Starting with X-rays

It all started in 1895 when Wilhelm Röntgen discovered X-rays. A potted history of Radiology is available at: www.bir.org.uk/patients-public/history-of-radiology

Most people refer to the image they obtain using the humble X-ray as simply “an X-ray”. This is obviously a bit of a misnomer. The image is obtained using X-rays (and thousands of them, not just one) but the correct term for the image itself is a radiograph. A simple X-ray or radiograph is essentially a single flat image of a 3 dimensional structure. Usually, at least two images will be taken from different angles. The X-rays are not able to penetrate the solid structure of bone as easily and may get absorbed altogether.

The body part of interest (e.g. the chest or hand) is exposed to X-rays generated by a special piece of equipment. These high energy rays can penetrate the body tissues to a different degree depending on the density of the tissue. For example, the X-rays can travel quite freely through the lungs which are largely air filled soft tissue sacs.

A special type of photographic plate will be placed behind the object being imaged to detect how many X-rays make it through the body part and out the other side. In this way a sort of black and white “shadow” is created of the area being imaging. Bones appear white on the radiograph; soft tissue, such as organs like the heart or liver, shows up in shades of grey, and air appears black.

More information on this process can be found here: www.nhs.uk/conditions/x-ray/Pages/How-is-it-performed.aspx

Whilst the images are obtained by a technician, known as a radiographer, the interpretation of the image is performed by a doctor. Many doctors are able to interpret simple radiographs such as chest X-rays but complex and detailed analysis will be performed by a Radiologist. A Radiologist is a doctor who has specialised in interpretation of medical imaging. The training required for this role involves at least 5 years of further study beyond medical school and foundation stage training. It is quite a skill. For a taste of how much is involved in the interpretation of a simple chest radiograph follow this link: http://radiologymasterclass.co.uk/tutorials/chest/chest_system/chest_system_start.html
**X-Rays in 3 Dimensions – the CT scan**

As mentioned above, a radiograph is a single flat image of a 3 dimensional structure. X-rays are also used for CT scanning. CT stands for computed tomography. It may also be referred to as a CAT scan (computer assisted tomography). **Tomography** refers to imaging by sections or “slices”. It essentially involves performing numerous radiographs at different points along the body part of interest perhaps just millimetres apart, like taking slices of a sausage as a series of pictures and using the multiple images to reconstruct a larger picture. The first CT scan was performed in 1972.

CT scanning works on the same principles as a radiograph. Different body parts absorb the x-rays in varying degrees. It is this crucial difference in absorption that allows the body parts to be distinguished from one another. With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around the patient, measuring the amount of radiation being absorbed throughout your body. Sometimes, the examination table will move during the scan, so that the x-ray beam follows a spiral path. The equipment looks something like this:

A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body, which are then displayed on a monitor. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior which can even be used to build a 3D view.

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**Questions**

Given that the body (or body part) is exposed to a series of X-rays in order to obtain a CT image, can you think of a potential disadvantage or hazard for the patient?

Some patients will be given an intravenous injection of an iodine based substance prior to the CT scan being performed. Why?