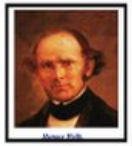
Problem One - Pain

The discovery of an anaesthetic, which would reduce the pain felt by a patient, was a major breakthrough in surgery. It meant the surgeon could work more carefully and take more time if the patient was not struggling.

In 1844 Horace Wells, a dentist in the USA, used nitrous oxide when extracting teeth. The problem with nitrous oxide was that fact that the anaesthetic didn't work on everyone.



In 1799 Humphrey Davy accidentally discovered that inhaling nitrous oxide (also called laughing gas) made less aware of pain.

In 1846 William Morton, another dentist, again in the USA, found that the gas ether was a more long-lasting anaesthetic. It was used in an operation to remove a growth from a patient's neck.

There was great excitement at the discovery of anaesthetics but there were problems in the use of ether.

- *Firstly, it sometimes made patients vomit.*
- *Secondly, it tended to irritate the lungs of patients so that they coughed even when they were unconscious.*
- *Thirdly, it had to be carried in large, heavy glass bottles, which were very difficult for the surgeon to carry around with them.*
- *Fourthly, it was highly flammable, which was a dangerous situation when the only form of artificial light was from candles or gas lights.*
- *Finally, it tended to produce a very deep sleep, which could last for days.*

While in Britain, Robert Liston used ether while amputating a leg. Liston was a famous London surgeon who once amputated a leg in two-and-a-half minutes but worked so fast that he accidentally cut off his patient's testicles as well.

Furthermore, during another high-speed amputation Liston amputated the fingers of his assistant and slashed the coat of a spectator, who, fearing that he had been stabbed, dropped dead with fright. Worse was to follow. Both the assistant and the patient died of infection caught during the operation or in the hospital ward.

A young surgeon in Edinburgh, James Simpson, wanted to discover a better anaesthetic than ether. One evening he invited some other doctors to his house, where they experimented by inhaling vapours from various chemicals. After Simpson's wife found them all unconscious, they realised that chloroform was extremely effective and it did not seem to have the negative side effects of ether.

Danger!

Chloroform affected the heart , and a number of young, physically fit patients died after inhaling it. However, in 1848, John Snow developed an inhaler that regulated the dosage and reduced the number of deaths.

Simpson used chloroform in an operation in Edinburgh as early as 1847, but its use became far more widespread after he came to work in London and especially after Queen Victoria used chloroform during the birth of her eighth child in 1853.

However, it was difficult to get the dose of chloroform correct – too little and the patient could still feel pain, but too much could be fatal, as was shown when Hannah Greener, a 14 year old girl who was having an infected toenail removed, died almost immediately after being given the anaesthetic.

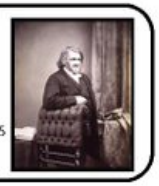
James Simpson was the first man to be knighted for services to medicine. When he died in 1870, over 30,000 mourners

Not everyone welcomed the use of anaesthetics.

- *The Victorian were very religious and some felt that pain relief was interfering with God's plan, especially as the Bible said that God had told Eve that childbirth would be painful.*
- *Some people distrusted anaesthetics because they were new and their effects were not fully understood.*
- *Furthermore, some doctors felt that it was easier for a patient to die if they had been made unconscious than if they remained awake and struggling.*
- *Additionally, the number of patients who died shortly after their operations actually increased when anaesthetics were used, which seem to prove that there was something wrong with anaesthetics.*

The effects of both ether and chloroform tended to remain in the body for some time afterwards, so the search for a better anaesthetic continued. It was found that cocaine was effective for pain relief, but was addictive.

However, in 1884 it was discovered that cocaine could be used as a local anaesthetic – to numb a specific part of the body – instead of a general anaesthetic, which made the patient completely unconscious. In 1905 a more effective version, called Novocaine, was developed to be used as a local anaesthetic.



Problem Two - Infection

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 Semmelweiss. 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.

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.

Deaths on the wards Semmelweiss 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.

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.

Years	Total cases	Recovered	Died	Death rate
1864 to 1866	35	19	16	45.7%
1867 to 1870	40	34	6	15.0%

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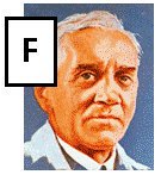

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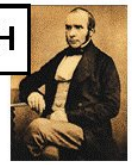

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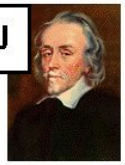

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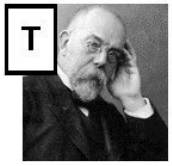

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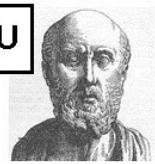

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Problem Three - Bleeding

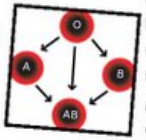
Blood loss has always been a major problem in surgery. Bleeding makes it difficult for the surgeon to see what he is doing, but there is also a problem that if the patient loses too much blood, his blood pressure drops, which affects his heart, and then his body cannot function and he dies.

During the 17th century, there were experiments with blood transfusions using blood from animals (usually sheep) as well as from humans. Although patients occasionally survived, in most cases they died and the procedure was banned. Once anaesthetics and antiseptics made it possible to perform complex operations, there was renewed drive to find a way of dealing with the two problems of blood loss.

The usual way to deal with wounds or amputations was to seal the blood vessels by placing a hot iron on to the wound or pouring boiling oil over it. This process was called cautery and was extremely painful.

In the 16th century a French surgeon, Ambroise Pare, developed metal clips to place on arteries during an operation. He also tried using silk thread to tie the blood vessels after an amputation instead of using heat to seal them. This was far less painful, but the ligatures did not always stop the bleeding if they were not tied properly. Furthermore, this was before Pasteur developed the germ theory and therefore there was no understanding of the way that a surgeon's dirty hands inside a wound increased the chances of infection and led to a higher death rate. For these reasons, cautery continued to be the main way of dealing with bleeding until Pare's idea of silk ligatures was further developed by Joseph Lister in the late 19th century.

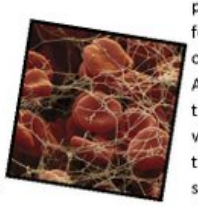
It had therefore become possible to at least partly control the loss blood during an operation, but the problem of replacing blood was not solved until after 1901 when Karl Landsteiner suggested that there were different blood types – A, B and O; a fourth group, AB, was added in 1902.



Landsteiner showed that blood transfusions had to be between people with the same blood group or else the patient died. However, even with this breakthrough, there was still the problem that a donor needed to be present to provide the blood whenever it was needed. This was not very practical and therefore his work did not have a big immediate effect on surgery.

During the First World War (1914-1918) many soldiers died in the trenches from loss of blood even when the wound itself was not fatal. As a result, there was a way new emphasis on the search for a way to store blood for use at a later date.

In 1915 the American doctor Richard Lewisohn found that adding sodium citrate stopped blood from clotting. This meant that the donor did not have to be present and therefore more transfusions could be carried out. Although it was found that the blood cells would deteriorate if the blood was not used soon afterwards, this discovery still saved lives of thousands of wounded soldiers.



Richard Weil found that this blood could then be stored in refrigerated conditions.

In 1916 Francis Rous and James Turner found that adding a citrate glucose solution allowed blood to be stored for longer. This meant that when an attack was planned, the army could ask for donations of blood from the public, so that they were available for transfusions to treat the wounded.

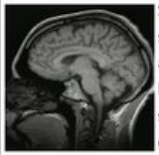
The first blood depot was established in 1917 for the Battle of Cambrai using blood group O, which can be safely given to all patients, whatever their blood type.

War and Surgery

In the First World War (1914-1918), surgeons often treated wounded soldiers close to the front line of fighting where the difficult conditions and large numbers of injuries put them under immense pressure. Surgeons therefore gained a great deal of experience in a wide range of injuries and sometimes had to improvise new techniques. In this way, war can be said to have accelerated their training.

The use of explosive weapons meant that many soldiers suffered deep wounds, and when fragments of clothing entered the wound, it caused infection. Surgeons found that cutting away infected tissue and soaking the wound with saline (salt) solution was the best way of dealing with this, Although they still could not deal with serious infection as antibiotics were not developed until later.

Surgeons also found themselves having to make early attempts at brain surgery because of the nature of some of the injuries received in the war.



At the start of the First World War, the New Zealand doctor Harold Gilles asked for permission to set up a plastic surgery unit in the British army. Before the First World War French and German surgeons were developing skin graft techniques, using tissue from another part of the body to repair an injury.

Harold Gilles was aware of these developments and asked permission to set up a plastic surgery unit in the British army. Gilles began to experiment with ways of reconstructing facial injuries and paid particular attention to the attempt to create a normal appearance.

He developed the new technique of pedicle tubes. A narrow layer of skin was lifted up from the body and stitched into a tube at one end.

The other end was still attached to the body and this meant blood continued to circulate and helped healthy skin to develop. When the tube had grown long enough, the free end was attached to the new site. Once the skin graft was in place, the pedicle tube could be cut free at the base.

Gilles kept careful records, including drawings of the injuries and reconstructions he created.

Another advancement that occurred during the war was in the area of prosthetics. Between 1914 and 1921 over 41,000 men in the British armed forces lost a limb.

Advances in prosthetic limbs included the use of light metal alloys and new mechanisms, but there were long waiting lists for these to be fitted and patients then needed training to use them properly.