

Computers Help Keep Us Healthy

Be a Power Reader

Understanding Vocabulary is an important part of reading. Before you begin, it is a good idea to locate the glossary (if there is one). Scan the glossary for terms you do not know. Then, when you come to the vocabulary term in the text, review the definition. This practice will help you remember what the word means.

Introduction

If you've been to a hospital lately, you've seen medical equipment everywhere. Did you know that practically all of these devices are controlled by computers? Many medical devices contain **embedded systems**. An embedded system is a computer system that is contained inside another device. Let's take a look at some of these devices.

Monitoring Vital Signs



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When patients are in hospitals, their **vital signs** may be monitored (kept track of). Vital signs include a patient's blood pressure, heart rate, and breathing rate. In the

past, nurses took each patient's vital signs manually. Today, a special device can be used to continually keep track of these signs. This device is called a vital signs monitor. You will often see this monitor near a patient's bed. The vital signs also may be sent to a central work area called a nurses' station.

Because the patient is being constantly monitored, the nurse knows immediately if something goes wrong. Also, the nurse can set the monitor so that an alarm goes off if a vital sign is not normal. If a patient's heart rate becomes much slower than normal, for example, a loud bell may sound.

The time that nurses previously spent checking patients' vital signs can now be used to give patients more personal care. For example, the nurse may have more time to answer a patient's questions about his illness.

"Let's Get an Image"

Have you ever injured an arm or leg and gone to the emergency room? Maybe the emergency room doctor said, "Let's get an image." The doctor wanted to get a look at the inside of your body to see if everything was normal.

One type of image is an X ray. X rays can be used to see if any bones are broken or out of place. Today there are many types of **imaging devices**. The process of getting an image is commonly called *scanning*. These images (pictures) let doctors find out what is going on inside your body without making a single cut.

CAT scans

A **CAT (computerized axial tomography)** scan is a 3-D (three dimensional) picture of the inside of a person's body. A series of X rays are taken as a device called a CAT scanner moves around the part of the body being scanned.



A CAT Scan of the Head

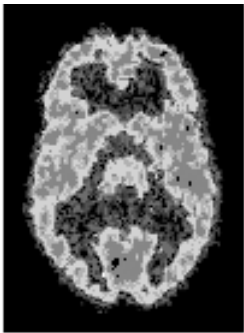
A computer uses these X rays to create a 3-D picture. The doctor can view the results on a monitor. CAT scans are good if a doctor needs to look for injuries like broken bones. They also are good at finding out if a patient is bleeding internally (inside his or her body). Internal bleeding is common after injuries such as car accidents.

MRI

CAT scans aren't very good at looking at soft tissues. The brain, for example, is made up of soft tissue. **MRI (magnetic resonance imaging)** is better for these jobs.

A newer type of MRI is called the **functional MRI (fMRI)**. In this case, the word *functional* means that the MRI shows the body as it is working, or functioning. Imagine that a patient has had a stroke. A stroke occurs when part of the brain doesn't get oxygen. For example, a blood clot may have blocked a blood vessel. The doctors want to know if the stroke has affected the way that the patient's brain works. A functional MRI lets doctors watch the brain as it is working.

PET Scans



PET Scan of a Brain

Like MRI, **PET (positron emission tomography)** lets doctors watch the brain at work. A special chemical substance is injected into the brain. This substance is attracted to those parts of the brain currently being used. The PET scanner then

shows where the substance has accumulated. These images can be compared to images of a normal brain. This helps doctors find out whether a brain is working properly.

Cutting Down on Cutting

Imaging devices help doctors see inside patients' bodies without actually going

inside. However, what if a child has appendicitis (an inflamed appendix) and the appendix must be removed? In the past, a surgeon (a doctor who performs operations) would cut open the child's abdomen and remove the appendix. The child's body would take weeks to recover.

Today, this operation can be done using a thin, lighted tube called a **laparoscope**. A small incision (cut) is made into the abdomen. The laparoscope is inserted through this cut. At the end of the laparoscope is a tiny camera. This camera displays a magnified image onto a monitor. The surgeon watches this monitor while he or she is operating. Special tiny instruments let the surgeon remove the appendix.

Laparoscopic surgery is used for many types of operations. Patients can often go home the day after having laparoscopic surgery. In the past, these same patients may have had to stay in the hospital for at least a week. As an added bonus, they have practically no scars!

Teaching Doctors to Ask the Right Questions

Have you ever played the game "Animal, Mineral, Vegetable?" You ask questions to try to find out what type of animal, mineral, or vegetable your opponent is thinking of. Asking the right questions is the trick to winning the game.

Determining what type of illness a patient has is like playing this game. The doctor must know what questions to ask. **Computer applications** have been created that help medical students learn how to diagnose (determine) a patient's illness. The computer begins by displaying some basic information such as a make-believe patient's age and sex. The computer might say that the patient is complaining of a sharp pain in her left shoulder. The medical student then enters questions into the computer. The computer answers each question. The student learns to alter his or her

questions based on answers to previous questions. Finally, the student diagnoses the patient's illness. The computer application then tells the student whether the diagnosis is correct. If the diagnosis is wrong, the computer application explains why the student's answer was not correct.



Student Practicing Laparoscopic Surgery

Virtual Surgery

Can you imagine what it would be like to perform an operation like a knee replacement on a patient? Often medical students learn how to perform such operations by watching experienced doctors. However, more and more medical students are using **virtual reality** to practice performing operations. The student gets practice in using real instruments such as laparoscopes and scalpels. A monitor displays what is going on inside the virtual "patient" as the student works. Even experienced surgeons can use virtual reality to learn new operations. This results in better prepared doctors when the time comes to operate on real people.

Medical Records

Today's patients may have many different tests (such as CAT scans and blood tests). To make matters even more complicated, a patient may be seen by more than one doctor. It is important that everyone who is caring for a patient be kept up-to-date on the patient's health.

How does a hospital make certain that doctors and nurses can get this information? It stores the information in large **computer databases**. Each patient has an individual **record** in the database. This record contains information such as test results and any medicines the patient is taking. Healthcare workers such as doctors and nurses can look at a patient's record if they need to know, for example, whether the patient is allergic to a certain drug.

Other Medical Databases

Did you know that when an organ (such as kidney or a heart) becomes available for transplant, it must be transplanted very quickly? A heart must be transplanted within four to six hours of being removed from the donor's body. The goal of the United Network for Organ Sharing (UNOS) database is to quickly match organs with those people who need them. In 2001, over 12,000 organs were transplanted. This was a seven percent increase over the previous year. Much of this increase is because databases make it easier to find the right person to receive a donated organ.

Other kinds of medical information are kept in databases. Many databases can be accessed by doctors over the Internet. Let's say a patient has a rare type of bone cancer. Her doctor can access medical databases to see what kinds of new treatments are being used.



Review Questions

1. What is the purpose of a vital signs monitor?
2. How is an MRI different from a CAT scan?
3. How have imaging devices changed the way some surgeries are performed?
4. How do special computer applications help medical students learn to diagnose illnesses?
5. How do computer databases help ensure better care for patients?



What Do You Think?

1. This article discusses how patient records are stored in databases. Can you think of other types of records that a hospital might want to store in a database?
2. Do you think it would be harder or easier to perform an operation by watching a monitor rather than actually looking at the patient's body? Why?
3. Healthcare costs are skyrocketing. Do you think any of the topics covered here will help reduce the cost of healthcare? Do you think any of them might increase these costs? Why?

Glossary

CAT (computerized axial tomography) A method of getting a three-dimensional image of the inside of the body. CAT scans are most useful in seeing hard substances such as bones.

computer application Instructions that computer hardware (a computer's physical parts) uses to let us perform specific tasks.

computer database A collection of related records stored in a computer.

embedded system A computer that is contained within another device.

fMRI (functional magnetic resonance imaging) A method of getting a picture of the inside of the body that shows chemical changes or the flow of fluids in a body part as it works. It is used on soft tissue such as the brain.

imaging device A piece of equipment used to get a picture (image) of something that is not normally visible, such as a person's heart. Examples include CAT, MRI, and PET scanners.

laparoscope A thin, lighted tube that is inserted into the abdomen during laparoscopic surgery. It contains a tiny camera that projects images onto a monitor.

laparoscopic surgery A method of operating in which the surgeon makes a tiny cut to insert a lighted tube (a laparoscope) into the abdomen. The laparoscope projects an image onto a monitor. The doctor watches this image while operating.

MRI (magnetic resonance imaging) A method of getting a picture of the inside of the body. MRIs are mainly used to examine soft tissue, such as the brain.

PET (positron emission tomography) A method of getting a picture of organs that shows them while they are working.

record (database) A collection of related data stored in a database. An example of a record would be all of the information on a single hospital patient.

vital sign A piece of information about a person's body, such as his or her heart rate or blood pressure.

vital signs monitor A device that keeps track of a person's vital signs, such as blood pressure and breathing rate. This information is displayed on a screen.

virtual reality An artificial environment created to place a person in an alternate world.