Skin Deep

Art and science, it could be argued, are poles apart. But artists and scientists have worked together for centuries. Artists illustrate and record the exciting, often erratic, progress of science throughout the ages – from cave paintings showing us how to hunt bison, through to detailed drawings of bacteria – and scientists give artists new tools, materials and insights.

Art can help communicate the beauty and complexity of science.

Mermaid illustration

Back in the 15th century when people seemed more concerned with Ancient Greek mythology than fact, natural history books – like *Buch der Natur* by Konrad von Megenberg (1475) – carried illustrations of mermaids and centaurs.

Factual descriptions of natural history came later when people started recording details of plant and animal specimens using engraving and woodcutting. Even then, though, it was clear that some artists worked using original material, whereas others worked from rough descriptions and sketches. Plagiarism was commonplace and the same mistakes were visible in subsequent work.

About three hundred years later exploration and natural history investigation started to really take off, and with it came better, more detailed and more factual illustrations. James Cook, for example, took illustrators with him on his voyages to the Pacific between 1768 and 1777 to investigate the movement of planets and water and the abundance of wildlife.

Then came the advent of photography in the nineteenth century and eventually the development of film and video. Finally, there was a direct means of capturing images of the natural world.

But despite many fervent claims, photography wasn't the death of art. From early woodcuts to digital images, illustration often records far more than a simple photograph.

Illustrating life's smaller things - a hidden world

You have to have a pretty fine eye to sketch a flea in any detail, which is why the improvement of optical instruments has been so helpful with plant and animal life illustration.

First hand lenses, followed by powerful light microscopes, and then microscopes that use beams of electrons instead of light, enabled finer and finer details to be recorded. First microscopic illustrations showed details of small creatures such as fleas. Soon the structures of cells inside plants and animals were being drawn. It wasn't long, though, before organisms too small to be seen using the naked eye, such as bacteria, fungi and viruses, were visible.

Microscopes have now developed to a point where we can even see and record the insides of these minute organisms: revealing a whole new world of previously hidden, complex and beautiful structures.

Internal organs: dead or alive

Drawings of the human body – internal and external, naked

The beauty of science

Despite the common threads of science and art, the appointment of an artist-in-residence by The Massachusetts Institute of Technology in 1994 still caused surprise in some circles. The current post-holder, Felice Frankel, says her role is to attract people to the work of her scientific colleagues through images: 'I am committed to communicating the beauty and ideas of science'.

and clothed – have vividly recorded and gradually increased our understanding of human anatomy and physiology. These, together with gruesome pictures of early medical practices – sawing off limbs, extracting teeth – have also helped provide a wider insight into contemporary society.

Medical illustrators have drawn from dissected corpses since before the time of Leonado da Vinci (1452-1519). But it's only fairly recently that internal images from living people could be obtained. Modern medical imaging techniques, such as radiographs, computer tomography (CT) scans, ultrasound scans, magnetic resonance images (MRI) and endoscopes have all made this possible.

Kroto's buckyballs

There are many different ways of modelling molecular structures...

Professor Harry Kroto and his colleagues worked through the night frantically sticking bits of paper together, trying desperately to understand the football-shaped structure that would eventually be dubbed buckyballs.

Their model – actually a truncated icosahedron – was of a newly discovered sixty-atom form of carbon, officially called buckminsterfullerine.

The wire model that James Watson and Francis Crick built while studying the structure of DNA (which is now in the Science Museum) is another example. Computer animation and balls on sticks are two more.

And it's through construction of these three-dimensional models that scientists begin to understand molecular form and function – it was only once the double helical structure of DNA was understood that it was possible to see how information could be encoded in the molecule and passed from one generation to the next (and where would the film *Jurassic Park* be without such discoveries?).

The science behind the technology

A radiograph is a photographic image using X-rays; the contrast depends on the way the X-rays have travelled through different body tissues. Soft tissues offer little resistance so that contrast sometimes has to be increased by introducing special agents, such as the barium containing liquids that are used to help view the gut. Computer tomography (CT) scans also use X-rays but takes a series of much narrower views rotating around the body. A computer processes these to produce final images that look like slices through the body.

Ultrasound scans build up a picture by detecting the echoes from sound waves (beyond the range of the human ear); they are good for examining soft tissue so can be used for checking the progress of babies in the womb. Magnetic resonance images (MRI) build up a computer generated cross sectional picture by placing the patient in a strong magnetic field and using pulses of radio waves. It has the advantage of not using hazardous ionising radiation (such as X-rays) and of showing soft tissue clearly.

Endoscopes use a narrow tube to see inside the body, light is persuaded to travel along the tube and back by means of 'fibre optics'. Glass fibres in the endoscope act like mirror coated tubes, reflecting light along their inside surface, so the tube can turn corners and view otherwise inaccessible places.

What you need to do:

- Choose an area of science or technology that interests you e.g. crystal structure; microscopy; large biological molecules; medical images; space images; plant structure; nanotechnology.
- Look at a variety of 2D and 3D images relating to your chosen topic. Where possible, consider examples from different periods in history and from different cultures.
- Use this material as a starting point to build up a coursework project that aims to communicate your view of the beauty and ideas of your chosen topic.

Resources that might help you:

Ford, B. J. *Images of Science: a history of scientific illustration*. 1992 ISBN 0-7123-0267-0

New Scientist No.2309, p42 (22 September 2001) has an account of an interview with Felice Frankel.

For science-art interaction and images:

www.wellcome.ac.uk (The Wellcome Trust has initiated several science/art projects, follow the Science/Art link; there is also a regular 'Picture of the Week'.)

www.sciencemuseum.org.uk (includes an online art exhibition)

www.nhm.ac.uk/services/piclib (a wide variety of online natural history images)

www.nlm.nih.gov/research/visible/visible_human.html (for examples of medical type body images)

For examples of molecular models:

www.chem.ox.ac.uk/mom

http://biop.ox.ac.uk/www/mol_of_life/index.html

If you want to go further:

- Modern technology is extending the ways in which images are being used in the advancement of science, technology and medicine. What relevance do these have for the artist?
- For a chosen period in history, examine the ways in which the advances in science and technology during that period were reflected in the work of its artists, designers and architects.
- Consider ways in which images have been used for information storage – from prayer beads to bar codes.