Lesson Five

Advances in Surgery and Public Health 1920-48; the NHS

Aims

The aim of this lesson is to enable you to learn about:

- the development of penicillin and the roles of Fleming, Florey and Chain
- the importance of the Second World War for developments in surgery, including skin grafts and blood transfusion, and for the role of women in medicine
- Beveridge, the development of the NHS and its importance for public health

Context

In the third lesson, we saw the importance of individual scientists in promoting medical advances, while in the following lesson, we saw how governments and war were perhaps even more vital. In this last lesson, we will see how governments and war continued to dominate 20th-century developments, but also the continuing importance of scientists and doctors such as Fleming, Florey and Chain. Finally, we continue our recurring theme of how the role of women in medicine was slowly becoming more important.

The development of penicillin and the roles of Fleming, Florey and Chain

During the second half of the 19th century, doctors and scientists took three vitally important steps for medicine:

STEP 1

First, Pasteur's germ theory inspired successful searches for the bacteria that caused diseases such as cholera.

STEP 2

Second, doctors and scientists then went on to produce preventive measures. Pasteur discovered how to use weakened forms of bacteria to give the body immunity and others also produced vaccines. For example, Calmette and Guerin discovered a vaccine against tuberculosis in 1906 and Behring discovered a diphtheria vaccine in 1913.

STEP 3

Finally, doctors and scientists moved on to focus on cures. After Koch stained bacteria, Ehrlich searched for a stain that would kill the bacteria – a magic bullet. The first magic bullet was Ehrlich's Salvarsan and the second was Domagk's Prontosil. Prontosil was a sulphonamide and its discovery inspired drug companies to discover and produce many curative drugs based on sulphonamides. However, sulphonamides could damage the liver and kidneys and were ineffective against more virulent microbes. It was penicillin that proved to be the most effective and influential magic bullet.

Activity 1	As you read this material on penicillin, fill in a factor sheet headed FACTORS IMPORTANT IN THE DEVELOPMENT AND PRODUCTION OF PENICILLIN.

The discovery of penicillin

Penicillin is based on mould and was first discovered in the early 19th century by John Sanderson, who found that little grew near it. In the 1880s, Joseph Lister was interested in Sanderson's discovery: he used the mould to cure a nurse's infected wound, but he did not use it again and he did not

publicise what he had done. Several other scientists were interested in the mould but could not produce enough of it or apply it effectively to patients.

When **Alexander Fleming** (left, 1891-1955) served as a surgeon on the battlefields of the First World War (1914-18), he was horrified by the infected wounds he had seen. In 1928, Fleming was working in the laboratory at St Mary's Hospital in London. He found that the penicillin bacteria killed staphylococci bacteria but he lacked the facilities and support to develop and test penicillin as a weapon against infection. However, he published his findings in 1929 and they inspired others.

Alexander Fleming photographed in his laboratory in 1928.

The development of penicillin

In the 1930s, the Oxford scientists Howard Florey and Ernst Chain were keen to develop the research that Fleming had publicised in 1929. In 1939, they established a research team that included experts in the fields of pathology, chemistry and biochemistry. Within three days of the outbreak of the Second World War, Florey asked the British government to fund the team's research into penicillin. The British government agreed because it knew that sooner or later Britain would have hundreds of thousands of soldiers with wound infections.

Florey (left) and Chain (right). Chain was a German-born biochemist who fled Nazi Germany because he was Jewish.

The production of sufficient quantities of penicillin proved problematic. Chain invented a process that combined the

latest freeze-drying technology with less sophisticated tools, amongst which were thousands of milk bottles (in which the team grew the bacteria), milk churns, a dog bath, a bedpan, and a hand pump. Despite all that equipment and a great deal of time consuming research, the team only produced a few grams of pure penicillin.

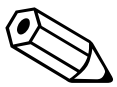
The few grams were just enough to experiment on eight mice. The mice were infected with dangerous microbes and four were given penicillin. Within 24 hours, the four who had not been given penicillin were dead but the other four were alive and healthy.

It was not until 1941 that the team produced enough penicillin to test on a human. A patient covered with infected sores and abscesses responded well to the penicillin and even sat up in bed, but the shortage of the penicillin was such that the team had to extract it from his urine until the penicillin totally ran out. The patient then suffered a relapse and died. However, as the team slowly produced more penicillin, two more patients were successfully treated.

Clearly, penicillin needed to be mass produced. Florey and Chain needed large-scale funding and a safe production site because a British laboratory might be bombed by the Germans. In June 1941, Florey travelled to the United States in an unsuccessful attempt to interest American drug companies in finding a way to mass-produce penicillin. The drug companies were not willing to invest because they were not convinced that they would make a profit.

Then the situation changed dramatically. After the Japanese bombed Pearl Harbor in December 1941, the United States was brought into the Second World War. The US government was now interested in a drug that would help America's wounded. In 1942, the US government gave $80 million to four drug companies. Those companies began to work on mass production and soon achieved great success.

By 1945 the U.S. Army was using 2 million doses of penicillin per month. It is likely that a further 15% of wounded British and American soldiers would have died without penicillin, which also halved the time the wounded spent in hospitals. After the war, penicillin was used on civilians. It was the first antibiotic.

Activity 2	The syllabus says that you should study "the roles of Fleming, Florey and Chain". Think up some descriptive words that could fit in front of the word "role" if you were asked about Fleming. Your descriptive words will probably be a mixture of positive and negative.
	

The importance of the Second World War

The Second World War (1939-45) was important for developments in surgery, including skin grafts and blood transfusions, and for the role of women in medicine.

Like the First World War, the Second World War led to advances in medicine and in particular in surgery. War invariably improves surgery because in wartime:

- surgeons are more willing to work to gather and to share their ideas because they are expected to help the soldiers of their nation and are often anxious to do so
- surgeons have to deal with more patients so they get more practice
- surgeons are prepared to work harder in wartime for the sake of their country
- industry is more prepared to spend money on developing new surgical equipment because of the greater demand
- governments are more prepared to spend a great deal of money on public health because the safety of the nation depends upon keeping as many soldiers as possible alive, both in order to continue to fight and because their families and friends want them well treated.

Skin grafts

In the last lesson, we saw how the First World War led Harold Gillies to develop a plastic surgery unit for burns victims. In the Second World War, his cousin and former assistant Dr Archibald McIndoe developed even better techniques. McIndoe

had plenty of practice: he treated over 4000 pilots whose faces and hands had been badly burned and disfigured by aviation fuel after they had been trapped inside their burning aircraft.

McIndoe's patients were greatly helped by recent developments in drugs, especially sulphonamides and penicillin. As a result of these drugs, McIndoe's patients suffered far fewer infection problems than the patients he and Gillies had treated in the First World War. The importance of McIndoe's wartime work at his hospital in East Grinstead, Sussex, was recognised and rewarded by a knighthood in 1947.

Activity 3

Produce a factor sheet headed HOW DID WORLD WAR 2 LEAD TO PROGRESS IN MEDICINE? As you read on, you will find more points to add.

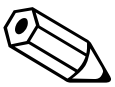
The Second World War, the role of women in medicine and blood transfusions

War always generated great pressure on medical practitioners and the need for extra help gave women new opportunities. We have seen how the Crimean War contributed to the professionalisation of nursing, and how nurses were used at the battlefront during the First World War. The First World War also constituted an important step in the slowly increasing acceptance and use of female doctors. There were more women doctors involved in the British overseas war effort in the Second World War than in the First World War, but they remained a small minority. Indeed, as late as 1965 only 7% of doctors were women.

Perhaps the most famous woman doctor of the Second World War was **Janet Vaughan** (1899-1993). She made an important contribution to the blood transfusion service. Earlier in her career, her gender gave her such problems gaining access to patients that she experimented on pigeons! As a young pathologist at Hammersmith Hospital in 1938, she played a vital role in establishing national blood banks in London. The milk bottles that were especially modified for the collection and storage of the blood were known as "Janet Vaughans". During the Second World War, the blood transfusion service became a highly professionalised and admirably slick operation. New techniques of refining and plasma storage

helped in this. In recognition of her role in this development, Janet Vaughan was made a Dame in 1957.

Poster issued by the local government in Bristol during the Second World War.

Activity 4	Suggest reasons why the city of Bristol authorities quoted from and pictured Winston Churchill on their blood transfusion campaign poster.
	

The Second World War was not only important for developing plastic surgery, blood transfusions and the role of women in medicine. The war was also a very important factor behind the establishment of the National Health Service.

Beveridge, the development of the NHS and its importance for public health

The government and health care, 1906-1939

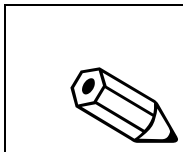
In the previous lesson, we saw how the Liberal governments helped lay the foundations of the modern welfare state in the years 1906-11. However, we also saw that the health provisions of the 1911 National Insurance Act were far from comprehensive. Many people received little or no help in health care from the government. Many relied upon their own health insurance policies – if they could afford them. The situation deteriorated during the economic depression of the 1930s, when people struggled to afford medical treatment – in 1934, over four million health insurance policies were invalidated because people had been unable to keep up their payments. The government's limited contribution to health care shrank further when the government reduced its contribution to health insurance under the economic pressure of the depression years.

Before the Second World War broke out (September 1939), national and local government in Britain were responsible for:

- school medical inspections
- free school meals and milk (from 1934) for many poor school children
- health clinics that gave free vaccinations and cheap baby food
- an increasing number of hospitals.

British schoolchildren drinking their free school milk during the Second World War (1942).

Activity 5	Suggest reasons why the British government seemed to focus on the health of children rather than adults.



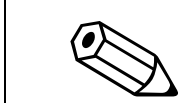
The government and health during the Second World War (1939-45)

During the Second World War, the national government took on far more responsibility for public health for several reasons:

1. Naturally, Nazi bombers focused on inner-city areas with high population densities and manufacturing industries, especially during the Blitz in 1940-41. Children were therefore evacuated from inner-city areas such as London's East End to rural areas. The condition of the evacuees shocked the more prosperous families in the countryside who were tasked with looking after them. Many evacuees had nits, lice and skin diseases because their homes had no running water or flush toilets. A report from the Women's Institute in 1940 noted:

'They were filthy; we have never seen so many children with lice and nits and lacking any knowledge of clean and hygienic habits. It seemed as if they hadn't bathed for months. Some children had dirty, septic sores all over their bodies. Many of the children were bed-wetters and were not in the habit of doing anything else.'

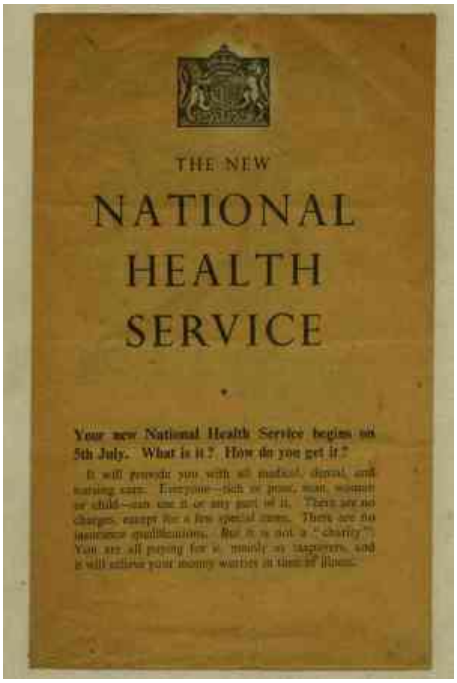
A Ministry of Health poster in the Second World War.

Activity 6	What were the advantages and disadvantages of evacuating children from cities such as London?
	

2. Food shortages prompted the government to order local education authorities to extend their provision of free school meals, and to order rationing. The rationing enforced by the government was designed to give Britons a healthy, balanced diet.

3. The large numbers of civilian casualties (especially during the heavy bombing of the Blitz in 1940-41) forced the government to ensure medical services could cope. The government took over the nation's 2378 hospitals under the Emergency Hospital Scheme from 1939. This accustomed people to the idea of comprehensive government responsibility for health care and prompted the wartime coalition government under Winston Churchill to task the civil servant William Beveridge with a rethink of the government's National Insurance Scheme.

The Beveridge Report and the development of the NHS


THE NEW
NATIONAL
HEALTH
SERVICE
Your new National Health Service begins on 5th July. What is it? How do you get it?

The **Beveridge Report** (1942) suggested a free National Health Service. Within two weeks of its publication, a Gallup poll revealed that 90% of British people had heard of the Beveridge Report and 80% believed its proposals should be adopted. Clearly, any political party that promised to implement Beveridge's ideas was likely to win the next general election.

An information leaflet issued by the government in 1948.

The Labour Party was elected to power in the general election in the summer of 1945. Under Prime Minister Clement Attlee, this Labour government introduced a comprehensive welfare state that looked after its citizens' basic needs from the cradle to the grave. The single most important element of this welfare state was the National Health Service (NHS). In 1946, the National Health Service Act said that Britons should have a free and comprehensive health care system. In July 1948, the NHS came into operation.

Reasons why the National Health Service (NHS) was established

1. Many suffered poor health during the economic depression of the 1930s and lacked the money to pay for medical care. This left a great impression on many Britons, including some leading Conservatives such as Harold Macmillan, whose Stockton constituency was an industrial area with high unemployment and dreadful poverty.

Bomb damage in London during the Second World War.

2. Under the pressure of civilian casualties in the Second World War, the government had taken responsibility for the provision of free hospital care. This had accustomed ordinary Britons and politicians to the idea that free hospital care was the responsibility of the government.

3. People had been shocked by the health and hygiene of evacuees and felt that something needed to be done about it. For example, Lord Chandos took in 31 evacuees but was horrified to find that they regarded "the floors and carpets as suitable places to relieve themselves".

4. The combination of both the economic depression of the 1930s and the Second World War prompted a growing sense amongst the public and some politicians that Britons deserved free healthcare. Some pointed out that without it, many Britons might not be fit to fight for Britain in the next war, others were motivated by their humanitarianism. For example, Aneurin Bevan said in a 1946 speech,

> 'Medical treatment should be made available to rich and poor alike in accordance with medical need and no other criteria. Worry about money in a time of sickness is a serious hindrance to recovery apart from its unnecessary cruelty. The records show that it is the mother in the average family who suffers most from the absence of a full health service. In trying to balance the budget she puts her own needs last... The essence of a satisfactory health service is that the rich and the poor are treated alike, that poverty is not a disability, and wealth is not advantaged.'

5. In summer 1945, a Labour government was elected to power. One of the reasons for Labour's electoral victory was the enthusiastic Labour Party support for Beveridge's proposals.

In contrast, the Conservatives under Winston Churchill had openly (and with good reason) wondered how Britain could afford free and universal healthcare.

6. Although the opposition to the NHS was very strong in some quarters, the Labour government dealt with it successfully. The proposed NHS was opposed by those who felt Britain could not afford it, by local authorities and voluntary bodies who currently ran the hospitals that would be nationalised under the Act, and by the British Medical Association. BMA members feared loss of income if they were employed by the government. In late 1946, 54% of BMA members said they would refuse to co-operate with the NHS, and by January 1948, the number was up to 90%.

   However, the Labour government's Minister of Health, Aneurin Bevan, was a dynamic, committed and persuasive individual. Bevan managed to win over the medical profession, especially through his assurances that they could still treat patients privately in NHS hospitals in order to supplement their government income. As a result, the NHS came into operation in July 1948.

The importance of the NHS for public health

All NHS services were available and free to all at the point of delivery. These services included...

- medicines
- appliances
- ambulances
- vaccinations
- health centres
- dentists
- family doctors
- blood transfusions
- hospitals
- specialists
- health centres
- antenatal and postnatal care
- opticians
- physiotherapists.

The NHS also-ran teaching hospitals and promoted medical research.

The NHS greatly improved the health and quality-of-life of the British population. Families were no longer haunted by the inability to pay for medical treatments. The British people were overwhelmed by what the NHS could do for them. For example, hundreds of thousands of Britons queued to see an optician and to get free glasses, and hundreds of thousands of women who had suffered from painful varicose veins for years now obtained treatment. The childbirth mortality rates soon dropped dramatically. Life expectancy rose, for example, from 66 years to 82 years for women in the years 1948-2008.

However, the NHS quickly proved far more expensive than had been expected, and in 1951 prescription charges had to be introduced – the first of several such extra charges. Furthermore, as the NHS increased life expectancy, the problems of financing it grew to the crisis point that would be headline news in Britain in the second decade of the 21st century.

Self-Assessment Test

1. How did war impact upon the discovery and production of penicillin?
2. What was the main problem encountered by Florey and Chain in their work on penicillin?
3. How many more Allied soldiers might have died without penicillin?
4. Who developed plastic surgery while working on Second World War pilots?
5. What important work did Janet Vaughan do in the Second World War?
6. How many health insurance policies were invalidated in 1934?
7. Why did governments take more responsibility for public health in the Second World War?
8. Which report was published in 1942?
9. When did the National Health Service come into operation?
10. Give four reasons why the NHS was established.

Suggested Answers to Activities

Activity 1:

Individuals – Sanderson, Lister, Fleming, Florey and Chain.
Governments– the British then the US governments funded the research on mass production.
Economic factors – drug companies only did research when money was on offer.
Science and technology – freeze-drying technology, scientific experiments (e.g. mice).
Communications – Fleming's article, Florey's flight to the USA.

Activity 2:

Pioneering role, important role, limited role.

Activity 3:

Government – aid to research and hospitals.
Individuals –e.g. William Beveridge.
Economic– governments and pharmaceutical companies more interested in expenditure because of greater demand.
Communications – e.g. Florey flying to the USA.
Science and technology (e.g. importance of developing blood banks because there were so many dead).
War – the number of military casualties led to progress in plastic surgery, and the numbers of civilian wounded and the evacuees accustomed people to the idea of the government's responsibility for public health.

Activity 4:

Churchill's picture gave the poster extra authority, it was eye-catching, he was always an inspirational figure.

Activity 5:

Children were the next generation of workers and soldiers and mothers. It was also easier to get people to accept expenditure on health if it was for young people, toward whom most adults felt protective.

Activity 6:

Advantages – it was safer away from the bombing of inner-city areas; eventually leads to public health improvements.
Disadvantages – homesick in an alien environment.

Suggested Answers to Self-Assessment Test

1. The First World War inspired Fleming's research and the Second World War and enabled Florey and Chain to obtain funding from the British and then the American governments.

2. It proved expensive to find a way in which to mass produce penicillin.

3. 15%.

4. Archie McIndoe.

5. The organisation of blood banks for blood transfusions in London.

6. Over 4 million.

7. The poor health of the evacuees, food shortages and civilian casualties.

8. The Beveridge report.

9. 1948.

10. The experiences of the economic depression of the 1930s and of World War II (1939-45), the poor health of the evacuees, the beliefs and promises of the Labour Party, the work of Aneurin Bevan.

Tutor-marked Assignment B

(a) Explain two ways in which the treatment of wounded soldiers in 1856 was different from the treatment of wounded soldiers in 1917. [6 marks]

(b) Explain two causes of improvement in nursing in the years 1848 to 1905. [8 marks]

(c) EITHER

(i) How far did the role of the British government in public health change in the years 1875-1948?

You may use the following in your answer:

- the 1875 Public Health Act
- the introduction of the NHS.

[16 marks]

OR

(ii) How far were important individuals responsible for changes in medical treatment in Britain in the years 1905-1948?

You may use the following in your answer:

- Alexander Fleming
- Aneurin Bevan.

[16 marks]

TOTAL 30 marks.