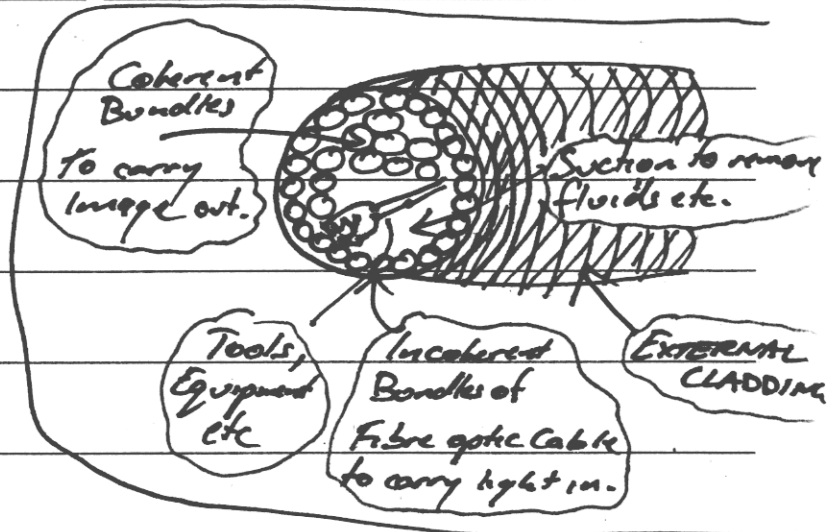


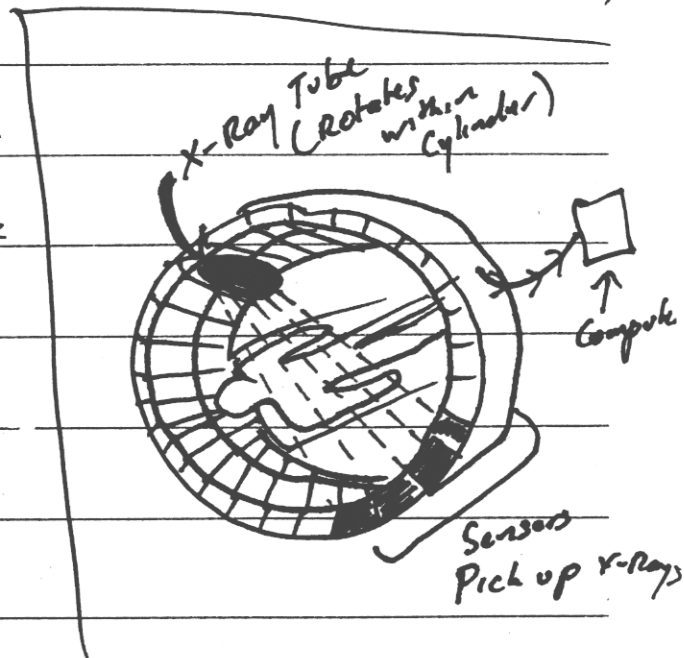
29a) An endoscope works by transmitting an image from inside the patient to allow doctors to see organs, tissue etc without risking infection

Endoscopes use total internal reflection in fibre-optic cables to create a small compact probe.



ii) CAT SCANS are produced using an x-Ray tube which is rotated within a tube of computer sensors. These sensors can pick up 256 shades of grey and can create a 3D image from the multi-angled x-ray

images created by the patient. The patient can be moved in or out of the tube while x-Rays are produced by the rotating x-ray tube, which can rotate 360° around the patient.



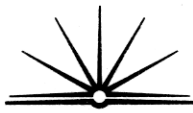
The image is then digitally



analysed and combined with the other received pictures to form a 3D image. Because the data is computerised, images can be manipulated to remove details and/or concentrate on specific organs.



b) (i) 50% of the technetium-99 remains in the body
after 6 hours. \therefore half-life = 6 hours.

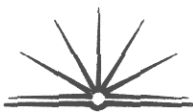


(ii) approx. 65% of the sample is ~~gone~~ still

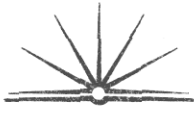
present. $\frac{65}{100} \times 6 \times 10^{-18} = 3.9 \times 10^{-18}$

$\therefore 3.9 \times 10^{-18}$ kg ~~are~~ ~~left~~ remains undecayed
after ~~the~~ 4 hours.

(iii) After 6 hours half the technetium-99 is gone, therefore half the information is gone too. Obviously the scan must be done before then. ~~the~~ A doctor should wait about 2 hours after the ~~the~~ injection though, as the radiopharmaceutical has to be given enough time to reach the particular area that is to be scanned. Therefore a range of 2-5 hours is when a scan should be done.



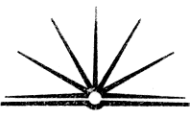
c)i) An MRI is less invasive than a CAT scan (as due to the use of X-rays CAT scans can cause concern especially if performed too much as X-rays ~~are~~ ~~for~~ subject the patient to radiation, ~~while~~ while MRI's use magnetic resonance of the body's nuclei and can therefore be performed safely and as often as needed. Additionally, the MRI image clearly ~~illustrates~~ ^{shows} the muscle ~~and~~ as well as the bone at very high accuracy and tears in the muscles/bone cracks can be clearly seen. CAT however does not show such detail and ~~of~~ may not detect small cracks in bones/muscle tears as MRI/functional MRI can.



c)ii) The doctor may order an X-ray to confirm this diagnosis as the X-ray will show the structure of the skull and most likely detect any breakages. X-rays are sufficient to detect such fractures as the skull is a large bone and will clearly show up on the X-ray. Additionally, a skull fracture may be ~~very~~ very serious and require immediate action. Since an X-ray only takes 5 minutes, it is sufficient to get a quick result and then the doctor can act upon it and hence treat the patient as required.

iii) Since the patient is suffering from a fractured skull and complains of other symptoms, an MRI should additionally be carried out on his head. With the MRI scan, an accurate picture of his brain would be obtained and it could then be checked by the doctor for abnormalities. The MRI would show the structure of the brain as well as any slight abnormalities/tears/damages within it to a high resolution/accuracy.

~~The MRI is quite expensive.~~ Abnormalities within the brain ^(if present) could then confirm this diagnosis.



d). Medical applications of ultrasound and magnetic resonance technology have had a major impact on modern society. They have improved the standard of care for ~~the~~ patients, extended $\frac{1}{2}$ our understanding of anatomy and physiology and have

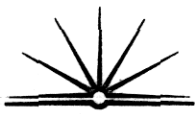
thus paved the way for improved better medical services for a diverse range of problems.

Ultrasound has been used in several fields of medicine, such as obstetrics, surgery and physiotherapy for a range of purposes.

- In obstetrics it has been used as an imaging technique to observe the fetus.

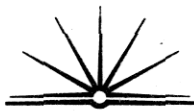
This has enormously extended our understanding of fetal development and can be used to diagnose ~~genetic~~ congenital defects such as Down's Syndrome before birth. This has caused ~~problems~~

ethical debate with issues such as abortion, as pre-birth diagnosis has encouraged increased numbers of women to terminate pregnancies if they are suspicious that the baby is not healthy. Debate still rages as to the moral implications of this application of ultrasound. Foetal



ultrasound, can be used to determine whether emergency caesarian section is required during a pregnancy, as this technology can ~~be used~~ measure fetal heart rates and can diagnose potential strangulation of the baby by the position of the umbilical cord.

- As a surgical tool, ultrasound is used to pinpoint the location of arteries and deep structures before injection, to ensure ~~that~~ accuracy during procedures. Biopsies can be done on deep structures such as the liver, using a ultrasound to guide the needle. It is also used to clean surgical implements, such as gastroscopes and colonoscopes, as the high frequency vibrations mechanically loosen debris before sterilisation. Although it can become expensive, ultrasound has improved the standard and safety

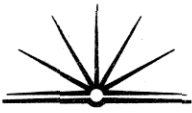


of many surgical procedures.

- New techniques for ~~ultra~~ treating conditions such as arthritis, heel spurs and gallstones are using ultrasound vibrations to alleviate pain and mechanically break apart structural deformities. This is still very expensive for most patients, as ~~these~~ such procedures are not yet covered by government subsidy schemes.

- Ultrasound using the doppler effect can be used to monitor blood flow rates to examine the heart, valves and arterial system. The process is called Doppler echocardiography and can detect atherosclerosis, valve diseases and thrombosis within the heart. Shunts and murmurs can also be investigated using this process. It can be difficult to image the heart, however, because of the physical positioning

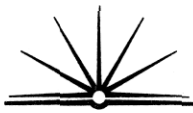
next book →



of the value.

Therefore medical applications of ultrasound have increased our understanding of many conditions and features of human anatomy, allowing higher standards of health care to be attained and new treatments to be devised. It has also caused some concerns, however, with ethical issues, such as abortion and inequity as some procedures are too expensive for ~~some~~ some hospitals or individual patients to have access to.

Similarly, applications of the magnetic field of particles to medicine have had both advantages and disadvantages for modern society.



Advantages

- Excellent resolution between soft tissues.
- Can 'see through' bone, which makes it ideal for researching the brain, which is hidden behind the skull. Has enabled greater understanding of the structure of the brain leading to new understanding of neurological disorders, eg Schizophrenia. This is of value to society as one in 5 people suffer from mental illness.

Disadvantages

- Very expensive technology. ∴ not equally accessible and has meant that there is less money in the system for other expenses.
- ~~20%~~ Some patients experience claustrophobia in the confined space of the machine. 2-3% of patients cannot complete the examination.
- Huge magnetic fields (up to 30000 times the strength of the Earth's magnetic field) are required. This poses a safety problem if any metal objects enter the examination room and means that the technique is not suitable for patients with metal implants or



- Functional MRI is able to study the function of the body, leading to a better understanding of human physiology, which can be used to treat diseases more effectively.
- Very safe technique, since there is no ionising radiation, which is of concern to many people.

prosthesis. This restricts its usefulness and contributes to high costs.

- Examination can take up to one hour, which can be inconvenient. It is a noisy procedure.

Therefore, ultrasound and magnetic resonance technologies have had a major impact on modern society, having both positive and negative consequences.