*This podcast helps you to understand the role of key individuals – Fleming, Florey and Chain’s development of penicillin.*

**Person 1:** Please welcome Howard Florey, Australian doctor and Head of Pathology at Oxford University and Ernst Chain, a scientist at Oxford University to our studio.

Let’s start with a question for you Florey, who discovered penicillin?

**Person 2:** Penicillin was discovered by Alexander Fleming by chance, and it took him over ten years.

**Person 1:** Please tell us more.

**Person 2:** Fleming was sent out during the First World War to find a solution for soldier’s wounds caused by streptococci and staphylococci, which did not heal using the usual antiseptics. Unfortunately, he did not find an answer. Ten years later, and still looking for an answer, he we went on holiday leaving behind a pile of dishes containing bacteria. On his return, sorting out the dishes he noticed around the mould staphylococci bacteria had disappeared.

**Person 1:** So it just took him being lazy to find a solution?

**Person 2:** Hmmm, not quite. It was a combination of chance, his observation skills and scientific experiments. Only then he discovered when penicillin mould was diluted it killed bacteria without harming cells. He then made a list of germs it killed and finally treated a colleague’s eye infection.

**Person 1:** So Chain, was this the discovery of penicillin as we know it?

**Person 3:** No, it did not work on deeper infections and doctors largely ignored his findings.

**Person 1:** When did you and Florey discover Fleming’s work?

**Person 3:** In 1938 when we were researching how germs could be killed.

**Person 1:** Florey, what did you do next?

**Person 2:** We realised the potential and tried to secure funding but with war looming we were only given £25. It was at this point I turned to the American government and secured enough to fund five years of research. This allowed us to experiment on mice and prove its worth.

**Person 1:** So penicillin became a recognised treatment?

**Person 2:** No, although we could treat mice it would take 3000 times the amount to treat humans. No one could afford to fund it and we had to grow it ourselves.

**Person 1:** When did you have an enough?

**Person 3:** In 1941 we thought we had enough. Our patient was Albert Alexander, a police officer with septicaemia. We treated him with penicillin injections and it worked. However, it ran out after five days and sadly Albert died. But we had proved its worth.

**Person 1:** How did you overcome the final hurdle and mass produce it?

**Person 3:** In 1941 America entered the Second World War and realised the potential of penicillin for treating wounds and made interest-free loans to U.S. companies to buy the expensive equipment to produce it. The British quickly followed and used 2.3 million doses on D Day.

**Person 1:** Final question… when did penicillin change from a wonder drug to an ordinary life saver?

**Person 2:** At the end of the war in 1945 penicillin began to be manufactured and used by everyone. By the 1960s it was becoming an everyday drug.

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*This podcast helps you to understand the fight against lung cancer in the twenty-first century: the use of science and technology in diagnosis and treatment; government action.*

Lung cancer is currently the second most common form of cancer; over 40,000 people are diagnosed annually. Medical evidence has proved a link with cigarette smoking and nearly 90 percent of cases are the result of smoking, with some linked to passive smoking.

Lung cancer is particularly deadly because during its early stages it is very hard to diagnose and is often discovered too late, as demonstrated in the statistics; only 1 in 3 people live for one year following diagnosis and just 10 percent live for more than five years. With poor survival rates the government has invested in prevention, diagnosis and treatment.

Prevention has included major government campaigns warning people of the dangers of smoking, through advertising, banning advertisements for cigarettes and making them invisible in shops. Laws have made smoking in public places illegal with the aim of reducing the effects of passive smoking and helping people give up.

Diagnosis is hard and often happens in the later stages of lung cancer when it has spread. There is currently no national screening programme because the technology does not exist. The government has invested money, through the NHS, but they are reliant on developments in science and technology as well as research undertaken by scientists. Current improvements in diagnosis are focused on high-risk individuals.

With diagnosis hard treatment is vital. Currently there are four forms of treatments; surgery, radiotherapy, chemotherapy and immunotherapy.

Surgery and radiotherapy are the most common forms of treatment. Surgery has been used since the 1930s but the majority of lung cancer sufferers have other smoking-related health problems meaning it can be too dangerous. Radiotherapy is used to kill the cancer using beams of radiation. Both have been refined and modified to increase access and survival rates. For instance, new surgical techniques are continually being developed, such as remote controlled micro-instruments and cameras. These have lesser impact on the body and speed recovery and the number of people who can access it.

Chemotherapy has been used since the 1970s if surgery and radiotherapy has not worked. Chemotherapy involves using particularly powerful chemical medicines to attack cancer cells, although there are significant side effects. New combinations of chemotherapy are constantly being used and results recorded.

Immunotherapy is a new treatment where the body’s natural immunity is increased to stop the cancer cells from defending themselves against the immune system.

The work against lung cancer shows how interdependant the various factors are that help to improve medicine and health. The wide range of factors involved in preventing and treating major killers include government, individuals, science and technology.

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*This podcast helps you to understand advances in understanding the causes of illness and disease, the influence of genetic and lifestyle factors on health.*

Advances in medicine and health since 1900 have been phenomenal. Whilst advances in understanding of the causes of illness and disease during the first half of the 1900s were steady, in later decades they were dramatic.

Genetic understanding has developed over a long period of time. As early as the 1800s scientists knew about the existence of DNA but it was not until the twentieth centurythat its importance was known. In 1953 Francis Crick and James Watson discovered the structure of DNA and proved that it existed in every human cell. They also showed how it passed from parent to child. But it was not until 1986 that the exact purpose of each gene in the human body was investigated through the Human Genome Project, which was completed in 2001. Since then, scientists have identified specific genes that pass on particular conditions and illnesses including cancer, diabetes and Parkinson’s disease. It is hoped that in the future scientists will find ways of helping sufferers from genetic diseases.

The link between lifestyle factors and an understanding of the causes of illness and disease has also had a positive impact on life expectancy since 1900. But it must be stated that the Ancient Greeks and Romans had made the link, although they lacked scientific proof.

In the late 1800s and early 1900s a number of new studies detailed the direct link. The first study by Edwin Chadwick, in 1842, highlighted that people in towns had, on average, shorter lives than people living in rural areas. Two reports; Charles Booth’s Life and Labour of the People in London, 1891–1903 and Seebohm Rowntree’s Poverty: A study of Town Life, 1901, showed that poverty seriously affected people’s health. These reports had an impact as they were conducted in different areas yet detailed the same findings – they were the forerunners to future research paid for by governments, universities and charities.

Today, the link between lifestyle factors – also known as lifestyle problems – and health are well documented. Lifestyle problems include drinking alcohol, poor diet and smoking and all have direct links to a variety of diseases, including some forms of cancer, heart disease and type 2 diabetes. The government invests heavily in advertising and publicity campaigns against smoking and the advantages of exercise with the aim of improving people’s lives.

Advancements in genetics and knowledge of the impact of lifestyle factors has developed alongside improved science and technology and combined they have enabled major changes in the accuracy of diagnosis. Findings are also shared internationally as methods of communication have progressed allowing more people to access and act upon information.

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*This podcast helps you to understand improvements in diagnosis: the impact of the availability of blood tests, scans and monitors.*

**Questioner**: Diagnosis of illness and disease has experienced rapid developments especially in the later part of the twentieth century. Illnesses are being identified earlier and the number that can be detected is also increasing. Speed and accuracy of diagnosis is also improving. Advancements in science and technology have allowed the creation of complex machinery and instruments to support doctors diagnose precisely the illness or disease a person is suffering from. Let’ see how many you know …

…Electron microscope.

**Interviewee**: Allows doctors to see much smaller objects such as human cells.

**Questioner**: Endoscopes.

**Interviewee**: A camera inside a flexible tube passed into the body so doctors can see inside the body without using surgery.

**Questioner**: What are scans used for?

**Interviewee**: Scan the body to identify cancers and other illnesses. They are widely used to screen for breast cancer to catch the disease as early as possible which is important for survival.

**Questioner**: Nuclear medicine?

**Interviewee**: Radioactive elements injected into the bloodstream.

**Questioner**: What is nuclear medicine used for?

**Interviewee**: To track and diagnose changes in the body through disease.

**Questioner**: Well done. You know them all with some specific examples.

**Interviewee**: Now it is my turn to test you on blood tests. Name one illness that has benefited from the development of a machine to test blood sugar levels.

**Questioner**: Diabetes.

**Interviewee**: Name one illness that has benefited from the development of a machine to test blood pressure.

**Questioner**: High blood pressure.

**Interviewee**: Briefly describe one limitation of standard blood tests.

**Questioner**: Following transplant surgery viruses that have lain inactive in the patient or donor for years can reawaken and standard tests regularly fail to detect them before surgery. The virus often returns in greater force when the patient’s immune system is supressed with drugs to prevent them rejecting the organ post-surgery.

**Interviewee**: Well done, all answers are correct, so far. Last question and it’s a hard one! In 2015 a new blood test was reported that could benefit organ transplant patients. Please tell me about it.

**Questioner**: It is a new cheap yet rapid test requiring only a drop of blood. It allows doctors to access a list of every virus that has infected or continues to infect a patient. It could transform disease detection.

**Interviewee**: Excellent knowledge.

**Questioner**: My final point and an important one is all these developments whilst transforming diagnosis in relation to pace and accuracy have cost huge amounts of money, paid for governments, medical companies and universities.

**Interviewee**: True but they save thousands of lives every year with some pieces of equipment available for use in the home including blood pressure, heart and cholesterol monitors.

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*This podcast helps you to understand the extent of change in care and treatment. The impact of the NHS and science and technology: improved access to care; advances in medicines, including magic bullets and antibiotics; high-tech medical and surgical treatment in hospitals.*

The extent of change in care and treatment since 1900 has been profound and has led to increased life expectancy and specialist treatments. A range of factors have been central to change, including technology, scientific knowledge and expertise, war and funding.

Science and technology have played a major role and had an impact on all discoveries and developments. Advancements in both areas have enabled scientists to identify the exact chemicals that are beneficial to patients in remedies. In 1909 Paul Ehrlich developed the first chemical, Salvarsan 606 that killed bacteria inside the body and became known as the first magic bullet. Unfortunately, it also killed patients. In the 1930s, Prontosil the first magic bullet safe for patients was created. Later, using further developments in scientific research and equipment, sulphonamide was identified as the important chemical in the cures.

War also played a crucial role; as shown in the development of penicillin, the first antibiotic. It was the American government which first realised its potential and gave companies interest-free loans to mass produce it. It was initially a wonder drug that saved soldiers’ lives yet today with the establishment of industrial technology and worldwide pharmaceutical companies, remedies such as penicillin have become common place within our lives.

Improved access to care has also led to higher life expectancy. Following the Liberal landslide in the 1906 general election there was a change of attitude towards government involvement in health and medicine. Between 1906 and 1919 there were several revolutionary laws passed that meant more people were able to access improving medical care and treatment. British governments have continued to intervene through funding, campaigns and further legislation.

Undoubtedly, the greatest change in care came with the introduction of the National Health Service, the NHS, in 1948, which provided free care for all at point of access. This allowed everyone access to a doctor, about 8 million people had never seen a doctor before 1948, and a range of health services. Many hospitals were rebuilt and doctors and nurses got new improved equipment. Its impact was quickly noted and one of the most obvious and quickest impacts of the NHS was a reduction in the number of women dying in or immediately following childbirth.

With improvements in hospitals following the establishment of the NHS they have become the major centres of high-tech treatments ranging from X-rays and blood transfusions which are now part of routine treatments to more specialist treatments such as transplant, keyhole and micro surgery. These are all possible and dependant on high levels of technical and scientific expertise.

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*This podcast helps you to understand new approaches to prevention: mass vaccinations and government lifestyle campaigns.*

**Person 1:** New approaches to prevention since 1900 – and, in particular, post-1950s – have led to longer life expectancy and people dying of illnesses later in life. I think the most important change and greatest impact on health has been mass vaccination programmes.

**Person 2:** I agree, there has been a dramatic change in causes of death from TB in 1911 to cancer and heart disease today. However, I believe the most important impact on prevention of illness and disease has been government lifestyle campaigns.

**Person 1:** I totally disagree, mass vaccination programmes put an end to the devastating epidemics of smallpox and cholera, and, today, vaccinations are commonplace. This has led to a decrease and the eradication of some of the major killers of the previous century.

**Person 2:** Whilst vaccinations are a significant part of preventing disease they have not always been well received by the public. For example, during the 1950s people did not vaccinate against polio despite the fear created by epidemics. It was not until the death of Jeff Hall, a famous footballer that people were frightened enough to have the vaccination.

**Person 1:** Most new medical advances are met with scepticism, but this does not mean they are not influential and important – take, for example, MMR. You also need to look at the positive impact of vaccinations, for instance, the vaccination against measles, found in 1964. Since its introduction the number of children contracting the disease has decreased and the vaccination has done a lot to wipe it out. Prior to the vaccination children died from the disease or at best would be in hospital for weeks. Another example is the annual investment the British government place in to the flu vaccination due to the significant threat posed by influenza. Vaccinations are an essential part of prevention and important to our health.

**Person 2:** I accept that vaccinations are important but I maintain government lifestyle campaigns have a greater impact on preventing illness and disease. British governments frequently run single-issue campaigns, for instance anti-smoking. In 1992 the Government’s ‘Health of the Nation’ initiative set the NHS targets to prevent and reduce deaths and illness in five major areas, including heart disease.

**Person 1:** But vaccinations are vital and continue to be developed, for example, in 2015 meningitis B.

**Person 2:** So are healthy lifestyles. A recent initiative gives everyone over the age of 40 an opportunity to have a health check every five years focusing on blood pressure, weight and cholesterol, alongside lifestyle advice. Enabling people to understand their current health and changes they can positively make.

**Person 1:** We will have to accept to differ.

**Person 2:** Yes, we will.

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