draw out some of the brain through the nostrils and then rinse out the rest with drugs. Next they make a cut along the side of the body with a sharp stone and take out the whole contents of the abdomen. After this they fill the cavity with myrrh, cassia and other spices and the body is placed in natron for 70 days."

"First they take a crooked piece of metal and with it draw out some of the brain through the nostrils and then rinse out the rest with drugs. Next they make a cut along the side of the body with a sharp stone and take out the whole contents of the abdomen. After this they fill the cavity with myrrh, cassia and other spices and the body is placed in natron for 70 days."

Those organs that were removed in the embalming process, were put in a jar along with preserving spices, and put into the tomb of the person being buried. Though religious law forbade the embalmers from studying the body, it is almost certain they would have gained some knowledge of the human anatomy simply from the work that they did.
Cures for the Black Death

The Black Death wreaked havoc throughout Medieval England. The Black Death killed one in three people and was to have a direct link to the Peasants Revolt of 1381. ‘Cures’ for the Black Death went from the absurd to having a degree of common sense about them. Regardless of this, the casualty figures for the Black Death were massive.

<table>
<thead>
<tr>
<th>Cures for the Black Death</th>
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<tbody>
<tr>
<td><strong>Vinegar and water treatment</strong></td>
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<tr>
<td><strong>Lancing the buboes</strong></td>
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<tr>
<td><strong>Bleeding</strong></td>
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<td><strong>Diet</strong></td>
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<td><strong>Sanitation</strong></td>
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<tr>
<td><strong>Pestilence medicine</strong></td>
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<tr>
<td><strong>Witchcraft</strong></td>
</tr>
</tbody>
</table>
Edward Jenner is alongside the likes of Joseph Lister, Robert Koch and Louis Pasteur in medical history. Edward Jenner was born in 1749 and died in 1823. Edward Jenner’s great gift to the world was his vaccination for smallpox. This disease was greatly feared at the time as it killed one in three of those who caught it and badly disfigured those who were lucky enough to survive catching it.

Edward Jenner was a country doctor who had studied nature and his natural surroundings since childhood. He had always been fascinated by the rural old wives tale that milkmaids could not get smallpox. He believed that there was a connection between the fact that milkmaids only got a weak version of smallpox – the non-life threatening cowpox – but did not get smallpox itself. A milkmaid who caught cowpox got blisters on her hands and Jenner concluded that it must be the pus in the blisters that somehow protected the milkmaids.

Jenner decided to try out a theory he had developed. A young boy called James Phipps would be his guinea pig. He took some pus from cowpox blisters found on the hand of a milkmaid called Sarah. She had milked a cow called Blossom and had developed the tell-tale blisters. Jenner ‘injected’ some of the pus into James. This process he repeated over a number of days gradually increasing the amount of pus he put into the boy. He then deliberately injected Phipps with smallpox. James became ill but after a few days made a full recovery with no side effects. It seemed that Jenner had made a brilliant discovery.

He then encountered the prejudices and conservatism of the medical world that dominated London. They could not accept that a country doctor had made such an important discovery and Jenner was publicly humiliated when he brought his findings to London. However, what he had discovered could not be denied and eventually his discovery had to be accepted – a discovery that was to change the world.

So successful was Jenner’s discovery, that in 1840 the government of the day banned any other treatment for smallpox other than Jenner’s.

Jenner did not patent his discovery as it would have made the vaccination more expensive and out of the reach of many. It was his gift to the world. A small museum now exists in his home town. It was felt that this was appropriate for a man who shunned the limelight and London. In the museum are the horns of Blossom the cow. The word vaccination comes from the Latin ‘vacca’ which means cow – in honour of the part played by Blossom and Sarah in Jenner’s research. A more formal statue of Jenner is tucked away in one of the more quiet areas of Hyde Park in London.

As a young man, Jenner also wrote about what he had seen cuckoos doing. His were the first written records to describe a baby cuckoo pushing the eggs and the young of its host out of the nest so that the baby cuckoo was the only one to receive food from its foster parents. This was only confirmed many years later but it stands as a testament to the importance of the countryside for Jenner. If he had gone to a city to further his career, would he had been in the right environment to make his famous discovery?
In 1980, the World Health Organisation declared that smallpox was extinct throughout the world.

The impact of Jenner’s vaccination can be seen in its impact in London in 1844:

Smallpox was a major killer before Edward Jenner’s vaccination that was to change medical history. Whilst Jenner’s vaccination did not eradicate smallpox, it had a marked impact on fatality rates in large and dirty cities such as London.

Smallpox casualties in London in 1844:

<table>
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<tr>
<th>Year old</th>
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Though these figures appear high – **8048 for the year** – they were a sign of the way the fight against smallpox was going. However, as medical treatment was far too expensive for the poor (and it would be the poor who lived in the least hygienic areas) it would be many more years before smallpox was finally eradicated from Britain. The irony is that Jenner gave his cure to the world for free rather than patent it for himself, though doctors could charge their patients for services rendered.
Health and Medicine in Medieval England

Health and medicine in Medieval England were very important aspects of life. For many peasants in Medieval England, disease and poor health were part of their daily life and medicines were both basic and often useless. Towns and cities were filthy and knowledge of hygiene was non-existent. The Black Death was to kill 2/3rds of England’s population between 1348 and 1340.

In 1349, Edward III complained to the Lord Mayor of London that the streets of the city were filthy:

"Cause the human faeces and other filth lying in the streets and lanes in the city to be removed with all speed to places far distant, so that no greater cause of mortality may arise from such smells."

No one knew what caused diseases then. There was no knowledge of germs. Medieval peasants had been taught by the church that any illness was a punishment from God for sinful behaviour. Therefore, any illness was self-imposed – the result of an individual's behaviour.

Other theories put forward for diseases included "humours". It was believed that the body had four humours (fluids in our bodies) and if these became unbalanced you got ill. Doctors studied a patient's urine to detect if there was any unbalance.

Astronomers blamed the planets going out of line

As important, no-one knew how diseases spread – the fact that people lived so close together in both villages and towns meant that contagious diseases could be rampant when they appeared; as happened with the Black Death.

Physicians were seen as skilled people but their work was based on a very poor knowledge of the human anatomy. Experiments on dead bodies were unheard of in Medieval England and strictly forbidden. Physicians charged for their services and only the rich could afford them. Their cures could be bizarre though some cures, including bleeding and the use of herbs, had some logic to them even if it was very much a hit-or-miss approach. One of the most famous physicians was John Arderne who wrote "The Art of Medicine" and who treated royalty. He was considered a master in his field but his cure for kidney stones was a hot plaster smeared with honey and pigeon dung!

Physicians would have had their own ideas as to what caused illnesses.

Those who blamed bad smells developed a 'cure' to make the bad smells go away.

Those who blamed bad luck would use prayers and superstitions.

Those who blamed the body's four humours used bleeding, sweating and vomiting to restore the balance of the four humours.

When by some luck, a patient got better or simply improved, this was a sure sign that a cure worked. It also meant that the cure used would be used again. If it did not work on the next patient, this was the fault of the patient rather than of the cure.

Operations were carried out by 'surgeons'. In fact, these men were unskilled and had other jobs such as butchers and barbers. The traditional red and white pole outside of a barber's shop today is a throwback to the days in Medieval England when barbers did operations. The red stood for blood and the white for the bandages used at the end of an operation.

Operations could end in death as post-operative infections were common.
Instruments used in an operation were not sterilised - as there was no knowledge of germs, there was no need to clean instruments used in operations. Patients might recover from small operations, such as a tooth extraction (though this could not be guaranteed), but operations that included a deep cut through the skin were very dangerous.

Some monasteries had cottage hospitals attached to them. The monks who worked in these hospitals had basic medical knowledge but they were probably the best qualified people in the country to help the poor and those who could not afford their own physician. By 1200, there may have been as many as 400 hospitals in England.

Cures from Medieval England:

For toothache:

Take a candle and burn it close to the tooth. The worms that are gnawing the tooth will fall out into a cup of water held by the mouth.

The cause of the Black Death according to Guy de Chauliac, a French doctor:

Three great planets, Saturn, Jupiter and Mars, are all in close position. This took place in 1345. Such a coming together of planets is always a sign of wonderful, terrible or violent things to come.

For evil spirits in the head:

For this, surgeons used trepanning. This was where a surgeon cut a hole into the skull to release evil spirits trapped in the brain. The operation might also include cutting out the part of the brain that had been 'infected' with these evil spirits. Incredibly, people are known to have survived operations such as these as skulls have been found which show bone growth around the hole cut by a surgeon – a sign that someone did survive such an operation if only for awhile.

For general illnesses:

People were told that a pilgrimage to a holy shrine to show your love of God would cure them of illnesses especially if they had some holy water sold at the place of pilgrimage. After the death of Thomas Becket in 1170, Canterbury Cathedral became a place of pilgrimage which brought even more wealth to the city. However, more people coming to the city also increased the risk of disease being brought in.

Blood letting:

This was when blood was drained from a certain spot in your body. The idea behind this was similar to trepanning in that it released bad blood from your body. The use of leeches was common for this but dirty knives were also used which only increased the risk to the patient.

Leeches used on royalty

Cauterisation:
This was where a physician identified that a certain part of your body was ill and it was cured by having red hot pokers put on it.

**Astrology:**

Astrology played an important part in many cures. For fever, one medicine book stated "A man suffering from fever should be bled immediately the moon passes through the middle of the sign of Gemini."
Howard Florey is as linked to penicillin as Sir Alexander Fleming is. Howard Florey, who developed a way of mass producing penicillin, should be seen as being as important as Jenner, Koch, Pasteur and Lister in the history of medicine.

Florey was born on September 24th 1898, in Adelaide, Australia. He died on February 21st, 1968, at Oxford in England. He trained as a pathologist who, with Ernst Chain isolated and purified penicillin (discovered in 1928 by Sir Alexander Fleming) for general clinical use. This mass production of penicillin proved to be vital to soldiers during World War Two where diseases that had previously been difficult to cure in a combat situation could now be treated far more effectively. For this research and achievement, Florey, Chain, and Fleming shared the Nobel Prize for Physiology or Medicine in 1945.

Florey studied medicine at Adelaide and Oxford universities until 1924. After holding teaching and research posts at Cambridge and Sheffield universities, he was professor of pathology at Oxford between 1935 and 1962. He was appointed provost of Queen's College, Oxford in 1962, and chancellor of the Australian National University, Canberra (1965), positions he held until his death. He was knighted in 1944 and made life peer in 1965.

Florey investigated tissue inflammation and secretion of mucous membranes. He succeeded in purifying lysozyme, a bacteria-destroying enzyme found in tears and saliva, and characterized the substances acted upon by the enzyme. In 1939 he surveyed other naturally occurring anti-bacterial substances, concentrating on penicillin. With Chain, he demonstrated its curative properties in human studies and developed methods for its mass production. Following World War II and the work of his research team in North Africa, penicillin came into widespread clinical use.
Joseph Lister is alongside the likes Louis Pasteur, Robert Koch, Alexander Fleming and Edward Jenner in the work he did to further medical knowledge. Joseph Lister did not discover a new drug but he did make the like between lack of cleanliness in hospitals and deaths after operations. For this reason, he is known as the ‘Father of Antiseptic Surgery’.

Lister was born in 1827 and died in 1912. As Professor of Surgery at Glasgow University, he was very aware that many people survived the trauma of an operation but died afterwards of what was known as ‘ward fever’.

Work on ward cleanliness and the link between germs and good post-operative health had already been studied by a Hungarian doctor called Ignaz Semmelweis. He argued that if a doctor went from one patient to another after doing surgery, that doctor would pass on to the next visited patient a potentially life threatening disease. He insisted that those doctors who worked for him wash their hands in calcium chloride after an operation and before visiting a new patient.

Deaths on the wards Semmelweis was in charge of fell from 12% to just 1%. But despite this, he came up against the conservatism of those who dominated Hungarian medicine and his findings were ignored. Semmelweiss died in 1865 of blood poisoning.

In 1865, Lister read about the work done by Louis Pasteur on how wine was soured. Lister believed that it was microbes carried in the air that caused diseases to be spread in wards. People who had been operated on were especially vulnerable as their bodies were weak and their skin had been cut open so that germs could get into the body with more ease.

Lister decided that the wound itself had to be thoroughly cleaned. He then covered the wound with a piece of lint covered in carbolic acid. He used this treatment on patients who had a compound fracture. This is where the broken bone had penetrated the skin thus leaving a wound that was open to germs. Death by gangrene was common after such an accident. Lister covered the wound made with lint soaked in carbolic acid. His success rate for survival was very high.

Lister then developed his idea further by devising a machine that pumped out a fine mist of carbolic acid into the air around an operation. The number of patients operated on by Lister who died fell dramatically.

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<th>Years</th>
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<td>6</td>
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Louis Pasteur was born in 1822 in Dole, France. Louis Pasteur’s name is forever cemented in the history of medicine. He, along with Alexander Fleming, Edward Jenner, Robert Koch and Joseph Lister, is of great importance when studying medical history. Pasteur’s discovery – that of germs – may seem reasonably tame by the standards of 2002, but his discovery was to transform medicine and see his name forever immortalised on a day-to-day basis in pasteurised milk – named in his honour.

Pasteur is important for three reasons:

**Pasteur showed that airborne microbes were the cause of disease.** Pasteur built on the work of Edward Jenner and helped to develop more vaccines. Pasteur’s career showed how conservative the medical establishment was at the time.

As a young man, Pasteur studied at the École Normale in Paris. In 1843, he became a research chemist. He developed such a reputation, that in 1854, aged just 32, he became Dean of the Faculty of Science at the University of Lille. At this time, Lille was the centre of alcohol manufacture in France. In 1856, Pasteur received a visit from a man called Bigo who worked at a factory that made alcohol from sugar beet. Bigo’s problem was that many of his vats of fermented beer were turning sour and, as a result, the beer had gone off and had to be thrown away. From a business point of view, this was a disaster. Bigo asked Pasteur to find out why this was happening.

After using a microscope to analyse samples from the vats, Pasteur found thousands of tiny micro-organisms. He became convinced that they were responsible for the beer going sour. Pasteur believed that they caused the putrefaction of the beer – not that they were the result of the putrefaction.

Pasteur continued his work on this theme by studying other liquids such as milk, wine and vinegar. In 1857, he was appointed Director of Scientific Studies at the École Normale in Paris. Between 1857 and 1859, Pasteur became convinced that the liquids he had studied were being contaminated with microbes that floated in the air. The medical establishment ridiculed him:

> "I am afraid that the experiments you quote, M. Pasteur, will turn against you. The world into which you wish to take us is really too fantastic."

La Presse, 1860

Pasteur was vilified in public but rather than give up, he determined to fight for what he believed in. Pasteur started to devise tests to prove that he was right. He was able to prove that:

Air contained living organisms

That these microbes can produce putrefaction

That...
these microbes could be killed by the heating of the liquid they were in. That these microbes were not uniformly distributed in the air.

In April 1864, Pasteur explained his beliefs in front of a gathering of famous scientists at the University of Paris. He proved his case beyond doubt — even if some of those present refused to believe him including Dr. Charlton Bastian who maintained his belief that putrefaction came from within and not from invading micro-organisms.

Up to 1865, Pasteur's work only involved beer, wine and milk. In 1865, he was asked to investigate his first disease called pébrine that affected the silk worm industry. Within a year, Pasteur had established that the disease was caused by a living organism and he now became convinced that microbes could also affect humans as well as beer and silk worms. In this sense, Pasteur believed that microbes could spread diseases among humans. Three of Pasteur's daughters had died between 1859 and 1865; two from typhoid and one from a brain tumour.

In 1865, a cholera epidemic hit Marseilles. Pasteur carried out a number of experiments in a hospital in the hope of finding the germ that caused this feared disease. He was not successful.

In 1868, Pasteur suffered from a brain haemorrhage that affected the left side of his body. This affected his ability to work but the work that he had done up to 1868, had inspired a number of younger scientists.

Pasteur developed his work by finding out ways humans could be prevented from getting a disease. He was inspired by his own desire to develop his knowledge but also by patriotism. Robert Koch was getting a great deal of attention throughout Europe for his discoveries and the French versus German rivalry that occurred provided a great spur to medical advances. In 1881, Pasteur met Koch at a meeting in London when the German was giving a lecture on what he had discovered up to that date. All Pasteur said to Koch after the lecture was "That is great progress".

Koch had gathered around him a team of skilled research scientists. Pasteur frequently worked by himself. He realised that this was not the way to proceed and he also gathered around him a team of research scientists. Pasteur had always lacked detailed medical knowledge. Because of this he introduced into his team two brilliant young doctors, Emile Roux and Charles Chamberland. The first disease this team worked on was chicken cholera – a disease that affected many poultry farmers.

Pasteur knew about the work done by Edward Jenner regarding smallpox. Pasteur reasoned that if a vaccine could be found for smallpox, then a vaccine could be found for all diseases. Pasteur did not know how Jenner's vaccination worked so he had to proceed searching for a chicken cholera vaccine using a process of trial and error.

In the summer of 1880, he found a vaccine by chance. Chamberland had inoculated some chickens with chicken cholera germs from an old culture that had been around for some time. The chickens did not die. Pasteur asked Chamberland to repeat what he had done but with a fresh culture of chicken cholera germs. Pasteur reasoned that a new culture would provide more potent germs.

Two groups of chickens were inoculated; one that had been given the old culture and one group that had not. Those chickens that had been given the old culture survived, those that had not died. The chickens that had been inoculated with the old culture had become immune to chicken cholera. Pasteur believed that their bodies had used the weaker strain of germ to form a defence against the more powerful germs in the fresher culture.
In April 1881, Pasteur announced that his team had found a way to weaken anthrax germs and so could produce a vaccine against it. Despite his fame, there were still those in the medical world who mocked Pasteur.

"Will you have some microbe? There is some everywhere. Microbiolatry is the fashion, it reigns undisputed; it is a doctrine which must not even be discussed, especially when its Pontiff, the learned Monsieur Pasteur, has pronounced the sacramental words, "I have spoken". The microbe alone is and shall be the characteristic of a disease; that is understood and settled;......the Microbe alone is true, and Pasteur is its prophet."

Rossignol, written in 1881.

Rossignol was the editor of "The Veterinary Press" and in 1882 he challenged Pasteur to a public test of his anthrax vaccine. The tests were held in May 1882. Sixty sheep used in the test. Pasteur kept ten as they were and divided the other fifty into two groups of twenty-five. One group was inoculated with his vaccine while twenty-five were not. All fifty were then injected with the anthrax virus. Those that were not inoculated died within two days. The inoculated group suffered no ill-effects and were described as being "sound, and (they) frolicked and gave signs of perfect health". They proved that Pasteur was not exaggerating the powers of his vaccine. "The Times" in Great Britain called Pasteur "one of the scientific glories of France".

Pasteur and his team turned next to the disease of rabies. Most human victims of rabies died a painful death and the disease appeared to be getting more and more common in France. Though the team could not identify the germ, they did find that the rabies germ attacked the nervous system only after it had made its way to the brain. The team traced the germ to the brain and spinal cord of infected animals and by using dried spinal cords, they produced a vaccine for rabies. The vaccine was first tried out on animals.

Pasteur injected 'clean' animals with the rabies germ found in spinal cord that was fourteen days old. At this age, the germ was relatively weak and unlikely to threaten the life of the animals. He then used spinal cords that were thirteen days old, twelve days etc. on the animals until they were injected with the most virulent germ found in infected spinal cord that was fresh. All survived this. But Pasteur faced a serious problem. What worked on animals might not work on humans.

In 1885, a young boy, Joseph Meister, had been bitten by a rabid dog, and was brought to Pasteur. The boy almost certainly would have died an agonising death if nothing was done so Pasteur took the risk on using his untested vaccine.

"The death of this child appearing to be inevitable, I decided, not without lively and sore anxiety, as may well be believed, to try upon Joseph Meister, the method which I had found constantly successful with dogs. Consequently, sixty hours after the bites, and in the presence of Drs Vulpian and Grancher, young Meister was inoculated under a fold of skin with half a syringeful of the spinal cord of a rabbit, which had died of rabies. It had been preserved (for) fifteen days in a flask of dry air. In the following days, fresh inoculations were made. I thus made thirteen inoculations. On the last days, I inoculated Joseph Meister with the most virulent virus of rabies."

Pastuer

The boy survived and Pasteur knew that he had found a vaccine for rabies. Three months later, when he examined Meister again, Pasteur reported that the boy was in good health.

Ironically, though Pasteur and his team knew that the vaccine worked, no one then in the world of science knew how it worked!
Vesalius, Andreas (1514–1564)

Belgian physician who revolutionized anatomy by performing postmortem dissections and making use of illustrations to teach anatomy. Vesalius upset the authority of Galen, and his book – the first real textbook of anatomy – marked the beginning of biology as a science.

Vesalius was taught anatomy in the Galenist tradition. Galen had never dissected a human body – all his accounts of the human anatomy were based on his research of the Barbary ape – although he was regarded as infallible and was venerated until the Renaissance. Vesalius was therefore taught principles of anatomy that had not been questioned for 1,300 years.

Dissatisfied with the instruction he had received, Vesalius resolved to make his own observations. His dissections of the human body (then illegal) enabled him to discover that Galen's system of medicine was based on fundamental anatomical errors. Vesalius disproved the widely held belief that men had one rib less than women. He also believed, contrary to Aristotle’s theory of the heart being the centre of the mind and emotion, that the brain and the nervous system were the centre.

Vesalius's book De humani corporis fabrica/On the Structure of the Human Body of 1543 employed talented artists to provide the illustrations and is one of the great books of the 16th century. The quality of anatomical depiction introduced a new standard into all illustrated works, especially into medical books, and highlighted the need to introduce scientific method into the study of anatomy. Together with the main work of astronomer Copernicus, published in the same year, On the Structure of the Human Body marked the dawn of modern science.

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Sir James Black made some of the most significant medical discoveries of the Twentieth Century. James Black is one of the few people in the History of Medicine to have left his mark through his medical developments seem to have remained far more famous than Black himself who preferred to keep out of the public limelight.

Sir James Black was born on June 14th 1924 in Lanarkshire, Scotland. He was brought up in Fife. His father was a mining engineer but with five sons to bring up money was tight. Black was encouraged by one of his teachers to attempt the entrance exams for the University of St. Andrews and aged fifteen he won a scholarship to this university where he studied medicine.

After graduating, Black taught in Singapore for three years before moving back to London in 1950. He returned to Scotland where he joined the University of Glasgow and established the Physiology Department. In 1958, Black joined ICI and it was while he was working for ICI that he made his greatest discovery.

Black worked for ICI from 1958 to 1964. During this time he developed propanolol – a beta-blocker. Propanolol became the world’s most widely sold drug and is credited with saving the lives of millions of people who suffered from heart disease. The development of Propanolol is now considered to be one of the most important medical events of the Twentieth Century.

Black continued his research at ICI and invested his time in finding a drug that could treat stomach ulcers. However, ICI did share his interest in this research and Black quit the company. He joined Smith, Kline and French and while he was working for them he developed he second major medical find – cimetidine, which was used to treat peptic ulcers. In 1975 this was launched under the brand name of Tagamet and overtook Propanolol as the biggest selling prescription medicine in the world.

Black was appointed Professor of Pharmacology at London University. He left this post in protest at the lack of funding for research. He joined the Wellcome Research Laboratories in 1978. In 1981, Black received a knighthood in recognition of his medical discoveries. In 1984 he resigned from this post after falling out with his boss, Sir John Vane.

In 1988 Sir James Black was awarded the Nobel Prize for Medicine along with Gertrude Elion and George Hitchings.

Black was appointed Head of Analytical Pharmacology at King’s College, London and remained in this post until 1992. During these years he spent his time trying to find a drug that could be used to treat stomach cancers.

In 2000, Black was awarded an Order of Merit – an honour held by only twenty-four members at any one time.

Between 1992 and 2006 Sir James Black was Chancellor of Dundee University.
Sir James Black died on March 22nd 2010. Obituaries called him “one of the greatest Scottish scientists of the Twentieth Century” while others stated that he had made more money for pharmaceutical companies than anyone else in the same century – though he made little personal financial gain from Propanolol and Cimetidine.
Robert Koch was born in 1843. Koch worked on anthrax and tuberculosis (TB) and he further developed the work of [Louis Pasteur](http://www.historylearningsite.co.uk/louis_pasteur.htm). Koch’s fame, alongside that of [Alexander Fleming](http://www.historylearningsite.co.uk/alexander_fleming.htm), [Edward Jenner](http://www.historylearningsite.co.uk/edward_jenner.htm), [Joseph Lister](http://www.historylearningsite.co.uk/joseph_liste.htm) and Pasteur himself, is firmly cemented in medical history.

Koch came from a poor mining family and it took him a lot of determination to get a university place where he first studied mathematics and natural science and then studied medicine.

Pasteur was convinced that microbes caused diseases in humans but his work on cholera had failed. He was never able to directly link one microbe with a disease. Koch succeeded in doing this.

Koch was a doctor and he had a detailed knowledge of the human body – something that Pasteur, as a research scientist – lacked. He was also skilled in experiments, the result of his work in natural sciences. Qualities that also proved to be important were his ability to work for long periods of time and his patience. However, Koch was also difficult to work with and could not tolerate anyone telling him that his theories were wrong.

In 1872, Koch became district medical officer for a rural area near Berlin. He started to experiment with microbes in a small laboratory he had built for himself in his surgery.

The first disease that Koch investigated was anthrax. This was a disease that could seriously affect herds of farm animals and farmers were rightly in fear of it. Other scientists had also been working on anthrax. In 1868, a French scientist called Davaine had proved that a healthy animal that did not have anthrax could get the disease if it was injected with blood containing anthrax. Koch developed this work further and for three years he spent all his spare time finding out what he could about the disease, including its life cycle.

Koch found out that the anthrax microbe produced spores that lived for a long time after an animal had died. He also proved that these spores could then develop into the anthrax germ and could infect other animals.
After this, Koch moved onto germs that specifically affected humans. In 1878, he identified the germ that caused blood poisoning and septicaemia. He also developed new techniques for conducting experiments that influenced the way many other scientists carried out their experiments. He knew that infected blood contained the septicaemia germ but he could not see these germs under a microscope, and therefore, other scientists were unlikely to believe what he thought to be true without the evidence.

Koch discovered that methyl violet dye showed up the septicaemia germ under a microscope by staining it. He also photographed the germs so that people outside of his laboratory could see them.

Koch also devised a method of proving which germ caused an infection. His work was rewarded in 1880 when he was appointed to a post at the Imperial Health Office in Berlin. Here, Koch perfected the technique of growing pure cultures of germs using a mix of potatoes and gelatine. This was a solid enough substance to allow for the germs to be studied better. Koch gathered round him a team of researchers in Berlin in 1881 and began to work on one of the worst diseases of the nineteenth century – tuberculosis (TB).

The TB germ was much smaller than the anthrax germ so the search for it was difficult. Using a more specialised version of his dye technique, Koch and his team searched for the TB germ. In May 1882, Koch announced that his team had found the germ. His announcement caused great excitement. It also generated what became known as 'microbe hunters' – a new generation of young scientists who were inspired by the work of both Koch and Pasteur. One of those who was inspired by Koch was Paul Ehrlich.

What was Koch’s legacy? He had finally laid to rest the belief that ‘bad air’ caused disease. He had inspired many other younger researchers to build on his work. He had found the germs of two feared diseases – anthrax and TB. He had developed research techniques that others could use throughout the world.

By 1900, twenty-one germs that caused diseases had been identified in just 21 years. "As soon as the right method was found, discoveries came as easily as ripe apples from a tree." (Koch) It was Koch who had developed the right methods.
The years 1919 to 1939 saw many important advances in the history of medicine. World War One had acted as a stimulus for medical progress which had continued post-war. The same was true for the era after World War Two.

Many advances had been made up to 1919 but knowledge on how germs caused infections and disease, did not mean that society had cures available. At the end of World War One, 20 million people in Europe died of flu – scientists knew what caused flu but had no cure for it. Better public health schemes existed in Britain but many of the poor in society were badly affected by diseases associated with lack of basic hygiene.

Between 1919 and 1939, the expanding use of technology and improved scientific techniques improved medical care. X-ray machines improved during these 20 years and in 1931 powerful electron microscopes were invented which meant that the body could be explored in much greater detail. The advent of insulin to combat diabetes was also a vital medical advance.
Antibiotics transformed medicine. The discovery of antibiotics began by accident. On the morning of September 3rd, 1928, Professor Alexander Fleming was having a clear up of his cluttered laboratory. Fleming was sorting through a number of glass plates which had previously been coated with staphylococcus bacteria as part of research Fleming was doing. One of the plates had mould on it. The mould was in the shape of a ring and the area around the ring seemed to be free of the bacteria staphylococcus. The mould was penicillium notatum. Fleming had a life long interest in ways of killing off bacteria and he concluded that the bacteria on the plate around the ring had been killed off by some substance that had come from the mould.

Further research on the mould found that it could kill other bacteria and that it could be given to small animals without any side-effects. However, within a year, Fleming had moved onto other medical issues and it was ten years later that Howard Florey and Ernst Chain, working at Oxford University, isolated the bacteria-killing substance found in the mould - penicillin.

In 1941, a doctor, Charles Fletcher, at a hospital in Oxford had heard of their work. He had a patient who was near to death as a result of bacteria getting into a wound. Fletcher used some of Chain’s and Florey’s penicillin on the patient and the wound made a spectacular recovery. Unfortunately, Fletcher did not have enough penicillin to fully rid the patient’s body of bacteria and he died a few weeks later as the bacteria took a hold. However, penicillin had shown what it could do on what had been a lost cause. The only reason the patient did not survive was because they did not have enough of the drug - not that it did not work.

Florey got an American drugs company to mass produce it and by D-Day, enough was available to treat all the bacterial infections that broke out among the troops. Penicillin got nicknamed "the wonder drug" and in 1945 Fleming, Chain and Florey were awarded the Nobel Prize for Medicine. Post-1945 was the era of the antibiotics.
Alexander Fleming and Penicillin

Alexander Fleming is alongside the likes of Edward Jenner, Robert Koch, Christian Barnard and Louis Pasteur in medical history. Alexander Fleming discovered what was to be one of the most powerful of all antibiotics – penicillin. This drug was to change the way disease was treated and cement Fleming's name in medical history.

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<td>Louis Pasteur</td>
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Medical changes from 1945

There were many medical changes during World War Two but these changes continued after the war. In Britain, the biggest change was the establishment of the National Health Service (NHS) that provided free medical care for all regardless of wealth. Prior to this those who could not afford something like a penicillin jab had to go without or make the necessary sacrifices to get the necessary money. The NHS provided this for free.

Post-1945, many advances were made in the management of pregnancy and childbirth. This included the ability to induce labour and the use of epidurals to ease difficult pregnancies. As a balance to this, there was a move for less state intervention in childbirth and the development of the right for women to have more natural childbirth. In 1956, the National Childbirth Trust was set up. The chance of infant survival also improved as medical knowledge developed – as was seen in the work done to increase the survival rate of ‘blue’ babies. The greater use of scans after 1945 also helped to detect problems earlier.

More vaccines were developed to control childhood diseases. After the war the health of children was generally better than at any other time in history. Vaccines against polio, measles and rubella were developed in the 1950's and 1960's. Tests were also developed for defects in babies such as the amniocentesis for spina bifida and Down’s Syndrome. Treatments were also developed for children with heart disease.

After 1945, major advances were also made in birth control. In earlier times there had been advances in rubber sheaths but they were seen more as a protection against syphilis as opposed to a form of birth control. The cap or diaphragm had been developed in the 1880’s but its availability had been very much limited as people were kept in the dark as to its very existence. Marie Stopes did much to change attitudes as to give women more freedom when concerning birth control. However, pre-war social conventions had done much to prevent the total spread of her ideas throughout Britain. Many social conventions had been swept away during the war and by the 1950's the contraceptive pill had been introduced as was seen as a way of giving women more control over their own destiny – and certainly taking this away from domineering men. By the 1960's, the contraceptive pill was widely available, as was the IUD (Intrauterine device). This had first been developed in 1909 but was more widely available after 1945. Certain types of IUD were also linked to pelvic infection and septic abortions as late as the 1970's and 1980's. Such concerns did much to stymie its use.

Many very significant medical advances were also made after 1945. One of the most important was the discovery of DNA by Wilkins, Crick and Watson. These three were also helped by the work done by Rosalind Franklin. DNA is the substance that makes life – a human cell that contains genes, which are made up of chromosomes, the basis of living tissue. This has in turn allowed the study of disease caused by defective genes such as in cystic fibrosis and Down’s Syndrome. In recent years,
Researchers have been able to identify specific genes that are responsible for specific diseases.

New drugs have also been created post-1945. The success of penicillin during the war, prodded researchers to study other moulds. Streptomycin, found in chickens, was used successfully to treat TB. This treatment was pioneered primarily in America after 1946. Streptomycin was also found to be capable of treating many other diseases that penicillin could not. However, it was found that too much use of streptomycin could lead to the TB germ developing a resistance to its use. After 1951, streptomycin was used with Isoniazid in the fight against TB. This again was developed in America. By the 1970’s, five antibiotics existed which could be used against TB. In recent years, despite this array of drugs against TB, there have been fears that TB can be resistant to all drugs that have been developed to fight it. The recent rise of TB in the more depressed areas of Britain’s cities has concerned many doctors. The problems with streptomycin did lead scientists to study why drugs lost their effectiveness and also why some people suffered side effects when they were used and others did not. The development in pharmacology has been a major development since 1945.

Since 1945, there has been a greater use of steroids in medicine. These were used to relieve pain and inflammation. Cortisone was used in injection form to treat rheumatoid arthritis. Cortisone also had the important side effect of reducing the body’s immune system. This made it useful to prevent the rejection of skin and kidney transplants. This in turn lead to the idea of using drugs to suppress the growth of cancers using cytotoxins.

The use of ultrasound and magnetic resonance since 1945 has also made it easier to diagnose disease. Ian Donald, Professor of Midwifery at Glasgow developed ultrasound in the 1950’s for looking at unborn babies. Magnetic Resonance Imaging can be used to detect diseases without the use of radiation making it less harmful to the patient. Three-dimensional CAT scans can also be used. The less use of radiation the better as some patients can be harmed by exposure to large doses of radiation. MRI (Magnetic Resonance Imaging) does away with this problem. The use of modern equipment such as the endoscope has also allowed for the internal examination of patients without the need for surgery.

Kidney dialysis was first tried in 1914 but only became more widely available in the 1960’s. The introduction of long term and repeated dialysis gave hope to patients who almost certainly would have died without this particular development.

Surgery in general has witnessed major developments since 1945. Far more operations can be carried out now on areas of the body that were rarely touched before 1945. Christian Barnard’s heart transplant was on an organ that few surgeons would have operated on. His pioneering surgery inspired others to do likewise and now heart operations are very common, as is surgery on organs such as the liver and kidneys etc. Microsurgery and keyhole surgery are common place now – as is the use of lasers in surgery. The major – though not exclusive – developments in
surgery are as follows:

Post 1953: the development of a successful heart lung machine allowed more complicated heart surgery to take place. Techniques have improved greatly here with coronary bypasses to improve blood supply to the heart since 1953 and the replacement of heart valves since the 1960’s. Artificial arteries have also been developed to improve blood flow. After 1961, pacemakers were introduced to maintain a regular heart beat.

From 1960 on, lasers were used to treat eye tumours etc.

Transplant surgery has also developed aided by drugs like cortisone, azathioprine and cyclosporin which have helped to reduce rejection. The first successful kidney transplant was done in Boston in 1954; the first heart transplant was in 1967 (performed by Christian Barnard); the first liver transplant was in 1963; the first heart and lung transplant was in 1982 and the first brain tissue transplant was in 1987.

Since 1945, there have been major developments in replacement surgery. Hip replacement was pioneered by John Charnley, orthopaedic surgeon at Manchester Royal Infirmary. Since then, there have been knees and elbows have been replaced.

In the area of reproduction, the development of IVF by Patrick Steptoe, led to the first test tube baby – Louise Brown – born in 1978. Steptoe’s work has given much hope to those couples who want children but have had difficulties producing them. However, the issue of IVF brought with it many ethical issues which cause controversy to this day.

Since 1945, there have been massive strides in the treatment of cancer. The use of a combination of drugs, radiotherapy and surgery have greatly increased a cancer patient’s chances of survival. During the 1950’s, research linked smoking to lung cancer and other external factors have also been identified – such as excess sunlight potentially causing skin cancer. It is now thought that 15% of all cancers are caused by viruses.

The major disease that has tested the medical world since the 1980’s has been HIV/AIDS. In the 1980’s, government’s touted HIV as near enough a death sentence and in Britain issued public health warnings on television showing icebergs crashing into the sea. Now, just twenty years on, combination drug therapy offers sufferers hope and a huge amount of research has gone into finding a cure or vaccination for this world-wide disease. ‘New’ diseases have also come to the fore including the Ebola virus.

There is a vast difference in the medical world of 1945 to that of 2002. Developments within medicine would have been expected but they have been in leaps in the last decades. Diseases that would have almost certainly killed in 1945 to 1950 are now usually treatable and in many instances curable.
Christian Barnard's place in medial history is based on the fact that Barnard performed the first open heart transplant in history. In 2002 such operations are common but in the late 1960's operations on the heart were rarely performed because of the risk of death and heart transplants were unheard of. Christian Barnard was a pioneer of organ transplants and he must be placed alongside the likes of Pasteur, Lister, Koch, Fleming, Florey and Jenner in any list of medical giants.

Christian Barnard was born in South Africa in 1922. He worked as a surgeon at the Groote Schuur hospital in Cape Town. After further training in America, he became a leading heart surgeon.

Barnard studied heart surgery at the University of Minnesota in the US and returned to South Africa to set up a cardiac unit in Cape Town. In December 1967 he transplanted the heart of a road accident victim into a 59 year old man, Louis Washkansky. This was the first operation of its kind and made Barnard a household name worldwide - fame that took him by surprise. Asked to describe his feelings after the Washkansky transplant, Barnard said:

"Not very much. It was a natural progression of open heart surgery. We did not think it was a great event and there was no special feeling. I was happy when I saw the heart beating again. We did not stand up or cheer or something like that. I didn't even inform the hospital authorities that I was going to do the operation."

Unfortunately, Washkansky died 18 days later from pneumonia. The drugs used to prevent the body rejecting the new heart adversely weakened his resistance to infection.

One of Barnard's patients lived for over a year and a half after surgery, but patients needed drugs to prevent the body rejecting the donor heart. These left them open to infection and many died, just like Louis Washkansky. After a while, all heart operations stopped because the risk of failure was considered too high.

In 1974 a researcher working in Norway discovered a new drug called cyclosporin. This drug helped to overcome the body's rejection of the donor organs and protected the patient against infection. Subsequent heart transplants were more successful and since the late 1980s the majority of patients have survived for more
successful and since the late 1980s, the majority of patients have survived for more than two years after surgery.

Barnard had demonstrated that heart transplants were possible. Even though many of his patients died soon after their operation, he had taken the first steps into a new form of surgery which is now routine in medical practice. In 1974, Christian Barnard carried out the first double heart transplant. He ended his career in surgery because of the impact of arthritis.

Barnard died in 2001, ironically of disease to his heart.

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<td>&quot;It's difficult to say. If you ask me what I would like to be remembered for, I would not say the transplants but the surgery. I have performed on children with abnormal hearts. It is much more difficult than transplantation and much more satisfying. With the surgical facilities we give a child a chance to lead a normal life.&quot;</td>
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http://www.historylearningsite.co.uk/christian_barnard.htm