Twentieth Century Medicine

20th Century Medicine

Penicillin – Fleming, Florey and Chain

There are many examples in medicine of false starts, and penicillin is one of them. In 1872 Joseph Lister noticed that mould of bacteria called penicillin killed other bacteria. Years later, in 1884, he used this mould to treat a nurse who had an infected wound. But Lister did not use it again. A miracle cure lay waiting for someone else to rediscover it.

In 1909 Paul Ehrlich developed the first chemical cure for a disease. This was Salvarsan 606, which he called a 'magic bullet' because it homed in on and destroyed the harmful bacteria that cause syphilis. It wasn't until the 1930s that Gerhard Domagk developed Prontosil, the second chemical 'magic bullet', to cure blood poisoning. Scientists then discovered that the important chemical in these cures was sulphonamide and drug companies then developed more sulphonamide cures for diseases such as pneumonia. However, 'magic bullets' could not kill staphylococcus germs which caused major infections and often killed the victims.

During the First World War a scientist called Alexander Fleming was sent to France to study soldiers' wounds infected with streptococci and staphylococci bacteria. These wounds were not healed by chemical antiseptics, and many soldiers died from them. Back home Fleming worked on finding a way of dealing with these bacteria.

Ten years later, in 1928, Fleming found what he'd been seeking. He was working at St Mary's Hospital, London. Going on holiday he left a pile of Petri dishes containing bacteria on his laboratory bench. On his return he sorted out the dishes and noticed mould on one of them. Around the mould the staphylococci bacteria had disappeared.

Fleming carried out experiments with the penicillin mould on living cells. He discovered that if it was diluted it killed bacteria without harming the cells. He made a list of the germs it killed and used it to treat another scientist's eye infection. However, it did not seem to work on deeper infections and in any case it was taking ages to create enough penicillin to use.

In 1929 Fleming wrote about penicillin in a medical journal but nobody thought his article was important. He had not used penicillin on animals to heal infections so had no evidence of it being useful.

In 1938 Florey and Chain were researching how germs could be killed. They read Fleming's article on penicillin and realised that it could be very effective, so they tried to get funding from the government. They got £25. With a war about to start and no proof that penicillin could help people, the government had other things to spend its money on. Instead Florey asked for money from America and got enough to pay for five years' research.

Florey and Chain discovered that penicillin helped mice recover from infections, but to treat one person they needed 3000 times as much penicillin! Even large drug companies could not afford to fund this quantity of work. So Florey and Chain began growing penicillin in whatever they could, using hundreds of hospital bedpans, even though bedpans were now in demand to make Spitfires!

By 1941 there was enough penicillin to test it on one person. The volunteer was Albert Alexander, a policeman who had developed septicaemia – a bacterial infection that attacks the whole body – from a tiny cut. Alexander was dying. Chemical drugs had not killed the infection. Florey and Chain requested permission to try their new 'purified' penicillin, and injections began. The penicillin worked and Alexander began to recover. However, the penicillin ran out after five days, even though Florey and Chain were extracting unused penicillin from the man's urine and reusing it in a desperate attempt to keep treating him. The poor policeman became ill again and died. Penicillin had shown that it worked and that it wasn't harmful to the patient – but how could they make enough of it?

Florey and Chain needed help to mass produce penicillin, but English factories were busy helping the war effort and couldn't be used. So Florey went to America – at just the right time. In 1941 America was attacked by the Japanese at Pearl Harbour and entered the war. The American government realised the potential of penicillin for treating wounded soldiers and made interest-free loans to US companies to buy the expensive equipment needed for making penicillin. Soon British firms were also mass producing penicillin, enough to treat the allied wounded on D-Day in 1994 – over 2.3 million doses.

Fleming, Florey and Chain were awarded the Nobel Prize in 1945, but more of the fame went to Fleming. He became a national hero in Britain and was honoured all over the world. Some scientists have argued that this was unfair and that Fleming has received too much credit for the development of penicillin.

Surgery since 1900

X-rays

A German scientist, Wilhelm Rontgen, was carrying out experiments in 1895 when he realised that rays of light in a covered tube were lighting up a far wall. They could pass through black paper, wood and flesh. He did not now what they were, so he called them x-rays.

Within months of Rontgen publishing his discovery the first X-ray machines were being used in hospitals. The First World War had a major impact on the common use of X-rays. Surgeons needed to locate bullets and shrapnel lodged deep within wounded men and X-rays provided the answer. Governments ordered the making of many more X-ray machines and they were installed in all major hospitals on the Western Front.

Blood transfusions

Blood transfusions were often attempted in the 1800s. Sometimes they worked. Mostly they did not. Nobody knew why. Then in 1901 Karl Landsteiner discovered the existence of blood groups. After this, blood transfusions became possible, provided the patient and the donor were in the same place. When doctors tried to store blood it clotted and could not be used for transfusions.

The problem of storing blood was solved during the First World War. There was a huge need for blood, and many soldiers bled to death because there was no store of blood to use. Two breakthroughs solved this problem. Firstly sodium citrate was added to blood to prevent it clotting. Later in the war scientists discovered how to separate and store the crucial blood cells and keep them in bottles for future use. This made possible the huge blood banks that supply blood today.

Fighting infection

Lister had begun the fight against infection, but wartime wounds caused problems that needed new solutions. Many wounds were very deep and bullets carried fragments of clothing carrying bacteria deep inside the body. This caused very deep infections. Gradually, through practice and trying out new methods on thousands of cases, surgeons learned to cut away the infected tissue and protect it with a saline solution. However, the development of penicillin in the Second World War was the real breakthrough in fighting infection successfully.

Radiotherapy

Marie Curie, together with her husband, Pierre, developed Rontgen's research on X-rays. In the process they discovered radium, which has been used ever since to diagnose cancers, and in radiotherapy to treat cancers. Their research was the beginning of modern treatment of cancers. As the research continued it became so complex that they built up a team of research scientists to share ideas. Marie Curie is the only woman to have won two Nobel Prizes, for her work on X-rays and on radium.

Plastic surgery

Plastic surgery had been carried out in India centuries earlier but was always limited by pain and the danger of infection. The terrible injuries of both World Wars led to a rapid development in techniques, especially skin grafts. In the First World War the injuries were mostly from bullet and shell damage. Surgeons carried out over 11,000 plastic surgery operations, increasing their experience and learning from each other. In the Second World War there were many more burns cases in tanks and aeroplanes. Archibald McIndoe alone carried out 4000 operations on burns cases.

Transplant surgery

The first heart transplant was carried out in South Africa in 1967. The lead surgeon was Dr Christiaan Barnard, who became world famous, but in reality he headed a team of highly skilled and experienced doctors, nurses and scientists. Other organs had been transplanted before then (kidneys in 1954 and liver in 1963) and since then ever more ambitious transplants have been carried out including the first marrow transplant in 1980 and the first heart and lung transplant in 1982. All depend on high levels of technical and scientific expertise. So many transplants have been carried out that a transplant Olympics is now held at regular intervals.

Improved anaesthetics

Anaesthetics in the later 1800s had to be inhaled through the nose and mouth. This made it difficult to control the dosage. Surgeons had to err on the side of caution for fear of killing a patient, so still tended to operate as fast as they could. In the 1930s Helmuth Wesse developed anaesthetics that could be injected into the blood stream, allowing more precise control of doses, therefore greater safety, and enabling longer operations. Nowadays local anaesthetics are so effective that patients can even have major operations such as hip replacements under local anaesthetic and without going to sleep at all.

Keyhole and micro-surgery

Once upon a time major surgery required surgeons to make large cuts into the body. Nowadays such large incisions are avoided as often as possible and in some universities there are 'Departments of minimally-invasive surgery', meaning that surgeons cut into the body through as small a hole as possible. All the tools needed are inside an instrument called an endoscope controlled by the surgeon using miniature cameras, fibre-optic cables and computers. Micro-surgery has also developed because of improvements in technology. Surgeons can now rejoin blood vessels and nerves, restoring the use of damaged and even severed limbs.

Public health after 1900

In 1906 a new Liberal government was elected with a landslide majority of votes. Many people expected this government to make major reforms to improve everyday life. Here are some of the measures it took. They may seem unimportant nowadays but a hundred years ago they were revolutionary.

1902 – Training was made compulsory for midwives.
1906 – Meals provided free for schoolchildren in need.
1907 – All births had to be notified to the local Medical Officer of Health. A health visitor visited each mother to make sure she knew how to protect her baby's health.
1907 – Nurses or doctors had to carry out medical checks on children in schools.
1908 – People in need over the age of 70 were paid an old-age pension.
1909 – Back-to-back housing was banned. New regulations enforced higher standard of house building.
1912 – Clinics were held in schools to give children free medical treatment.

One of the biggest changes introduced by the Liberal government was the National Insurance Act of 1911. The aim was to give workers medical help and sick pay if they could not work through illness. Until then workers who fell ill had a choice – carry on working or get no pay, which meant they had no chance of affording medical help.

The National Insurance scheme required the worker, his employer and the government to pay into a sickness fund. It was a major step forward but many people were left out of the scheme. It only included people in work, not their families. Most women and all children were excluded. So were the unemployed and elderly, and anyone who had a long-lasting illness.

In 1919, after the end of the First World War, a new Housing Act became law. The government had promised 'Homes fit for Heroes' for the returning soldiers, and this Act said that local councils had to provide good homes for working people to rent. A quarter of a million new homes were built. In the 1930s many old, unhealthy slum houses were cleared and another 700,000 new houses were built.

However, in other ways medical care was harder to find. In the 1930s unemployment rose to over 3 million, leaving all those unemployed outside the National Insurance Scheme. Even people in jobs could not afford to keep up their payments and so could not get free medical help. The system set up in 1911 was failing. The most worrying evidence came from towns where unemployment was high. In some towns the number of deaths among children under the age of one was rising again.

The National Health Service

The Second World War had a major impact on people's attitudes. It wasn't just the armed forces who were risking their lives. It was the first war in which all people felt they were 'in it together'. Many people at home died during bombing raids. The feeling grew that everyone should have the chance to good health care, not just the wealthy. In addition:

- Many children were evacuated from towns to the countryside and to better-off homes. Middle class families were shocked at the condition of some of the children who were dirty, unhealthy and undernourished.
- After all the sacrifices of the war, people wanted a better future. Better healthcare was an important part of this.
- During the war many people did get free healthcare to keep them fit for the war effort.

The national coalition government asked a leading civil servant, Sir William Beveridge, to write a report on what should be done to improve people's lives. Among his recommendations were:

- Setting up a National Health Service, free to everyone and paid for from taxes. Doctors, nurses and other medical workers would become government employees instead of charging the sick to create their wages.
- Everyone in work would pay National Insurance out of their wages. This would pay benefits (sick pay, old age pensions, unemployment pay, etc) to everyone whether they were working or not.

The Beveridge Report was greeted with enthusiasm by many people. People queued outside shops to buy their own copy and 600,000 copies were sold. However, there was opposition. The most important opposition came from the doctors themselves,

but their opposition ended when Aneurin Bevan, the Minister of Health, agreed that doctors could continue to treat patients privately and charge them fees as well as working for the National Health Service (NHS).

Opposition to the NHS:

- Doctors were afraid they would lose their freedom and be unable to treat private patients who paid fees.
- Some people still believed that the poor and sick were poor simply because of laziness. They did not think the poor should be helped.
- Some people thought that people would grow lazy because they were getting 'something for nothing' and this would make people less likely to bother working.
- Local councils and charities objected to the government taking over control of hospitals from them.

In July 1948 the NHS was introduced. Now everyone could get free treatment. Until 1948 about 8 million people had never seen a doctor because they could not afford to do so. Many hospitals were rebuilt. Doctors and nurses got new, improved equipment. The NHS played an important part in increasing people's life expectancy, particularly helping to reduce the numbers of women dying during, or shortly after, childbirth.