Medical imaging technologies worksheet

Photo Credit: Clipart.com to understand the pros, disadvantages and potential of diagnostic imaging technologies in brain research. Context By the time students reach high school level, they need to develop a deeper and broader understanding of the relationship between technology and science. (Benchmarks for Scientific Literacy, p. 47.) When teaching this lesson, it's important to know where your students are in terms of understanding the dynamic relationship between technology and science. For example, studies have shown that high school students do not distinguish between the roles of science and technology unless asked to do so. Students tend to associate science with medical research and believe that it is more beneficial to society than the technology they associate with pollution or weapons. Students seem to understand the impact of science on technology, but they don't always appreciate the impact of technology on science. (Benchmarks for Scientific Literacy, page 334.) This lesson gives students a brief introduction to the various diagnostic imaging technologies used in brain research. They will study how these technologies provided answers about brain structure and function and the new questions they allowed scientists to ask. Keep in mind that the focus is on imaging technologies themselves, not on the detailed structure and function of the brain. More Motivation Ask Students the following questions: What do you know about the brain? How did scientists gather this information? Allow an open discussion that can trigger specifics about brain structure, the function of two hemispheres and other components, the role of neurotransmitters and electrical impulses, and diseases that affect the brain. Answers to the second question may include brain autopsy, behavioral observation and technologies such as X-rays, CT scans and other imaging techniques. Think about the impact of imaging technology on brain research. Tell students that this lesson will give them the opportunity to learn about visualization technologies that are used to study brain structure and function. Development How students do a lesson, ask them to keep in mind the following questions: How does imaging technology help scientists answer questions about the brain and ask new ones that will further develop their knowledge? How can what scientists learn about the brain help them develop new technologies? If students have access to a student sheet. Students will get a quick overview of several modern visualization technologies by filling out step 1 sheet. Make sure students use brain Imaging student sheet technology to write notes. Assign students to small groups for a more in-depth study of one of these technologies, as described in Step 2 There are several websites available; You can expand this assignment by providing or encouraging students to find other websites or printed materials to use in their research. Do students share their research with the class as indicated in step 3 sheets. Encourage students to write down what they learn from their classmates' reports in their charts. For your information, an approximate diagram is provided on the teacher's sheet. Assessment Do students complete an understanding that you have learned the section of the sheet. When they think about the technologies of visualizing the future, ask them to review the diagrams they have created and think about what they have learned about the strengths and weaknesses of modern technology and what more scientists need to learn about the brain. You can highlight some of the problems with modern technology: costs, lack of detailed information and lack of speed. Do students share their Brain Machines for Tomorrow with the class and participate in the discussion of the questions they discussed at the beginning of The Development: How does visualization technology help scientists answer questions about the brain and ask new questions that will further develop their knowledge? (Different technologies allow us to view both the structure and function of the living brain. how people age.) How can what scientists learn about the brain help them develop new technologies? (The more brain information scientists learn from modern technology, the more specifically they can develop new machines. For example, modern imaging technologies have shown that the brain processes information very quickly, although these machines too slowly track much of this activity in detail. Encourage students to keep up with the real Brain Machines for tomorrow, following new developments in imaging technology online and in news magazines and newspapers. Extensions of the following online resources can be used in addition to students' understanding of imaging technology and the brain: How Your Brain Works offers easy-to-understand information about the underlying functioning of the brain. The Brain Atlas, sponsored by Harvard Medical School, provides basic information about brain imaging technology, as well as multiple images of the normal and sick brain. This lesson is part of a series of Science NetLinks lessons on optical technology. Other lessons серии включают Magnify It! It! Seeing around corners (3-5) and looking into space (6-8). Send us feedback on this lesson, by the end of this section, you'll be able to: Compare and contrast the methods of medical imaging in terms of their function and use in the study of the human body For thousands of years, the fear of the dead and legal sanctions have limited the ability of anatomists and physicians to study the internal structures of the human body. The inability to control bleeding, infection and pain has made surgery rare, and those that have been performed, such as wound sucking, amputations, tooth extraction and tumors, skull drilling, and C-section- are not significantly advance knowledge of internal anatomy. Thus, theories about the function of the body and about diseases were largely based on external observations and imagination. However, in the fourteenth and fifteenth centuries, detailed anatomical drawings of the Italian artist and anatomist Leonardo da Vinci and the Flemish anatomist Andreas Vegalia were published, and interest in human anatomy began to grow. Medical schools began teaching anatomy through human autopsy; some resorted to a serious robbery to get the corpses. Eventually, laws were passed that allowed students to dissect the corpses of criminals and those who donated their bodies for research. However, it wasn't until the late nineteenth century that medical researchers discovered non-surgical methods to look inside a living body. X-ray German physicist Wilhelm Roentgen (1845-1923) experimented with electric shock when he discovered that a mysterious and invisible beam would pass through his flesh, but would leave the outline of his bones on a screen covered with a metal compound. In 1895, X-ray made the first solid recording of the inner parts of a living person: an X-ray image (as it was called) of his wife's hands. Scientists around the world quickly began their own experiments with X-rays, and by 1900 X-rays were widely used to detect various injuries and diseases. In 1901, Runtgen was awarded the first Nobel Prize in Physics for his work in the field. X-ray is a form of high-energy electromagnetic radiation with short wavelengths capable of penetrating solids and ionizing gases. As they are used in medicine, X-rays are emitted from the X-ray machine and directed to a specially treated metal plate placed behind the patient's body. The radiation beam results in the darkening of the X-ray plate. X-rays slightly inhibit soft tissues that show how gray it is on the X-ray plate, while solid tissues such as bones largely block the rays, producing light tinted shadows. Thus, X-rays are best used to visualize solid structures such as teeth and bones (Figure 1.5.1). However, as with many forms of high-energy radiation, X-rays can damage cells and initiate changes that can Cancer. This risk of excessive exposure to X-rays has not been fully assessed for many years after widespread use. Figure 1.5.1 - X-ray of the hand: High energy electromagnetic radiation allows the internal structures of the body, such as bones, to be seen in X-rays like these. (credit: Trace Meek/flickr) Improvements and improvements to X-ray techniques continued throughout the twentieth and twenty-first centuries. Although more sophisticated imaging techniques are often replaced, X-rays remain a workhorse in medical imaging, especially for fractures and for dentistry. Lack of exposure for the patient and operator is currently swollen with adequate protection and limitation of exposure. Modern X-rays of medical imaging can depict a two-dimensional image of the body area, and only at one angle. In contrast, later medical imaging technologies produce data that is integrated and analyzed by computers to produce 3D images or images that show aspects of the body's functioning. The CT scan refers to the image by section. Computed Tomography (CT) is a non-invasive imaging technique that uses computers to analyze multiple transverse X-rays in order to reveal the smallest details about the structures in the body (Figure 1.5.2a). The technique was invented in the 1970s and is based on the principle that as X-rays pass through the body, they are absorbed or reflected at different levels. In technology, the patient lies on a motorized platform, while a computerized axis tomography rotates 360 degrees around the patient, taking X-rays. The computer combines these images into a two-dimensional view of the scanned area, or slicing. Figure 1.5.2 - Medical Imaging Methods: (a) Head CT results are shown as successive cross sections. (b) The MRI machine generates a magnetic field around the patient. (c) PET scanning uses radiopharmaceutical systems to create images of active blood flow and physiological activity of the organ or organs that are targeted. (d) Ultrasound technology is used to monitor pregnancy because it is the least invasive of imaging techniques and does not use electromagnetic radiation. (credit a: Akira Ohgaki/flickr; credit b: Digital Cate/flickr; credit c: Raziel/Wikimedia Commons; credit d: Isis/Wikimedia Commons) Since 1970, the development of more powerful computers and more sophisticated software has made CT scanning a routine for many types of diagnostic assessments. It is especially useful for scanning soft tissues such as the brain and chest and abdominal insides. His level so accurate that it can allow doctors to measure the mass size up to a millimeter. The main drawback of CT scanning is that it exposes patients to a dose of radiation many times higher than that of X-rays. In B children who undergo CT 0 are at increased risk of developing cancer, as are adults who have multiple CT. A CT scan or CT scan rests on a circling scanner that revolves around the patient's body. Watch this video to learn more about CT scans and CT scans. What type of radiation does a CT scanner use? Magnetic Resonance Imaging Magnetic Resonance Imaging (MRI) is a non-invasive medical imaging technique based on a phenomenon of nuclear physics discovered in the 1930s in which matter exposed to magnetic fields and radio waves were found to emit radio signals. In 1970, a doctor and researcher named Raymond Damadian noticed that malignant (cancerous) tissues and colds emit different signals than normal body tissue. He applied for a patent for the first MRI scan, which was clinically used in the early 1980s. Early MAGNETIC resonance imaging scanners were rough, but advances in digital computing and electronics have led to their advancement in any other method of accurate imaging, especially for tumor detection. MRI also has a major advantage of not exposing patients to radiation. The drawbacks of MRI include their much higher cost, and the discomfort of the patient with the procedure. The MRI scanner exposes the patient to such powerful electromagnets that the scanned room must be protected. The patient must be encased in a metal tube-like device for the duration of the scan (see figure 1.5.2b), sometimes as long as thirty minutes, which can be uncomfortable and impractical for sick patients. The device is also so noisy that, even with earplugs, patients can become anxious or even scared. These problems were somewhat overcome with the development of an open MRI scan, which does not require the patient to be fully enclosed in a metal tube. Patients with iron-containing metal implants (internal stitches, some prostheses, and so on) cannot undergo AN MRI scan because it can knock out these implants. Functional MRI (FMI), which detects the concentration of blood flow in certain parts of the body, is increasingly used to study activity in parts of the brain during various activities of the body. This helped scientists learn more about the location of various brain functions, anomalies and diseases. The patient undergoing an MRI is surrounded by a tubular scanner. Watch this video to learn more about MMI. What is the function of magnets in MRI? Positron emission tomography of positron (PET) represents if the so-called radiopharmaceuticals are used, substances that emit radiation that is short-lived and therefore relatively safe to enter the body. Although the first PET scanner was introduced in 1961, it took another 15 years before companies have been combined with technology and have revolutionized its potential. The main advantage is that PET (see figure 1.5.2c) can physiological activity, including the metabolism of nutrients and blood flow, the organ or organs targeted, while CT and MRI can only show static images. PET is widely used to diagnose many diseases such as heart disease, the spread of cancer, some forms of infection, brain abnormalities, bone and thyroid disease. PET relies on radioactive substances injected a few minutes before the scan. Watch this video to learn more about pet. How is PET used in chemotherapy? Ultrasonography Ultrasonography is a imaging method that uses the transmission of high-frequency sound waves into the body to generate an echo signal that is converted by the computer into a real-time image of anatomy and physiology (see figure 1.5.2d). Ultrasonography is the least invasive of all imaging methods, and is therefore used more freely in sensitive situations such as pregnancy. The technology was first developed in the 1940s and 1950s. Ultrasonography is used to study the function of the heart, blood flow in the neck or limbs, certain conditions such as gallbladder disease, and fetal growth and development. The main drawbacks of ultrasonography are that the image quality is highly dependent on the operator and that it is unable to penetrate the bones and gas. When there is a problem in a particular body tissue, the doctor can remove a tissue sample from the body and prepare it as a microscope slide. The doctor can view structures that are not visible to the naked eye. Widely used microscope techniques include light microscopy, scanning electron microscopy (SEM) and electron transmission microscopy (TEM). Tissue samples used in light microscopy are usually colored using colorful dyes to enhance contrast, as different parts of the cells take dye differently. In contrast, SEM can increase to 500,000x and TEM can increase to 10,000,000x. Both SEM and TEM use electronic waves rather than light to enlarge the sample. SEM provides a 3D image of the surface of the sample, while TEM provides high-resolution images from an ultra-thin sample. Detailed anatomical drawings of the human body were first available in the fifteenth and sixteenth centuries; however, it was not until the late nineteenth century, and the discovery of X-rays that anatomians and doctors discovered non-surgical methods to peer inside a living body. Since then, many other methods have been developed, including CT, MRI, PET scanning, ultrasonography and advanced microscopy techniques that provide more accurate and detailed about the shape and function of the human body. Functions. Functions.