People decide to become doctors for many different reasons. Some like the excitement of testing their own theories to find new treatments and cures for human disease, while others like the satisfaction of using those treatments to help people. Some people are interested in working with technology to improve health, while others are more interested in exploring the complex systems that make up the human body.

At the University of Iowa, different people with different interests work together every day to make people healthier. Researchers, physicians, nurses, teachers and students work with imaging specialists, physical and occupational therapists, health care administrators, technology experts and countless others to provide some of the best care in the nation.

No matter where your interests lie, there’s a place for you in science and medicine. The University of Iowa Health Care STEM (science, technology, engineering, and math) programs including UI Gross Anatomy will show you a few of the possibilities. We invite you to take a look inside the University of Iowa and see what we’re doing. Use this workbook to explore science, health and disease. Discover the world of medicine at the University of Iowa.

But be warned: Just like medicine itself, it may get gross — but never boring!

How does a Cochlear Implant Work?

1. A microphone located externally behind the ear picks up sounds and turns them into electrical signals.
2. The electrical signals are sent to a speech processor, worn either on the body or on the ear, where they are “decoded,” or turned into a special pattern of electrical pulses.
3. Electrical pulses are sent to a coil located behind the ear on the outside, which transmits them across the skin by radio waves to an array of electrodes implanted deep within the cochlea.
4. The implant sends a pattern of electrical pulses to a tiny radio receiver located just under the skin behind the ear.
5. The receiver sends the pulses along an electrical wire wrapped within the cochlea.
6. The wire delivers the energy to an array of electrodes, sometimes as many as 22.
7. The auditory nerve picks up the tiny electrical pulses and sends them to the brain, where they are recognized as sound.

Student Questions:

Name two ways someone might become deaf and qualify for a cochlear implant.

When placing a cochlear implant, the surgeon drills a hole in what bone? Where is it located? (Requires watching the video to answer.)

How does a cochlear implant differ from a hearing aid?

How will you prevent future hearing loss for yourself?
There are a variety of reasons why someone might become deaf and qualify for a cochlear implant. This can include genetics (born this way), sickness (meningitis, rubella), medicines (some antibiotics or chemotherapy), or even head trauma. In order to understand how the cochlear implant replaces missing sound, it is important to understand how we hear. When you hear a doorbell, car alarm or crying baby, your outer ear, made of cartilage, collects the sound and sends it into the middle ear. The sound waves bounce off your eardrum, then the three tiniest bones in your body — called the hammer, anvil and stirrup (together, smaller than an orange seed) — make the sounds louder before sending them to the inner ear and then through the cochlea, where tiny hair cells turn them into electrical energy. Your brain receives the energy and recognizes it as the “sound” of a doorbell, car alarm, or a crying baby.

For a person who is profoundly deaf or severely hard of hearing, this process doesn’t work properly. For them, a cochlear implant may provide them with a sense of sound. Although it sounds very different from normal hearing, eventually the brain gets used to it and learns to recognize sounds, so that many people with cochlear implants can hear alarms, environmental sounds and conversations.

A cochlear implant is very different from a hearing aid. Hearing aids simply make the sounds louder, so that damaged ears can hear them. Hearing aids can be very useful for the majority of the hearing impaired population, but for a small segment not enough benefit is gained from hearing aids. Those patients are then cochlear implant candidates. Cochlear implants go around the damaged parts of the ear altogether and directly stimulate the auditory nerve, which sends sounds to the brain.

The cochlear implant, a small, complex electronic device, consists of an external portion that sits behind the ear to pick up sound; a second part that is surgically placed under the skin; and an array of electrodes that are placed about an inch into the cochlea.

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**DID YOU KNOW?**

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- University of Iowa graduates include:
  - A pathologist who unlocked the mystery of what caused the **Spanish Flu pandemic** in 1918;
  - An innovative investigator who discovered the value of fluoride in strengthening bones, a discovery that led to the **creation of Crest® toothpaste**;
  - A leader in understanding and treating sports injuries who contributed to the **creation of the first NIKE® shoe**;
  - A key researcher in the **development of the automobile seat belt** in the 1960s;
  - And 25,000 other alumni who have tended to the health care needs of Iowans and populations worldwide, and have made significant contributions to biomedical research and medical education.

- More than 7,400 health professionals care for more than **50,000 inpatients annually** at the University of Iowa Hospitals and Clinics, including 29,000 acutely ill children and adults.

- University of Iowa Hospitals and Clinics is one of the nation’s most prestigious teaching hospitals and a leading center for “around-the-clock” multidisciplinary, patient-centered care. The hospital’s commitment to care, compassion and discovery earns high rankings for quality and expertise.
Cataract is a common eye condition that affects millions of people, particularly as they get older. A cataract is a clouding of the eye's naturally clear lens. The lens focuses light rays on the retina—the layer of light-sensing cells lining the back of the eye—to produce a sharp image of what we see. When the lens becomes cloudy, light rays cannot pass through it easily, and vision is blurred.

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Dr. Ponseti, born in 1914 on the Spanish island of Menorca, learned as a teenager how to do intricate, precise work by helping in his father's watch repair shop. When he was 16, he attended the University of Barcelona where he earned degrees in biology and medicine. After his graduation, in 1936, he served as a medic during the Spanish Civil War, treating hundreds of bone and joint wounds. He left the country as a political refugee, and after spending some time in Mexico, came in 1941 to the University of Iowa to finish his medical residency.

In 1944, he joined the University of Iowa's orthopaedic surgery faculty. (Doctors who specialize in orthopaedic surgery work with the muscles, bones and joints of the body.) Dr. Arthur Steinbinder, head of the department at the time, asked Dr. Ponseti to review the results of clubfoot surgeries being performed at the University of Iowa. What Dr. Ponseti saw was not encouraging. He found that children treated with the surgery often had foot stiffness, pain, arthritis and limited movement as adults, and often required additional surgery.

Dr. Ponseti came up with his method by studying the anatomy and functions of a baby's foot. "If you know how to untwist the foot, that's all you need to know," he said, although coming up with the technique took several years and convincing others to use it took even longer. Today, however, due in large part to Dr. Ponseti's dedication to helping children with clubfoot, the Ponseti Method is used all over the world and is recognized as the best treatment for the condition. Hundreds of doctors came to University of Iowa Health Care from all over the world to be trained by Dr. Ponseti and his colleagues. Dr. Ponseti treated patients until his death in October 2009 at the age of 95. With a parent or adult, check out www.ponseti.info to learn more about Dr. Ponseti and to view more videos about clubfoot.

Student Questions:

What is clubfoot?

Why did Dr. Ponseti develop the Ponseti Method of clubfoot correction?

How long does the Ponseti Method take from start to finish?

DID YOU KNOW?

- Many famous athletes, including figure skater Kristi Yamaguchi, soccer great Mia Hamm, and football star Troy Aikman, were born with clubfoot.
- At birth you have 350 bones in your body. You now have 206 bones. What happened to the rest? They fused to other bones to make larger bones.
CHAPTER 3
Treating Clubfoot with the Ponseti Method

Clubfoot is a birth defect that happens when the muscles, tendons and bones in the foot develop abnormally while the baby is still a fetus inside its mother. Each year, 150,000 to 200,000 babies all over the world are born with clubfoot.

While researchers have been unable to pinpoint the exact cause of clubfoot, both genes and the environment are thought to play a role. Fortunately, Dr. Ignacio Ponseti, a doctor at the University of Iowa, developed an innovative, non-surgical treatment for the condition that is safe, easy, cost-effective and most importantly, successful in almost 100 percent of cases. The Ponseti Method, which Dr. Ponseti came up with more than 50 years ago, involves gently stretching the child’s foot back into place and keeping it there with a series of toe-to-groin plaster casts. After several weeks in the casts, the child then wears a brace, first all the time and then only at night, until he or she is about four years old. After that, no more treatment is usually needed.

Student Questions:

- Where in the eye does a cataract form?
- Name two ways people can get cataracts.
- How do you lower your risk of getting cataracts?
- Are patients awake during cataract surgery?

DID YOU KNOW?

- The University of Iowa is an international leader in vision research and care with particular strength in inherited eye diseases. People from all over the world come to the University of Iowa because of this reputation.
- Scientists at the University of Iowa are using stem cell biology and tissue engineering to regenerate cells in the eye with the potential to restore vision.
- Your eyeball doesn’t fall out when you lean over or walk because it is held in by six hard-working muscles. The muscles pull your eyeball back and forth, so you can read and look around. Each day these muscles move about 100,000 times. For your legs to get the same workout, you’d have to walk about 50 miles!
CHAPTER 2

The da Vinci® Surgical System is a robotic “surgeon” that helps humans perform “minimally invasive” surgery — meaning it is done through a very small opening rather than a large incision. With the da Vinci® robot, one surgeon stands by the robot to help guide the instruments into the patient, while another surgeon sits at computer controls several feet away and directs the robot’s arms, much like playing a video game. The da Vinci® robot magnifies the area being operated on so surgeons can get a better look, and moves in ways that a surgeon’s hands cannot.

In 2002, the University of Iowa helped pioneer robotic surgery and has continued to lead the field. Today, many other hospitals in Iowa and elsewhere also use the da Vinci® system.

Warning: The contents of this video are graphic.

The skills you develop by playing video games may help you with the skills needed to become a robotic surgeon.

Student Questions:

- How many surgeons does it take to perform surgery using the da Vinci® robot?
- Name three surgeries that the da Vinci® robot is used for in patients today.
- What are the advantages of the da Vinci® robotic surgical method compared to other types of surgeries?

- The da Vinci® robot is used for lots of procedures at the University of Iowa including surgeries in the stomach, intestines, colon, heart, kidneys and reproductive organs.
- The University of Iowa was the first in the world to use robotic surgery to remove a diseased colon from a child.
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Cataract Removal
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An acute sudden onset cortical cataract in a person with Type 1 (juvenile) diabetes.

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Cool facts about University of Iowa Health Care

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Or contact:
Jacqueline Kleppe Williams
Manager, Community and STEM Education
University of Iowa Health Care
Marketing and Communications
Division of External Relations
4148 WL, Iowa City, IA 52242
Phone 877-MED-IOWA or (319) 384-3025
or via e-mail at stem-education@uiowa.edu

Web Resources

For more information and resources related to science, health, diseases and medicine go to the Hardin Library for Health Sciences: [lib.uiowa.edu/hardin](http://lib.uiowa.edu/hardin)

Students can learn more about the road to becoming a physician at: [medicine.uiowa.edu/osac/admissions/match.html](http://medicine.uiowa.edu/osac/admissions/match.html)

More information about going to medical school can also be found at: [aspiringdocs.org](http://aspiringdocs.org)

This website from the National Institute on Deafness and Other Communication Disorders has student and teacher activities: [nidcd.nih.gov/health/education](http://nidcd.nih.gov/health/education)

Information about the "gross side" of science, designed just for kids, can be found at the Grossology website: [grossology.org](http://grossology.org)

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Or contact:
Jacqueline Kleppe Williams
Manager, Community and STEM Education
University of Iowa Health Care
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University of Iowa Health Care is a fully integrated academic medical center, uniting the UI Roy J. and Lucille A. Carver College of Medicine, University of Iowa Hospitals and Clinics, and UI Physicians, the largest multi-specialty group practice in Iowa. As the state’s premier academic medical center, UI Health Care provides high-quality, patient-centered care, conducts groundbreaking biomedical research, and educates the scientists and health care providers of the future.