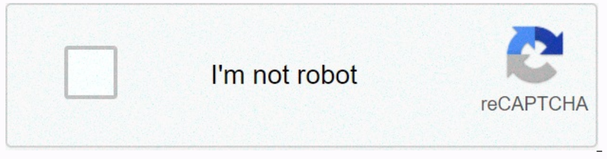

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X-ray machine components and functions

Wilhelm Roentgen encountered the potential of X-rays when he played with cathode rays in 1895. The German physicist placed various objects in front of them to measure their reactions in front of a photographic plate that can record images. Roentgen wanted to know what his wife's hand would look like when exposed to mysterious rays. Behold, the plaque created an image of her bones and flesh, similar to what we see today on medical X-rays. The ability to create images in the human body was a revolutionary, Nobel Prize-worthy work. Today, X-rays are used in various places, from dentists and doctors' offices to airport security checkpoints. Although medical scans help doctors and patients around the world monitor injuries and conditions, they also have a disadvantage: radiation. As we discuss, X-rays emit a kind of radiation that can be harmful to humans if the intensity is too high or exposure is too frequent. In this article, we will explore the risks and benefits of using this tool to reveal valuable information about yourself and the universe. But first we look at the dual personality of X-rays and why they can be useful and harmful. Read on to learn more. Content It is best to think of X-rays as they are: a kind of electromagnetic energy. These rays have short wavelengths, which allows them to carry a lot of energy. Still, when we consider what happens when you capture the human body, the term ionizing radiation enters the equation. Ionizing radiation can knock down electrons that orbit the nuclei of atoms-- as if something had knocked the Earth out of its orbit around the sun. When electrons are pushed out, they create charged molecules or atoms called ions that can disperse and disrupt other atoms in our cells. Advertising Radiation damage to cells can also alter our DNA, increasing the likelihood that our cells will mutate during replication or even cancerous over time. That is why doctors use only an effective dose of X-rays, or the lowest amount to get the job done during medical imaging. What's more, radiation adds up over time, so frequency matters, too. X-rays aren't just doom and gloom. Fortunately, our cells heal after brief encounters. In medical context, X-rays provide a view of bones, teeth and internal organs that are not visible from outside the body. They help to assess fractures, fractures and abnormal bone growth, and allow doctors to monitor the effectiveness of operations. Ultimately, the benefits of receiving proper medical treatment often outweigh the risks of radiation. It is also true that X-rays lead us to strange things that our children and pets accidentally swallow. Next, find out which group has the greatest vulnerability to X-rays. Short exposure to ionizing radiation is not so worrying in adults, as mature cells can quickly (for the most part), but the bones and tissues of children and children are more at risk. Children's cells divide faster as they grow, creating more opportunities for mutation replication and DNA damage. Pregnant women should tell their doctors that they are with the baby before they have any X-rays. And even if most medical scans do not expose the fetus to radiation, it is important to discuss things with the doctor, so that we are sure. Also, because the effects of radiation on the body accumulate with time, doctors reserve the use of X-rays on young patients for times when an immediate health problem outweighs the long-term risk - similar to what happens to adults [source: U.S. Food and Drug Administration]. This vulnerability leaves children at greater risk of developing cancer and other health problems in later life. Advertising The next time you take on medical tests, it might be a good idea to ask a few questions. On the following page, you'll find out what to ask. Sure, X-rays have a dark side, but there's a lot you can do to reduce your exposure. First of all, you should understand that scientists have created ways to minimize exposure to X-rays. This mostly involves offering recommendations, measuring the input doses of the skin - the amount of rays absorbed by the skin - certain procedures, ensuring the proper functioning of the equipment and providing the best training to people who use machines. In general, the FDA regulates the production of X-ray devices, while states make laws to oversee technology use [source: U.S. Environmental Protection Agency]. Advertising To make sure that you are not unnecessarily exposed, check the level of instructions and certification of technicians and physicians performing medical X-rays. Since training varies, you will want to look for professionals with more education and experience. For example, you may want to find clinics with plate-certified radiologists for more serious scans. Feel free to ask your doctor why an X-ray is or is not necessary. Can you be exposed to X-rays outside the office? You can find out on the next page. We learned that medical X-rays give doctors a unique insight into the flesh and bones under the skin, but how else are they used? In recent years, the U.S. Transportation Security Administration has used X-ray detectors to detect weapons and other potentially dangerous objects that metal detectors can't detect. This certainly strengthens the safety of passengers before boarding, but also exposes them to X-rays. The use of these backscatter scanners has caused controversy, but is still common in many U.S. airports. Generally speaking, though, the amount of radiation is small compared to typical medical scans. From a perspective, the average amount of radiation that people are exposed to from these scanners is equal to two minutes in the air on an aircraft while at its normal altitude - a place that lacks atmospheric protection from incoming radiation [source: TSA]. Advertising Still, frequent flyers as well as aircraft workers should be more careful when using scanners too often. Did you know that X-ray radiation is not limited to our world? Continue reading to learn about its use in science. The use of X-rays in astronomy gives us a lot of great information about the universe. Many events in the universe, from black holes to comets and stars, emit unique radiation signatures. Although we generally cluster all the X-rays together, those coming from outer space are a little different. They are created from natural phenomenon in the universe, which emit a huge amount of energy (and heat). Advertising To measure X-rays or energy from particles in space, scientists collect information using satellites outside the Earth's atmosphere. Such X-rays give us clues to the origins of the universe and contribute to our perception of the northern lights that normally line the night sky. Back on Earth, scientists create X-rays with particle accelerators that move electrons near the speed of light around the track until they emit rays of radiation. This allows researchers to examine the atomic structure of materials – both synthetic and environmental. Want to know more about X-rays? Check out the next page for more interesting resources. HowStuffWorks looks at tes and outs giving blood. Centers for Disease Control and Prevention. Emergency preparedness and response: radiation emergencies - radiation measurement. May 10, 2006. (April 20, 2011) Clinic. CT scan. 12 (April 20, 2011) . Electromagnetic spectrum. March 27, 2007. (April 20, 2011) . The most forthcoming X-Ray Jet Discovered provides clues to the Big Bang. NASA news. 25 November 2007. (20 April 2011) . Wilhelm Conrad Roentgen - Biography. (April 20, 2011) North American Company. Radiation exposure during X-ray and CT scans. November 15, 2010. (April 20, 2011) Security Administration, U.S. Department of Homeland Security. FREQUENTLY ASKED QUESTIONS: Advanced imaging technology. (April 20, 2011) of Colorado. X-ray security. Physics 2000. (April 20, 2011) . environmental protection agency. Radiation protection: health effects. March 24, 2011. environmental protection agency. RadTown USA: Medical X-rays. July 19, 2010. (April 20, 2011). . Food and Drug Administration. Radiology and children. June 23, 2008. (April 29, 2011) . Food and Drug Administration. Reduction of radiation from medical X-rays. February 19, 2009. (April 29, 2011) have you ever had an X-ray taken? X-rays are used to analyze problems with bones, teeth and organs in the human body; to detect cracks in metal in the industry; and even at airports for baggage control. Yet, despite their versatility, the invention of the X-ray machine was not intentional. The scientific and medical community will forever be indebted to the accidental discovery of German physicist Wilhelm Conrad Röntgen in 1895. While experimenting with electric currents through a glass cathode tube, Röntgen found that a piece of platinum barnate shone, even though the pipe was enclosed in thick black cardboard and was all over the room [source: Britannica]. He theorized that some kind of radiation must travel through space. Röntgen did not fully understand his discovery, so he called him X-rays because of its inexplicable nature. To test his newfound theory, Röntgen asked his wife for help with his first X-ray scans and took pictures of bones in his hand and wedding ring in what became known as the first röntgenogram [source: Nobel Prize]. He found that when they are emitted in complete darkness, X-rays pass through objects of different density, making the body and muscle of his wife's hand more transparent. Thicker bones and a ring left a shadow on a special photographic plate covered with platinum barium cyanide. The term X-ray or X-ray stuck though it is still sometimes referred to as röntgen ray in German-speaking countries [source: NASA]. Röntgen's discovery has received a lot of attention in the scientific community and in the public. In January 1896, he gave his first public lecture on X-ray scans and showed the ability of rays to photograph bones in living flesh. A few weeks later in Canada, an X-ray was used to find a bullet in a patient's leg [source: Taming the Rays]. Honorary degrees, medals, streets named in his honor and membership in academic ies followed. Recognition culminated in the awarding of the first Nobel Prize in Physics in 1901 [source: Nobel Prize]. Röntgen deliberately did not authenticate his discovery because he felt that scientific progress belonged to the world and should not be for profit. Profit.

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