COACHES' RESOURCES

Engineering Meets Medicine

The 2010 Body Forward Jr.FLL Challenge builds an understanding of the complex network of medical, scientific, and engineering cooperation required to bring even the tiniest medical advances to us. The most mundane items may bring the biggest surprises. The sheer scope can be mind-boggling, even for adults, but the Challenge lays the groundwork for understanding the roles that all kinds of careers play in keeping us strong and healthy. Remember that your library, local hospital, and area physicians, nurses, working scientists and engineers also can be great resources for your team.

DISCUSSION TOPICS

The Body Forward Challenge opens opportunities for discussion as your team works. Consider introducing some of these questions for discussion as your group works; remember to keep your language kid-friendly and appropriate for the team's age.

- What if your team's medical tool or machine didn't exist? Would they be as healthy and strong? What else could be used to help them?

- What if the people delivering medical supplies didn't arrive and the hospitals ran out? Could people get the help they need? What else might change?

- Ask your team to think of some people they know who have been helped by doctors, scientists, and engineers. Who helped them? Why was it important that those people got help? What would happen if they didn't?

- Some items (like Band-Aids, eyeglasses, and ice packs) can be used anywhere. Others (like X-ray machines, operating rooms, machines to analyze blood, and surgical tools) can only be found in special places. Why is this? Consider a field trip to visit a hospital, laboratory, doctor's office, clinic, or the school nurse. Or perhaps your team might tour an ambulance or medevac helicopter.

- What are some ways that the item your team selected was protected so it arrived without being damaged? What are some things that your team members can do to make sure they get where they are going safely?

- Your body has many, many parts. Many of them work together. Which parts work together? What do they do? What would happen if they couldn't work together?

WEB RESOURCES

If you have internet access, there are many sources for age-appropriate information about biomedical engineering. Here are some that you may find helpful.

Websites Geared to Children

Science for Kids
http://www.eurekalert.org/scienceforkids/

National Geographic Kids
http://kids.nationalgeographic.com/

Science News for Kids
http://www.sciencenewsforkids.org/

Everyday Illnesses and Injuries
http://kidshealth.org/kid/ill_injure/index.html

Kids Work!
http://www.knowitall.org/kidswork/hospital/history/index.html

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History of Medicine
http://www.childrenfirst.nhs.uk/kids/news/features/fantasy_fun/history-of-medicine.html

Discover Engineering
http://www.discoverengineering.org/

Rader's Physics for Kids
http://www.physics4kids.com/

Rader's Chem4Kids
http://www.chem4kids.com/
http://www.chem4kids.com/files/bio_intro.html

Rader's Biology4Kids
http://www.biology4kids.com/

Tiki's Guide to Genetic Engineering
http://tiki.oneworld.net/genetics/home.html

WEBSITES HOSTED BY PROFESSIONAL ORGANIZATIONS

These websites will help you learn more about careers in Biomedical Engineering. They might also be useful in finding experts in your area. These sites provide good background information for coaches, but rarely contain language that is readily understood by children.

Engineering in Medicine and Biology Society
http://www.embs.org/

American Academy of Orthotists and Prosthetists
http://www.oandp.org

Orthopaedic Research Society
http://www.ors.org/web/index.asp

American Institute for Medical and Biological Engineering
http://www.aimbe.org/

Biomedical Engineering Society
http://bmes.associationdatabase.com/aws/BMES/pt/sp/Home_Page

Stanford Biodesign Program
http://innovation.stanford.edu/bdn/index.jsp

BME Source
http://171.65.102.151/~bmesource
BME Source is the Web portal for the biomedical technology design community. It provides a guide to high-quality, basic information about clinical problems, medical technologies that address them and business and law resources that assist in technology transfer.

Society for Biomaterials
http://www.biomaterials.org/

Materials Research Society
http://www.mrs.org/s_mrs/index.asp

WEBSITES WITH BIOMEDICAL ENGINEERING CAREER INFORMATION

Careers in Biomedical Engineering from the Biomedical Engineering Society
http://bmes.seas.wustl.edu/careers.asp

BME Alliance
http://www.bmecareeralliance.org/

BOOKS

Artificial Limbs (Innovation in Medicine; 21st Century Skills) by Susan Heinrichs Gray
Publisher: Cherry Lake Pub., Ann Arbor, MI (August 2008)

Ugh! Icky, Sticky, Gross Stuff in the Hospital (Icky, Sticky, Gross-Out Books) by Pam Rosenberg, Beatriz Helena Ramos (Illustrator)
Publisher: The Child's World, Inc., Mankato, MN (2008)

The Human Body by Seymour Simon
Publisher: Collins; First Edition (September 2, 2008)

Human Body (DK Eyewitness Books) by Richard Walker
Publisher: DK CHILDREN; Har/Com/Ps edition (March 30, 2009)

Enjoy Your Cells series
Cold Spring Harbor Laboratory Press, Danvers, MA

Blood and Guts (The Brown Paper School) by Linda Allison
Publisher: The Yolla Bolly Press, Covelo, CA (1976)

Human Body by Steve Parker
Publisher: Mason Crest Publishers, Broomall, PA (2009)

Robot (DK Eyewitness Books) by Roger Bridgman
Publisher: DK CHILDREN (March 1, 2004)

Exploring The History Of Medicine: From The Ancient Physicians Of Pharaoh To Genetic Engineering
by John Hudson Tiner
Publisher: Master Books, Green Forest, AR (1999)

Girls Think of Everything: Stories of Ingenious Inventions by Women by Catherine Thimmesh, Melissa Sweet (Illustrator)
Publisher: Houghton Mifflin Company, New York, NY (2000)

The Kid Who Invented the Popsicle: And Other Surprising Stories about Inventions by Don L. Wulffson
Publisher: Puffin Books, New York, NY (1999)

We also found a number of books on various body systems published by The Child's World (author: Susan Heinrichs Gray) and True World (author: Christine Taylor-Butler).

MAGAZINE ARTICLES—ONLINE AND IN PRINT

Batteries Built by Viruses by Stephen Ornes
Publication: Science News for Kids (Magazine/Journal)
Date: October 28, 2009
Publisher: Science Service, Inc.

Making Good, Brown Fat
http://www.sciencenewsforkids.org/articles/20090909/Note2.asp

New Twists for Phantom Limbs
http://www.sciencenewsforkids.org/articles/20091118/Note3.asp

Heart Revival
http://www.sciencenewsforkids.org/articles/20080130/Note2.asp

The Electric Brain
http://www.sciencenewsforkids.org/articles/20070808/Note2.asp

A Better Flu Shot
http://www.sciencenewsforkids.org/articles/20070418/Note2.asp

A Fix for Injured Knees
http://www.sciencenewsforkids.org/articles/20070228/Note2.asp

Cool Cast Facts
http://kidshealth.org/kid/feel_better/things/casts.html

A New Touch
http://www.sciencenewsforkids.org/articles/20070214/Note2.asp

Disease Detectives
http://www.sciencenewsforkids.org/articles/20061115/Feature1.asp

Sun Screen
http://www.sciencenewsforkids.org/articles/20060712/Feature1.asp

Germ Zapper
http://www.sciencenewsforkids.org/articles/20060524/Note2.asp

Attacking Asthma
http://www.sciencenewsforkids.org/articles/20060405/Feature1.asp

Nonstop Robot
http://www.sciencenewsforkids.org/articles/20061129/Note2.asp

Getting in Touch with Touch
http://www.sciencenewsforkids.org/articles/20070411/Feature1.asp

Computers with Attitude
http://www.sciencenewsforkids.org/articles/20040303/Feature1.asp

ONLINE VIDEOS

Dean Kamen: The emotion behind invention (20 minutes)
http://www.ted.com/talks/dean_kamen_the_emotion_behind_invention.html
Queue up the video to 8:10 to see some amazing footage of artificial arms and hear Dean Kamen, founder of *FIRST*, talk about his experience meeting soldiers who lost arms and legs in the war.

Secrets of movement, from geckos and roaches: Robert Full on TED.com (20 minutes)
http://blog.ted.com/2007/11/robert_full.php
How engineers designed an all-terrain robotic foot.

Accessible design in prosthetics (10 minutes)
http://blog.ted.com/2009/04/accessible_desi.php
Check out some really cool artificial legs and the woman who uses them!

Anthony Atala on growing new organs (18 minutes)
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue.html
Queue up the video to 2:10 and see some tissue regeneration (organs grown in a lab) to create new arteries, ears, and internal organs for transplant. The language is complicated but the images are amazing!

GLOSSARY

archeologist

A person who studies ancient times and ancient people by looking at what is left of their buildings, tools, dishes, weapons, and other things. Archeologists study people who lived hundreds and thousands of years ago.

artificial limbs

A man-made replacement for an arm, leg, hand, foot, eye, or other body part. Artificial limbs can be made from willow wood, fiberglass, plastics, glass, or metal. Artificial limbs are also called prosthetic devices.

bacteria

Living things that have only one cell and can be seen only with a microscope. Some bacteria cause diseases. Bacteria that make you sick are also called germs.

bandage

A strip of cloth for covering a sore, wound, or injured body part.

biomedical engineering

Biomedical Engineers study biology and medicine to develop new tools and machines for health care. They develop medical diagnostic machines, medical instruments, artificial organs, joint replacement parts, and prosthetic devices.

biologist

A scientist who studies living things, like plants and animals, to learn how they live and grow.

cast

A special, hard bandage for keeping a broken body part still while it is healing. Casts are soft on the inside and hard on the outside. Casts can be made from plaster of paris, fiberglass, or plastic.

chemist

A scientist who studies how things called elements change when they are heated, cooled, or mixed with something else. All living and nonliving things are made up of elements. There are more than 100 elements. They include things like gold, carbon, iron, and oxygen.

clinic

A place where people don't need to stay in a hospital can go to get medical help.

diagnostic machines

Machines, like microscopes and X-ray machines, that help with studying sick and hurt people so that doctors can figure out what is wrong. See also machine.

engineer

Someone who uses science to create new things that people can use. Engineers create things like bridges, roads, computers, telescopes, cars, airplanes, medical machines and tools, and many others.

germs

A living thing that causes disease. Germs are too small to be seen without a microscope.

hospital

A place where doctors, nurses, and others take care of people who are sick or hurt.

inhaler

A medical tool that helps people breathe in their medicine. Most inhalers are small enough that they can be carried in a pocket. Sometimes they are called puffers.

laboratory

A room or building where people work with science and engineering.

machine

A thing created for doing some kind of work, like a sewing machine, a bulldozer, and an X-ray machine. Machines are made of parts that move and parts that stay still.

medicine

The science of treating or preventing disease.
Medicine is also a name for things that people drink, swallow, chew, breathe in, rub or spray on their skin, or get in a shot to help kill germs, take away pain, or keep them from getting sick.

physicist

A scientist who studies the way things move and the way work is done. Physicists study light, heat, energy, sound, electricity, and mechanics.

programmer

A person who writes the instructions for a computer to follow.

prosthetic

See artificial limbs

scientist

A person who watches (observes) and experiments to learn about things that exist in the world.

skull

The bones that cover your head and protect your brain.

special scissors

A tool for cutting. Biomedical engineers have created special scissors that help doctors and nurses in their jobs. Some are used for removing stitches from healed cuts. Others are used to remove casts. Still others are used during surgery. Each is designed to help doctors and nurses cut only what they need to without hurting the person they are helping.

stethoscope

A medical tool used to listen to sounds from the heart, lungs, and other body parts.

surgery

A way of helping sick or hurt people by cutting into, taking out, or repairing body parts. Only doctors can do surgery. Nurses and others help the doctors during surgery.

thermometer

A medical tool used to measure how hot (or cold) something is.

tongue depressor

A medical tool used to hold your tongue down so a doctor or nurse can see into your throat. Tongue depressors are usually made out of wood.

tool

A thing that you can hold in your hand and use to do work. Some tools get their power from you. Some tools get their power from motors.

vaccine

Something put into the body to help fight off a disease. Vaccines are made of dead or weak germs. When those dead or weak germs get in your body, your body makes germ fighters that keep you from getting the disease.

virus

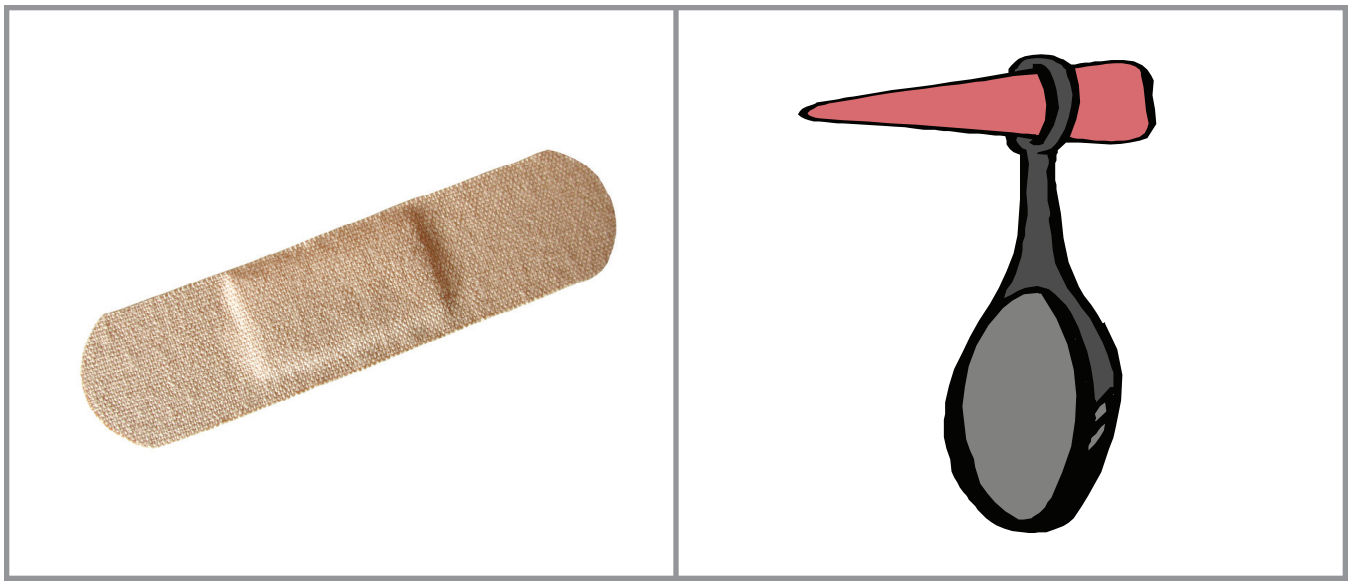
A tiny, living thing that grows in cells and makes you sick. Viruses are smaller than bacteria. Viruses that make you sick are sometimes called germs.

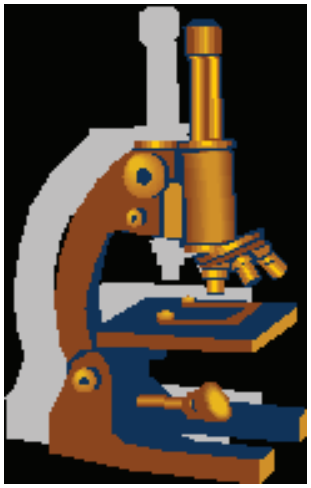
X-ray machine

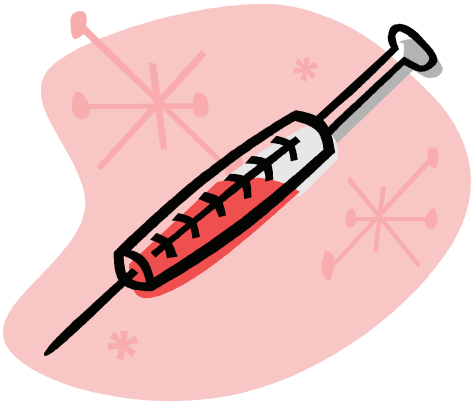
X-rays are invisible and can go through solids, like your body. X-ray machines are a kind of camera that lets doctors take pictures and see bones and other body parts that are inside you.

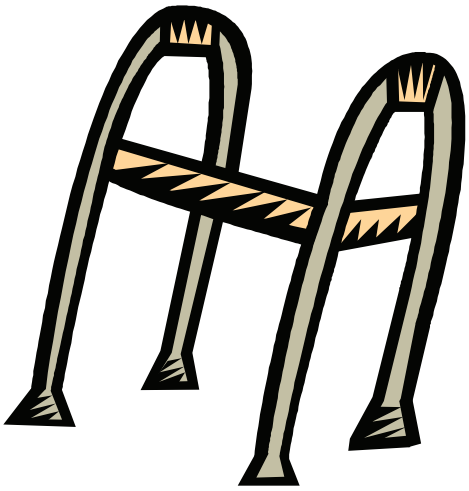
IMAGE RESOURCES

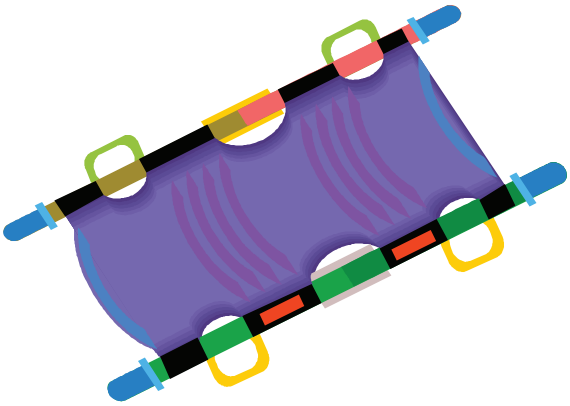
The following images show a variety of medical tools and machines. You can create a set of flash cards (simply cut out the images and paste them on 3 x 5 index cards) to prompt your team if they have difficulty thinking of medical tools they have seen. See how many they recognize. See if they can tell you about where and how they are used.

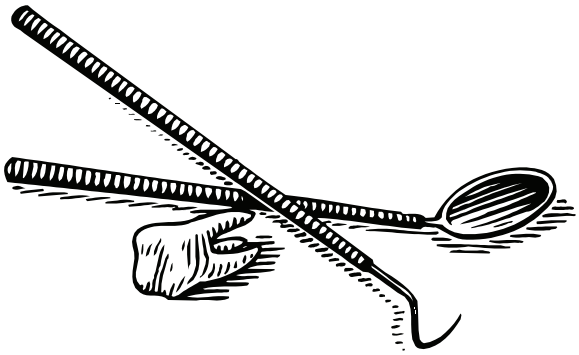


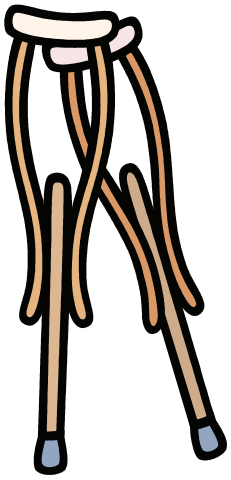


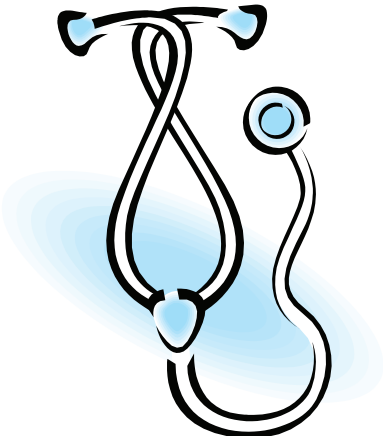


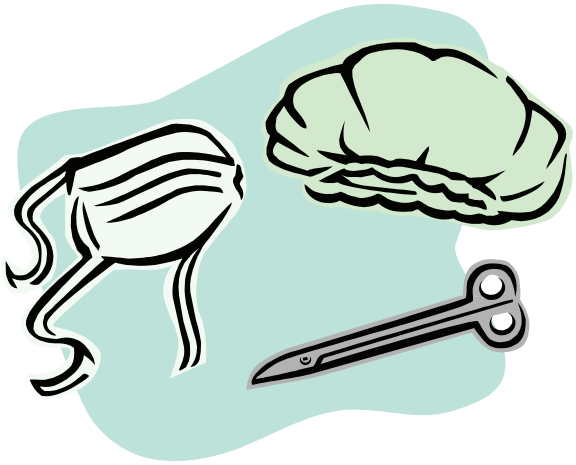


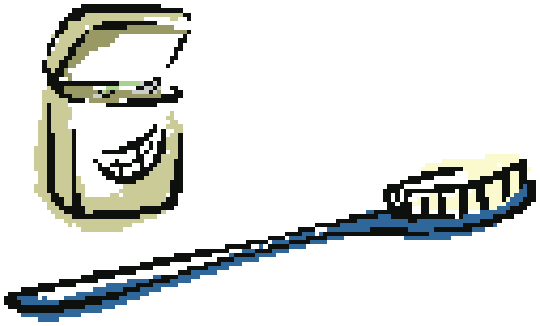


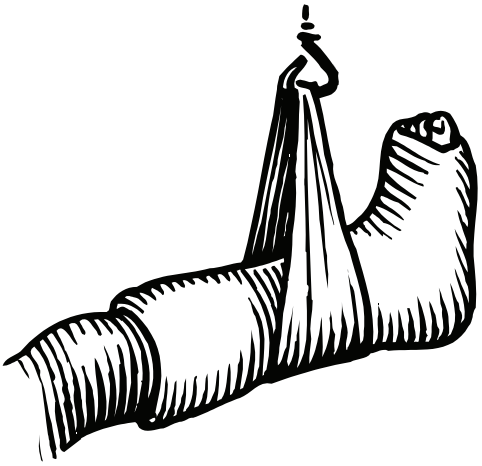


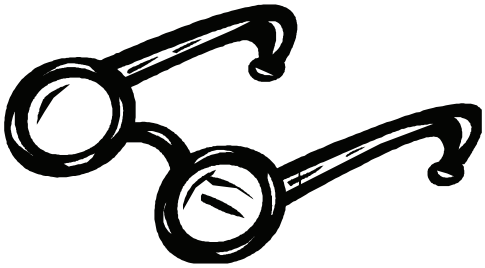


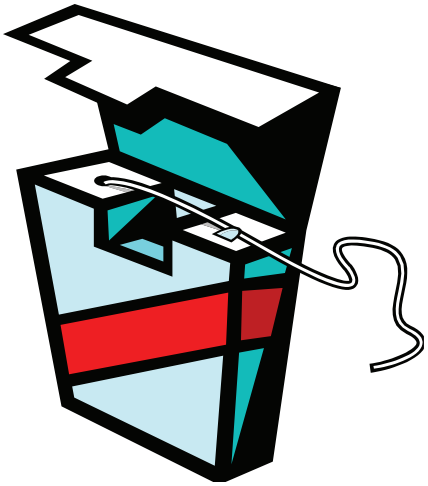
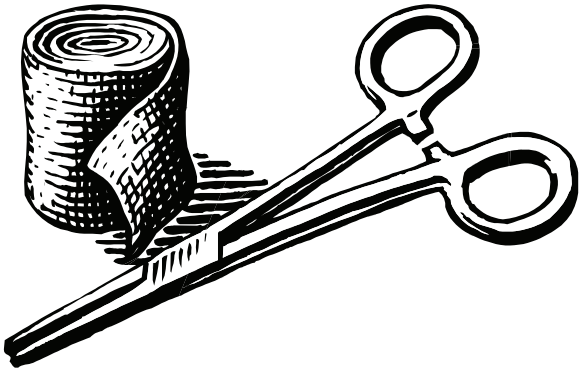
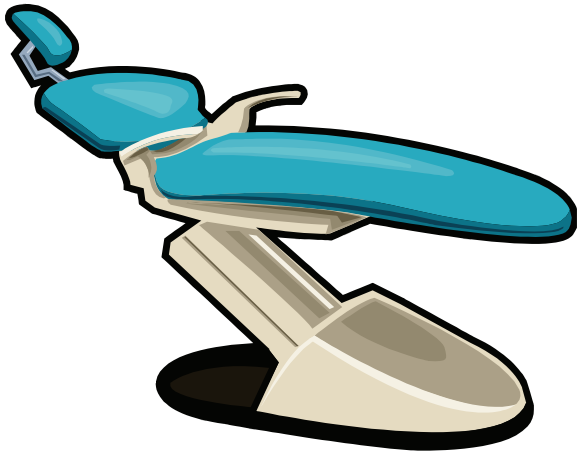
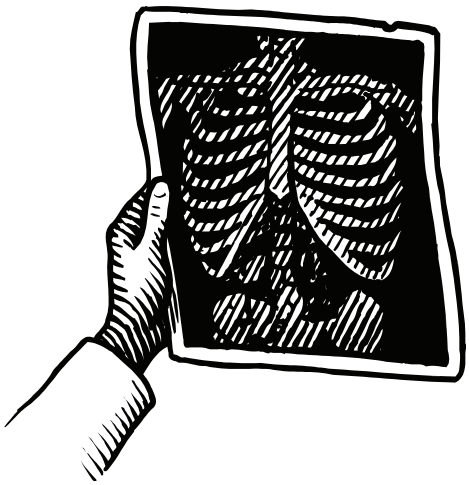








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