

KQ4: How much progress has been made in medical knowledge over time?

MEDIEVAL AND EARLY MODERN PERIODS : c.1300s-1700s

Medieval physicians used a variety of sources of information:

- Examining a patient's **urine**; samples were matched against a colour on a urine chart which led to a particular diagnosis.
- **Astrologers** consulted a book called the *Valemeccum* or 'zodiac man' charts to work out which treatments could be used at that time.
- Bleeding, purging or forcing patients to vomit was based on the theory of the **Four Humours** was developed by Hippocrates and Galen in ancient times; four important liquids, called humours, which stayed in balance when a person remained healthy; treatment involved getting the humours back into balance.

The 16th century Renaissance in learning led to the invention of the printing press in Germany and new scientific inventions like the thermometer and microscope, both of which helped improve medical observation.

Andreas Vesalius, Professor of Anatomy at Padua University in Italy, dissected corpses to understand human anatomy. In 1543, he published *The Fabric of the Human Body*, with detailed anatomical drawings. His insistence on dissection of human, not animal, bodies introduced new scientific methods of investigation.

Ambroise Paré was an army surgeon. Wounds were cauterised with boiling oil after amputations, sealing the arteries with a red-hot iron. Paré discovered that wounds healed more quickly if covered with bandages and the ends of arteries were tied using silk ligatures. In 1575, Paré published *The Collected Works of Surgery* - research on amputations, setting fractures and the treatment of wounds.

William Harvey studied medicine in Cambridge before becoming a doctor and a lecturer in anatomy. Harvey believed in the importance of observation and experimentation. By dissecting live animals to study the movement of the muscles in the heart, he proved that blood flowed around the body, carried away from the heart in arteries and returned to the heart in veins. He proved that the heart acted as a pump. In 1628 he published his findings in his book, *Motion of the Heart*.

Key Words

Humours - Four liquids (phlegm, blood, black bile and yellow bile) in the body, that were related to the four seasons and to the four elements (air, fire, earth and water) and believed to cause illness when they became unbalanced.

Anatomy - The study of how the human skeleton fits together.

Dissection - Cutting open and examining the structure of a dead body.

Cauterise - A method of treating amputated limbs or wounds by burning them with a hot iron or oil to prevent infection, stop the bleeding and seal the wound.

Ligature - A thread tied around a vessel to constrict the flow of blood.

INDUSTRIAL PERIOD : c.1800s

19th century doctors believed in spontaneous generation - fumes (miasma) given off by decaying material caused disease to spread. Improvements in microscopes in the late 17th century had already led to the discovery of micro-organisms.

Louis Pasteur carried out scientific research at several French universities before being appointed Professor of Chemistry at the Sorbonne University in Paris in 1867. His most important research included:

- Pasteurisation - boiling the liquid killed harmful germs. It was soon used to stop milk turning sour, as well as beer, wine and vinegar going bad.
- Germ theory - microbes in the air caused decay; in 1861, Pasteur published his 'germ theory' based on his experiments.
- Vaccination theory - in 1879, Pasteur injected chickens with a weakened form of chicken cholera by accident and they became immune, discovering how vaccines work; he did the same for anthrax (1881) and rabies (1885).

Robert Koch was a German doctor who could link bacteria to a particular disease. By 1875, he had identified the bacteria that caused anthrax. In 1878 he did the same for septicaemia (blood poisoning) He stained bacteria so they could be seen under a microscope, and bred bacteria for study. He identified the TB and cholera bacteria. Koch was a pioneer of this new science of 'bacteriology'. The German government set up the Institute of Infectious Diseases in Berlin in 1891. In 1905 he was awarded the Nobel Prize for his research.

Paul Ehrlich, student of Koch, developed Salvarsan 606 in 1910 as a treatment for syphilis. It was a 'magic bullet', designed drug to target a specific germ.

WELSH EXAMPLE: Dr J W Power - Power was the Medical Officer of Health for Ebbw Vale who set up courses in bacteriology to train doctors in germ theory. He also opened a public health laboratory in Cardiff to study bacteriology.

WELSH EXAMPLE: The foundation of orthopaedics [see KQ3 for details]

Key Words

Pasteurisation - The process of heating liquids to destroy harmful micro-organisms.

Chicken cholera - An acute infection of the bowels seen in chickens.

Anthrax - A highly infectious and often fatal disease affecting cattle and sheep.

Rabies - An acute infectious disease of the nervous system spread by the saliva of infected animals.

Tuberculosis (TB) - a serious infectious disease that affects the lungs.

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MODERN PERIOD : c.1900s-present day

X-rays - In 1895, Wilhelm Röntgen, Professor of Physics at the University of Würzburg in Germany, discovered X-rays. He realised they would pass through paper, wood, rubber and human flesh but not through bone or metal. Surgeons could see inside the patient without surgery. X-rays really became important during the First World War, enabling doctors to locate deeply lodged bullets and shrapnel inside the bodies of soldiers. Marie Curie developed mobile X-ray units which could be used nearer the front line, making diagnosis and treatment of injured soldiers quicker and easier.

Ultrasound and MRI scans - The second half of the 20th century saw the development of a new range of scanning techniques, which transformed doctors' abilities to see inside the body:

- Ultrasound scanning has developed since the 1950s using high frequency sound to produce 3D images of the inside of the body.
- First used in 1977, the magnetic resonance imaging (MRI) scanner uses a strong magnetic field to create pictures of features inside the body in a computer.

DNA and genetic research - Francis Crick and James Watson explained the structure of DNA in 1953. The Human Genome Project was set up to identify the role of each of the 100,000 genes in a human DNA molecule. It was completed in 2003 and provided the complete genetic blueprint of a human being. As a result of the work on DNA, scientists identified that the causes of some illnesses are genetic. Genetic screening and testing has been used for preventing disease. Work continues on gene therapy, using genes from healthy people to cure the sick.

WELSH EXAMPLE: Martin Evans and stem cell research - In 2007, while Professor of Mammalian Genetics at Cardiff University, was awarded the Nobel Prize for medicine for his work on stem cells. He developed the technique of gene targeting.

Key Words

X-ray - A picture produced by exposing photographic film to X-radiation (made up of X-rays), a form of electromagnetic radiation; doctors use these images to see the bone structure of parts of the body.

DNA - Deoxyribonucleic acid, the molecule that genes are made of.

Genetics - Study of what genes are, how they work and how they are passed on.

Genome - Complete set of genes that an individual organism inherits.