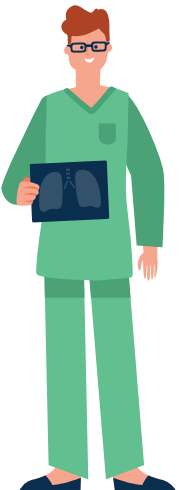
Medical Technology

Dialysis, Internal Imaging, Surgery, Vaccines & Medications

5549 GRYPHON ROBOTICS

Medical Fields of Study

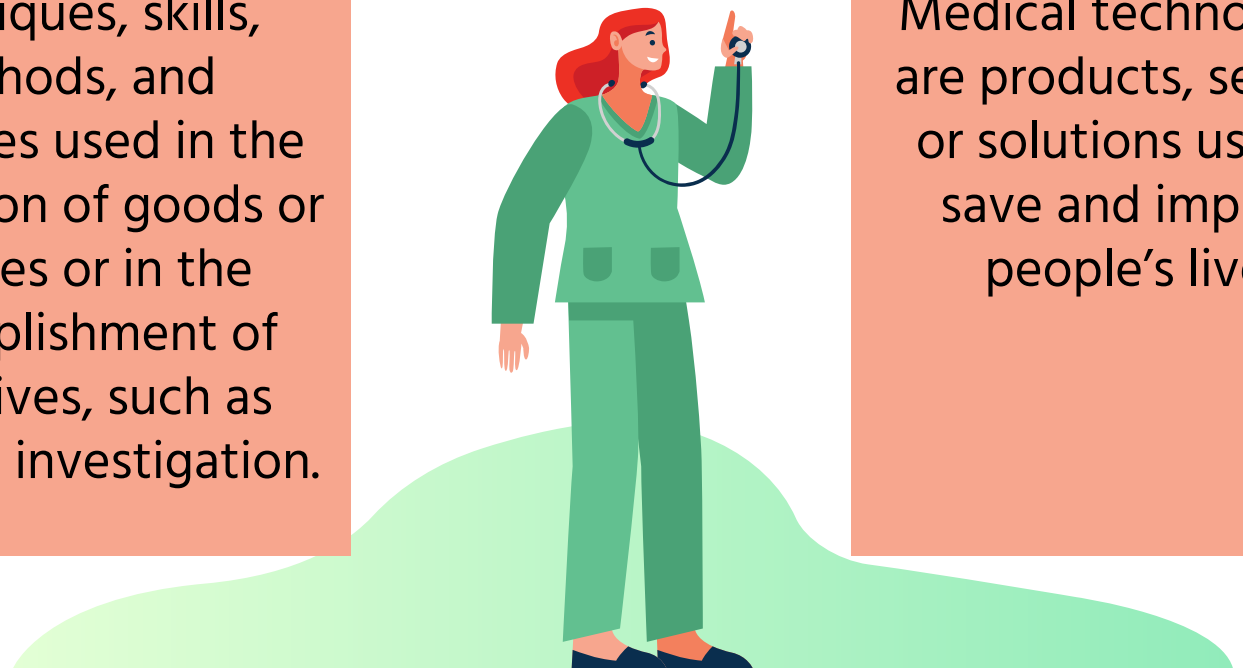
Dentist
Medical & Clinical Laboratory Technician
Prosthetist
Surgeon
Radiologist
Pediatrician
Nutritionist
Paramedic
Pharmacist
Veterinarian
Physician
Optometrist
Anesthesiologist
Phlebotomist
Dentist
Audiologist
Psychiatrist
Nurse
Physical Therapist



What is Medical Technology?

Technology

Techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation.



Medical Technology

Medical technologies are products, services or solutions used to save and improve people's lives.

Common Medical Instruments

Stethoscope

Blood Pressure Monitor

Thermometer

Reflex Hammer

Otoscope and Ophthalmoscope


Stethoscope

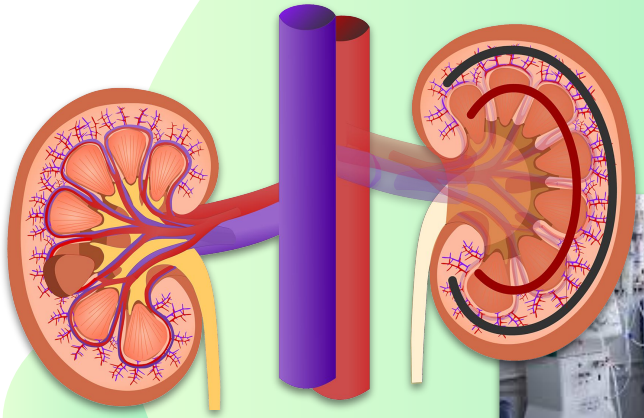
Dialysis

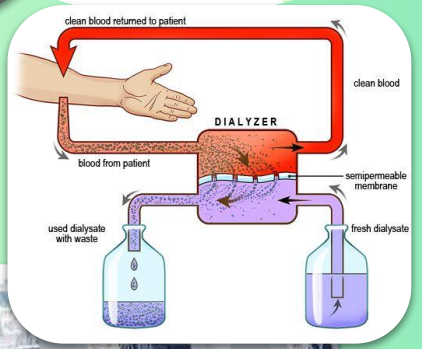
Dialysis

Have you ever wondered what is the function of your kidneys? Why are they so important? What happens during dialysis? What's the big deal with kidney transplants?

Materials

- 2 clear cups
- ½ spoonful crushed chalk (chunky, doesn't need to be fine, just not a whole piece)
- • Small bag (to crush chalk in)
- ½ cup of water
- Food coloring (any color) (if using colored chalk, do not need this)
- Coffee filter
- Rubber band or tape
- Spoon



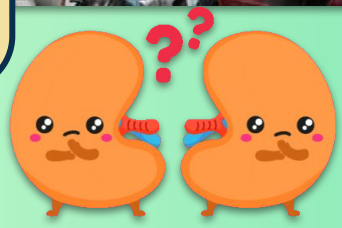


Think About It...

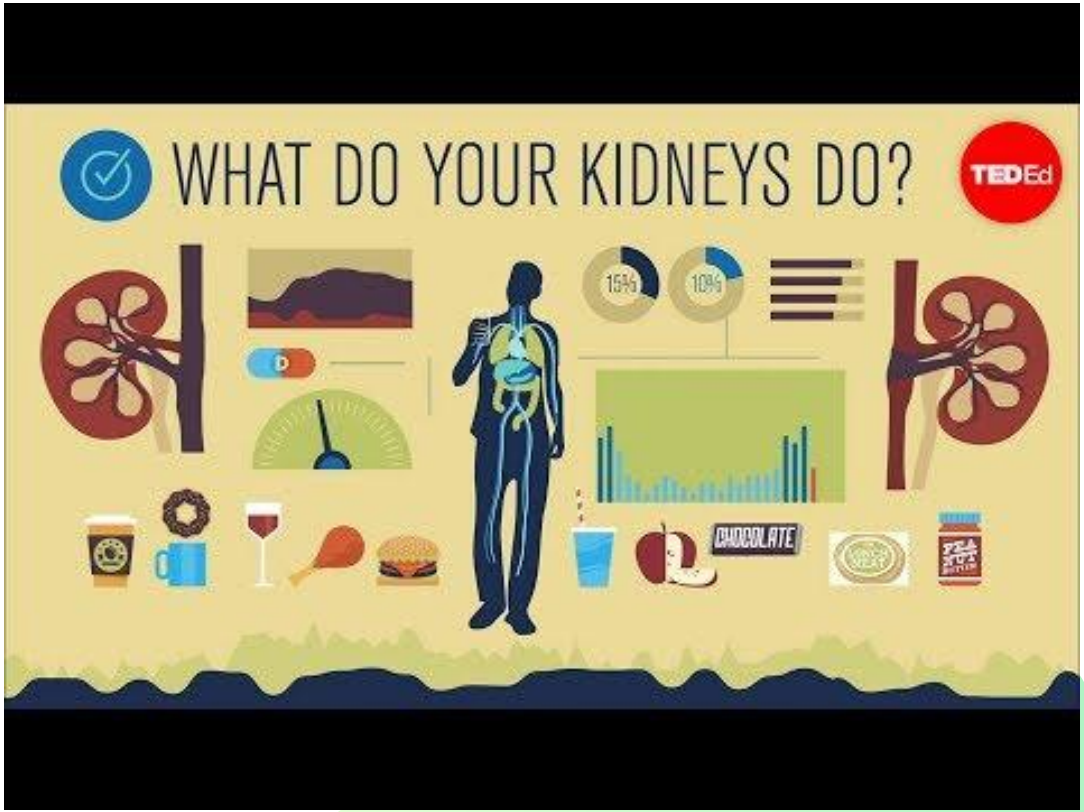
- what would happen if our trash was never picked up and removed?

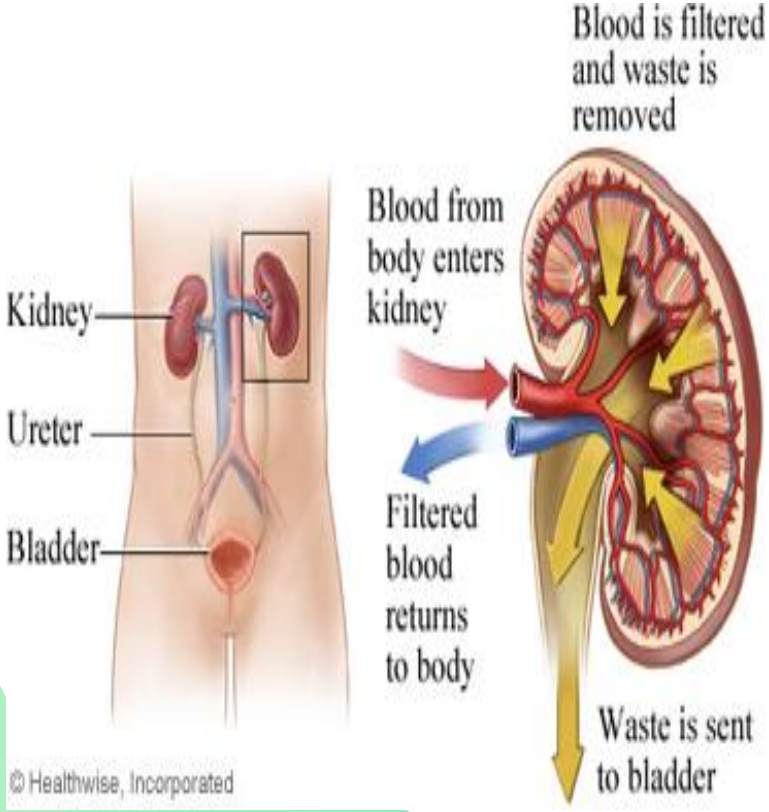
- How do you think waste is removed from our bodies?

There is no space for a landfill in your body to contain wastes. You must be able to expel wastes from your body. This is the role of the excretory system.



Excretory System → Kidney





Kidney Filtration Activity

Try this activity at home to see for yourself how the kidneys work. Record yourself filtering "blood" and share with your friends and family so they can learn how the kidneys work too.

Materials

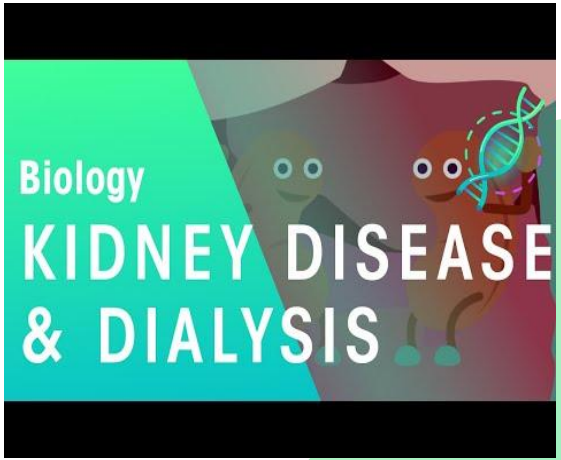
- 2 clear cups
- ½ spoonful crushed chalk (chunky, doesn't need to be fine, just not a whole piece)
- • Small bag (to crush chalk in)
- ½ cup of water
- Food coloring (any color) (if using colored chalk, do not need this)
- Coffee filter
- Rubber band or tape
- Spoon

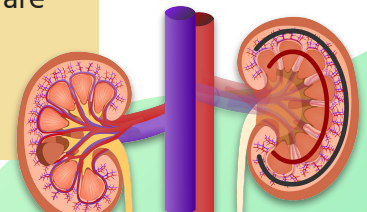
Chronic Kidney Disease (CKD)

Click HERE to learn more about CKD

Chronic kidney disease (CKD) is a condition characterized by a gradual loss of kidney function over time.

- 37 million American adults have CKD and millions of others are at increased risk.
- Anyone can get chronic kidney disease at any age
- Early detection can help prevent the progression of kidney disease to kidney failure.
- Heart disease is the major cause of death for all people with CKD.
- Glomerular filtration rate (GFR) is the best estimate of kidney function.
- Hypertension causes CKD and CKD causes hypertension.
- Persistent proteinuria (protein in the urine) means CKD is present.
- High risk groups include those with diabetes, hypertension and family history of kidney failure.
- African Americans, Hispanics, Pacific Islanders, American Indians and Seniors are at increased risk.
- Two simple tests can detect CKD: blood pressure, urine albumin and serum creatinine.

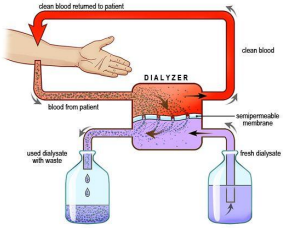




Glomerular Filtration Rate (GFR)

This test measures the level of kidney function and determines the stage of kidney disease a patient is in. A doctor can calculate it from the results of a blood creatinine test, your age, race, gender and other factors. The earlier kidney disease is detected, the better the chance of slowing or stopping its progression.

Chronic Kidney Disease Treatment - Dialysis



There are two treatment options for kidney failure: dialysis (hemodialysis or peritoneal dialysis) and kidney transplantation.

You need dialysis if your kidneys no longer remove enough wastes and fluid from your blood to keep you healthy. This usually happens when you have only 10 to 15 percent of your kidney function left.

Hemodialysis is a procedure where a dialysis machine and a special filter called an artificial kidney, or a dialyzer, are used to clean your blood.

Chronic Kidney Disease Treatment - Transplant

There are two treatment options for kidney failure: dialysis (hemodialysis or peritoneal dialysis) and kidney transplantation.

A kidney transplant is an operation that places a healthy kidney from another person into your body. The kidney may come from someone who has died or from a living donor who may be a close relative, spouse or friend. It can even come from someone who wishes to donate a kidney to anyone in need of a transplant. However, a kidney transplant is a treatment, not a cure, and it is important to care for the new kidney with the same care as before receiving the transplant.

Read **HERE** about how Selena Gomez received a Kidney Transplant due to effects from the serious disease Lupus.

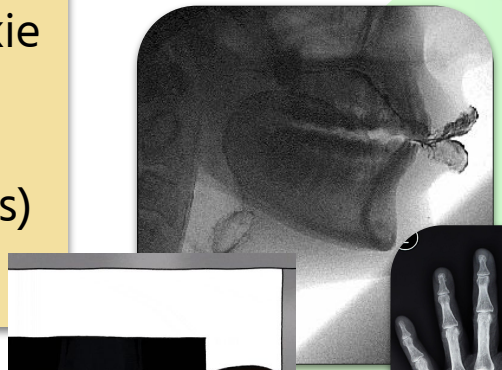
Internal Imaging

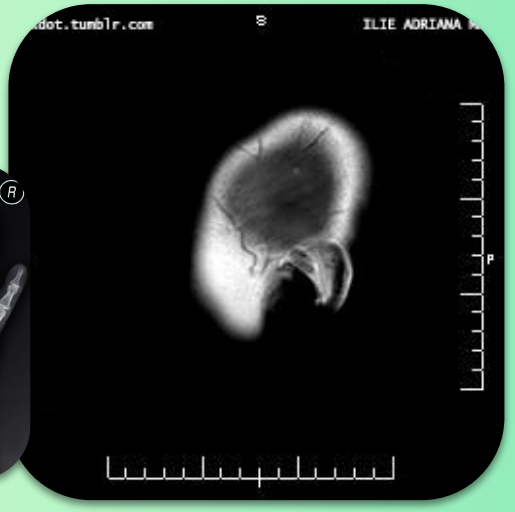
Internal Imaging

Have you ever wondered how doctors can see through your skin? How X-rays and MRI's work?

Materials

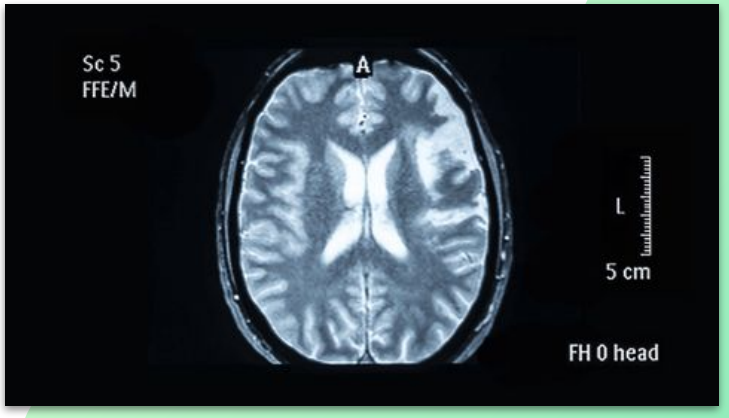
- A shallow but long dish of water (I used a cookie tray)
- Water
- Cylinder items (like cans)



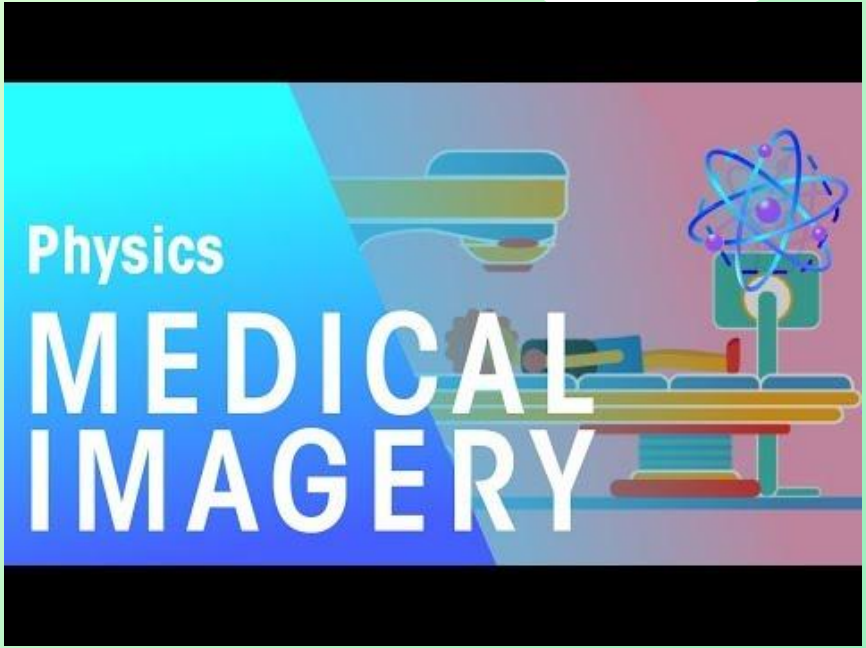


What is Internal Imaging (Medical Imaging)?

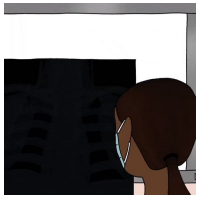
Internal Imaging, or Medical Imaging, refers to the technique of photographing the interior parts of the body for medical purpose. This is often used by Radiologist, who work in the medical branch of Radiology. The images can be used to reveal problems with organs and diagnose diseases and abnormalities. Medical Imaging also includes techniques that can produce graphs and data rather than pictures.



Medical Imaging



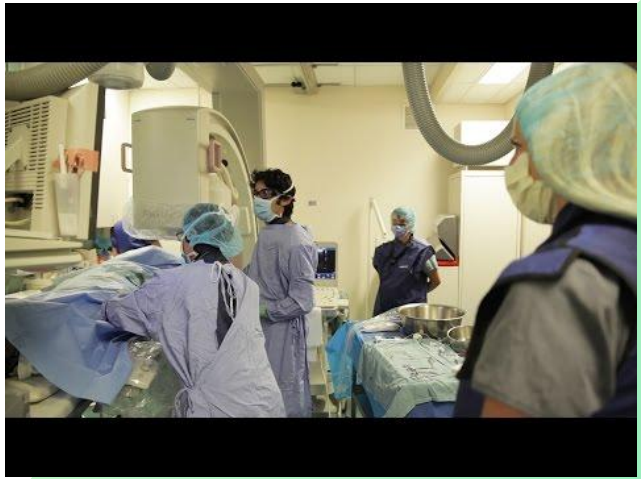
Explains examples of Medical Imaging and it's uses



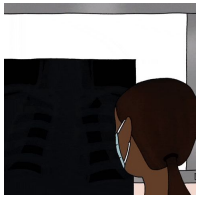
What is Radiology?

Radiology, or diagnostic imaging, both diagnosis diseases using medical images AND treats diseases using radiant energy. These two parts are called diagnostic radiology and interventional radiology. The x-ray, MRI, and ultrasound are all examples of tools that can be used in both surgery AND diagnosis.

Explains Interventional and Diagnostic Radiology



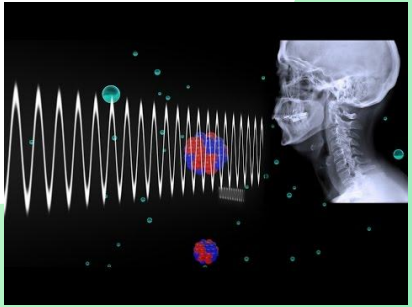
How do X-Rays Work?



X-rays are a type of wave on the electromagnetic spectrum. They produce waves of electromagnetic energy that are not visible to human eyes. X-rays are produced by a negatively charged electrode (or a metal rod) heated by electricity. This causes electrons to be released and produce energy. The X-ray machine directs the energy towards a metal plate, when the energy collides with the plate, an X-ray is produced.

The image appears because a piece of film is placed behind the area that a picture is being taken of, when the X-rays enter your body it will pass through any areas that cannot absorb the X-ray. Those areas will remain dark on the film, and areas that absorbed the X-ray will turn white on the film.

Watch this video if you're still confused



Modeling X-Rays

In this activity, we'll be modeling how X-Rays work!

The waves from the water act like X-rays. When there is another object, the wave are dispersed. This is similar to having bones absorb the X-rays, rather than them passing through.

Materials

- A shallow but long dish of water (I used a cookie tray)
- Water
- Cylinder items (like cans)

Directions

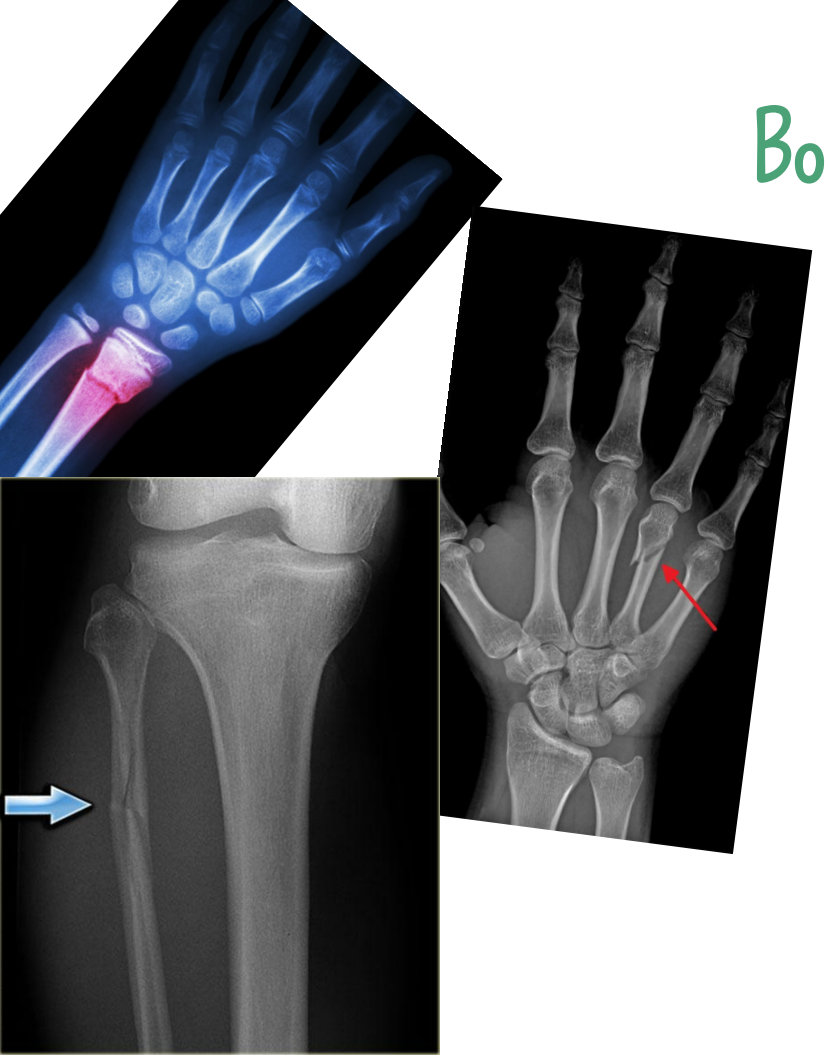
1. Fill the cookie sheet with water, make sure it doesn't overflow.
2. Drop the cylinder into the water.
    a. Notice how the waves don't stop until they hit the edge of the sheet
3. Place another cylinder into the water
4. Drop the original cylinder again
    a. This time the waves bounce around the other can

Get To Know Your Bones!

Want a challenge? Try to label and assemble human bones HERE

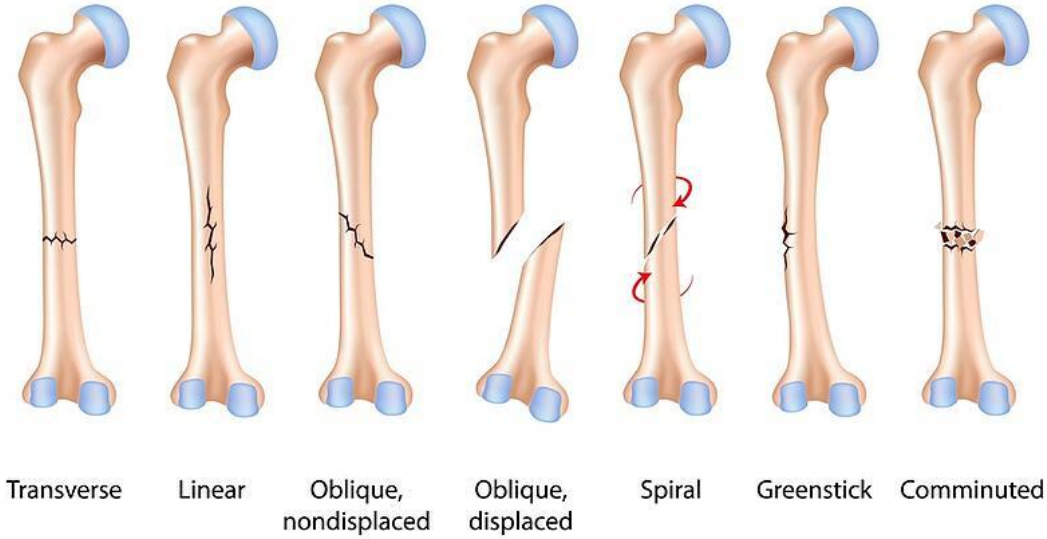
Learn a bit about your skeletal system HERE

Bone Fractures



Learn about how to understand bone fracture X-Ray's HERE!

Types of Bone Fractures



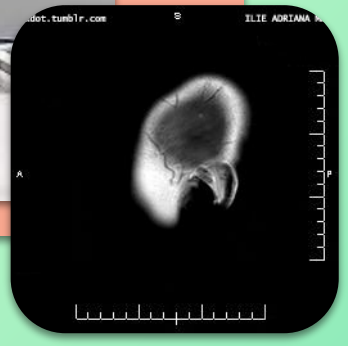
Learn more about the difference here!

MRI

Magnetic Resonance Imaging (MRI) uses magnets and radio waves to see an indepth look at bones, organs, and tissues. They are used to diagnose cancers, tumors, blood vessel irregularities, bone disorders, and more. MRI Scans produce a higher quality image and can see more soft tissue and behind the bones compared to a CT Scan. However, they are usually more expensive, take longer, and can be loud.

CT Scan

Computed Tomography (CT) Also referred to as a CAT scan. A CT Scan takes several x-ray's to create multiple cross section images of your body. Can be used to diagnose circulation problems, head conditions, and more. In an emergency, CT Scans are used because they are faster and can quickly diagnose a problem. CT Scans also require much more radiation, over 1000x more than a typical x-ray. While this isn't fatal, multiple CT Scans can add up.



Ultrasounds

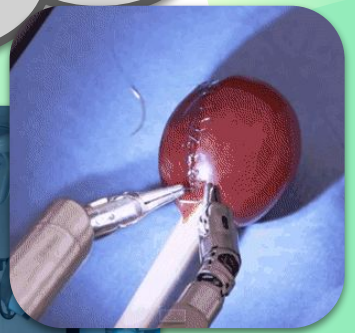
Surgery

Surgery

Materials

- Banana
- Dental Floss
- Needle Holder (or you can just use your fingers for now
- Curved Needle (or standard needle)
- Knife

Have you ever wondered about the different types of surgery and why people get surgery?



Different Types of Surgery and Surgeons

The American College of Surgeons has 14 different classifications of surgery:

(1) cardiothoracic surgery
(2) colon and rectal surgery
(3) general surgery
(4) gynecology and obstetrics
(5) gynecologic oncology
(6) neurological surgery
(7) ophthalmic surgery
(8) oral and maxillofacial surgery
(9) orthopaedic surgery
(10) otorhinolaryngology
(11) pediatric surgery
(12) plastic and maxillofacial surgery
(13) urology
(14) vascular surgery.

You can read more about the differences here!

Reasons for Surgery

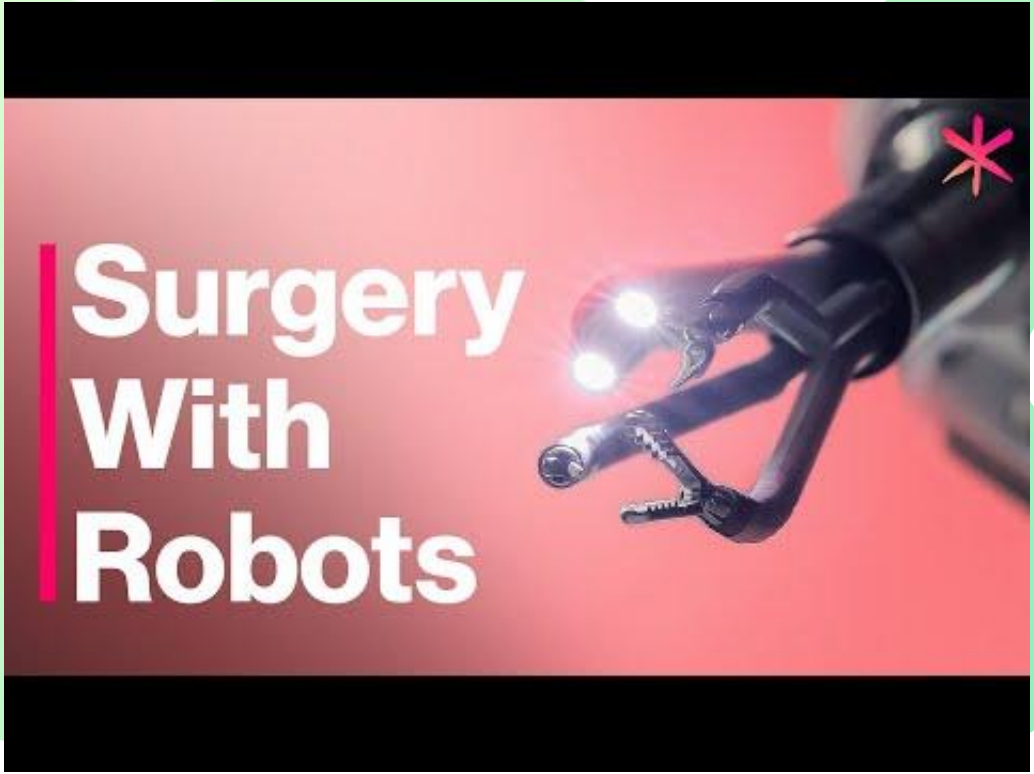
Surgery can be performed for a number of reasons both personal and medical. It can be performed to learn more about a condition, reposition bones, remove tissues or tumors, transplant organs or tissue, implant medical devices and much more.

Stages of Surgery

1. **Preoperative:** the care given from the time between admittance to the hospital and the surgery beginning.
2. **Perioperative:** the time related to the time right before the operation.
3. **Intraoperative:** the time during the surgery
4. **Postoperative:** the time followed right after the surgery
5. **Post-discharge**: the time after the discharge from the hospital where the patient is still healing and may come in for check ins.

Throughout this process, the patient is being cared for by a variety of people including nurses and surgeons.

Robotic Surgery - A New Era of Medical Technology



How to Properly Clean a Wound

1. Trim or shave the area surrounding the wound to avoid contamination and to ensure proper airflow. The wound edges should be exposed and clearly visible. Ideally, there should be a half-inch diameter of hair-free skin surrounding the wound.

2. Irrigating and washing the wound will remove bacteria and debris from the wound. Use an antibacterial soap, like Dial, to gently wash the skin wound and surrounding tissue. Then, allow warm water to flow over and into the wound for a period of two full minutes. This should be done immediately following the injury and three times daily until the wound is healed.

3. Following wound irrigation, pat the cut, scrape, bite or gash dry using a sterile gauze pad. A clean paper towel can be utilized to dry the surrounding area. Avoid using towels, as this can simply transfer additional bacteria to the clean wound and to also prevent any further infection

Suturing and Stitching Supplies

Forceps → Needle Holder

A surgical instrument capable of being used to guide a thread inside a body and to cut the thread comprises a forceps jaw having first and second opposed surfaces each provided with a serrated portion and a cutting portion.

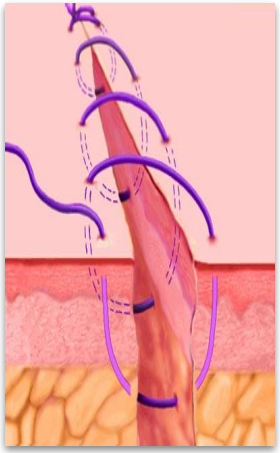
Curved Needle

Curved needles is probably the best needle you can use in the suturing process. The curved needle are shaped like an arc to make the job easier and faster. The needle help you sew the wound in any type of suture either it be continuous, non continuous, or pure string.

Types of Sutures

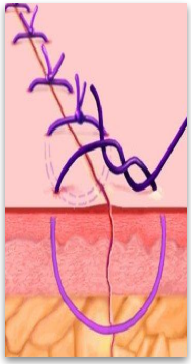
Continuous

A continuous suture, Also called uninterrupted suture is made from an uninterrupted series of stitches that are fastened at each end by a knot.



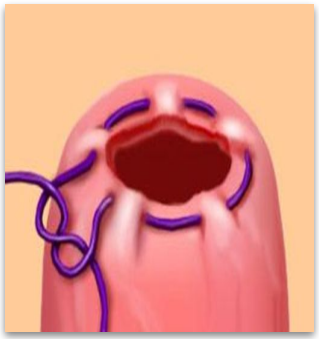
Non-Continuous

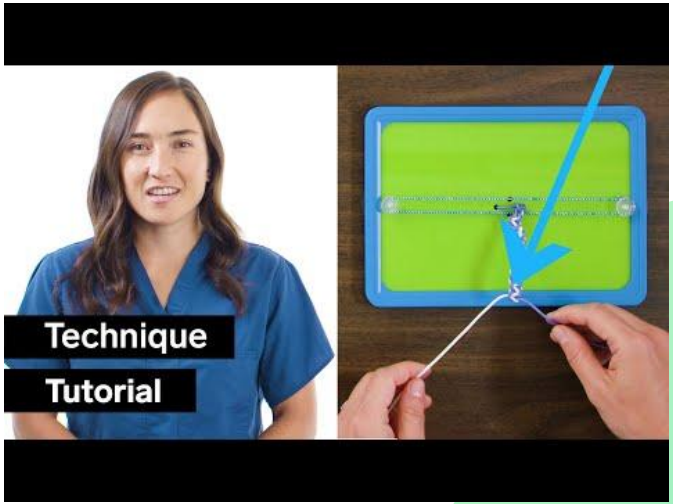
A Suture also called Interrupted Stitch. Each stitch is tied separately. May be used in skin or underlying tissue layers. More exact approximation of wound edges can be achieved with this technique than with the running stitch



Purse-String

A continuous stitch paralleling the edges of a circular wound. The wound edges are inverted when tied. Commonly used to close circular wounds, such as hernia or an appendiceal stump





Your Turn - Suture a Banana!

Materials

- Banana
- Dental Floss
- Needle Holder (or you can just use your fingers for now
- Curved Needle (or standard needle)
- Knife

1. Obtain a banana, this will be your mock patient.

2. Give your patient a two inch cut through their dermal layer only (the peel of the banana only).

3. Thread your suture material (floss) through your needle. You will need approximately 10 inches of floss per wound – modify as needed. Tie a square knot to hold material in place.

4. Grasp the needle with the needle holder or simply use your fingers for the purpose of today's demonstration.

5. **Continuous Stitches:** Begin your sutures slightly before your wound. Tie a square knot on your first incision. Continue with a non-interrupted stitch throughout the length of the wound. Finish with a square knot and cut off excess ends.

So You Want to Be a Surgeon...

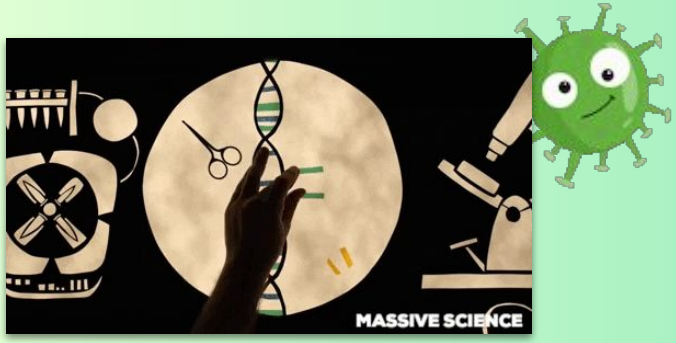
Vaccines & Medications

Vaccines and Medicine

Materials

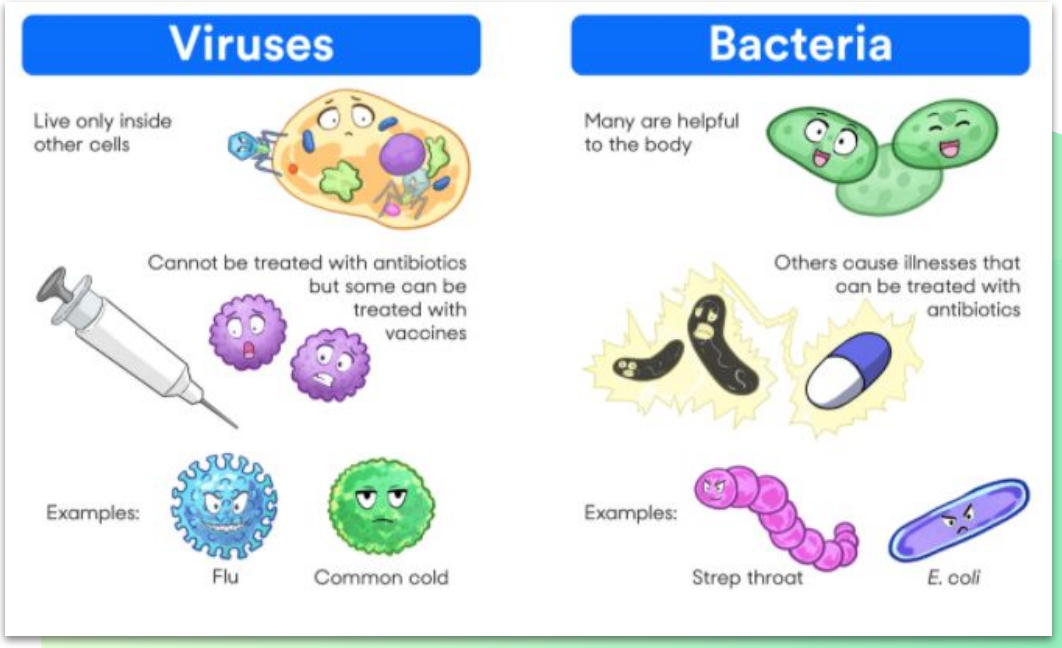
- Your computer!

Have you ever wondered how vaccines work? How medicine knows where to go in your body?



What is a Germ?

Learn more about the differences between viruses and bacteria using this Newsela article HERE!



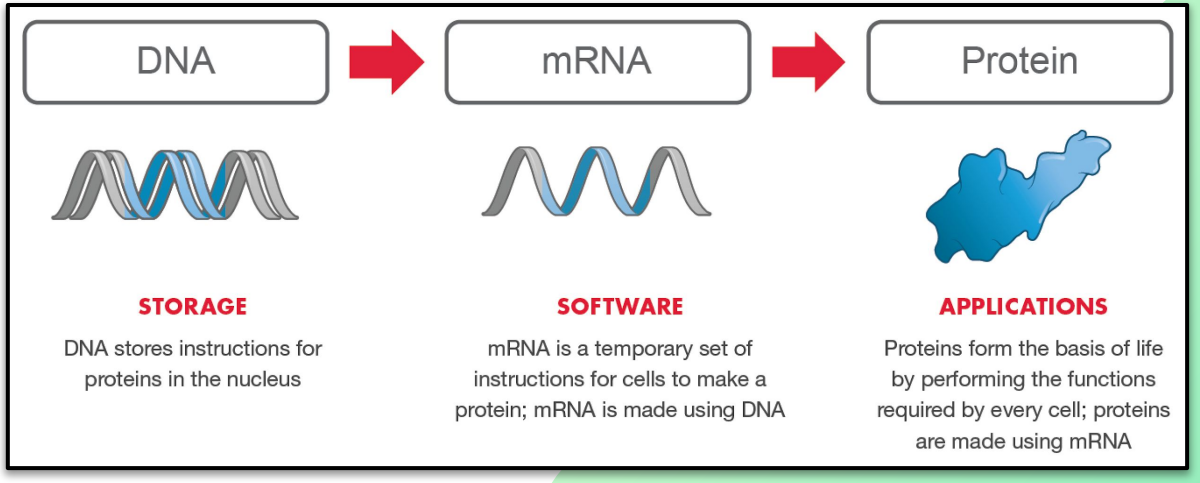
What is a Vaccine?

A vaccine is a tool used to help prevent diseases, they do this by exposing the body to the disease in small doses to prepare the body for the disease. mRNA vaccines work slightly differently. mRNA vaccines are used against infectious diseases (like Covid) and they teach cells how to make a protein to fight against the disease, rather than expose them to the disease.

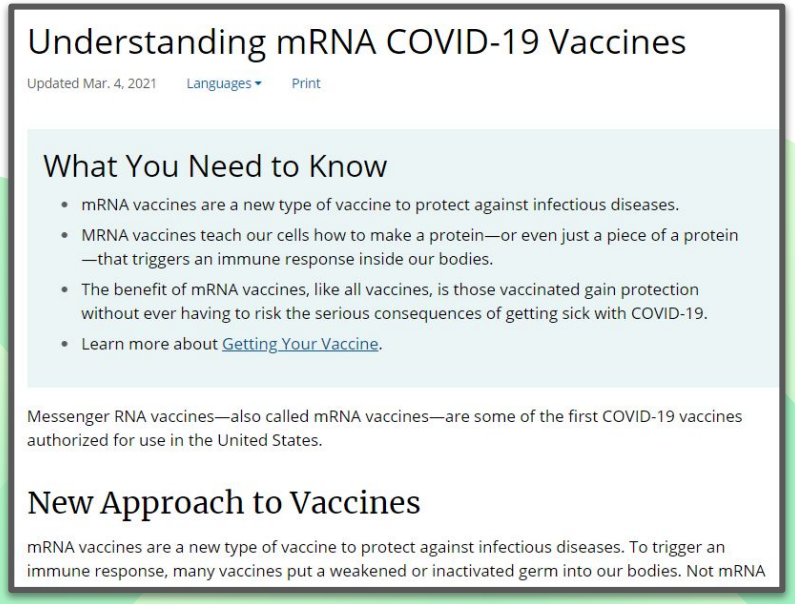
Different Type of Vaccines

A More Indepth Look of mRNA...

Messenger RNA is a single-strand molecule within our cells. It is similar to DNA, but instead of making up genetic code, it carries the instructions on HOW to make the genetic code and proteins within our body. The cytoplasm and enzymes (a type of protein) take the information from the mRNA and use it to make proteins. An mRNA vaccine will use the mRNA to deliver specific instructions on how to make proteins to counteract viruses. The Covid vaccine is the first mRNA vaccine to be approved, but this technology is not new and has been worked on pre-covid.



Understanding mRNA COVID-19 Vaccines



Understanding mRNA COVID-19 Vaccines

Updated Mar. 4, 2021 Languages Print

What You Need to Know

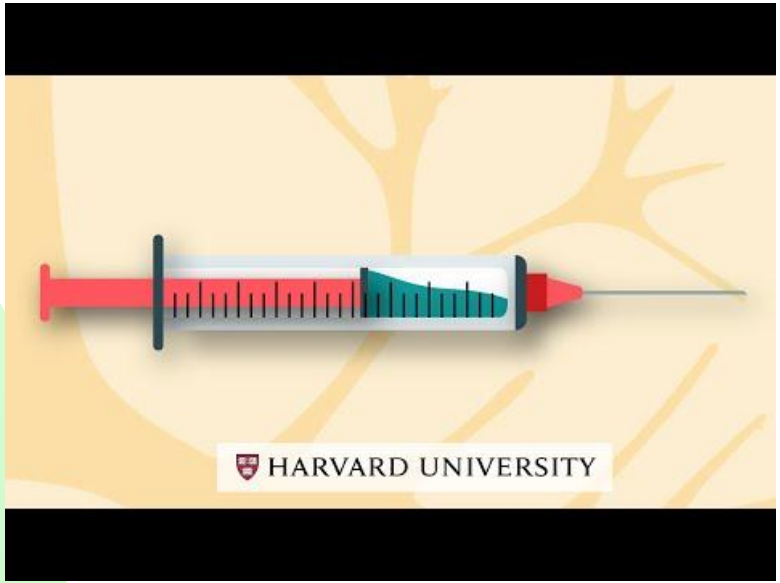
- mRNA vaccines are a new type of vaccine to protect against infectious diseases.
- MRNA vaccines teach our cells how to make a protein—or even just a piece of a protein —that triggers an immune response inside our bodies.
- The benefit of mRNA vaccines, like all vaccines, is those vaccinated gain protection without ever having to risk the serious consequences of getting sick with COVID-19.
- Learn more about Getting Your Vaccine.

Messenger RNA vaccines—also called mRNA vaccines—are some of the first COVID-19 vaccines authorized for use in the United States.

New Approach to Vaccines

mRNA vaccines are a new type of vaccine to protect against infectious diseases. To trigger an immune response, many vaccines put a weakened or inactivated germ into our bodies. Not mRNA

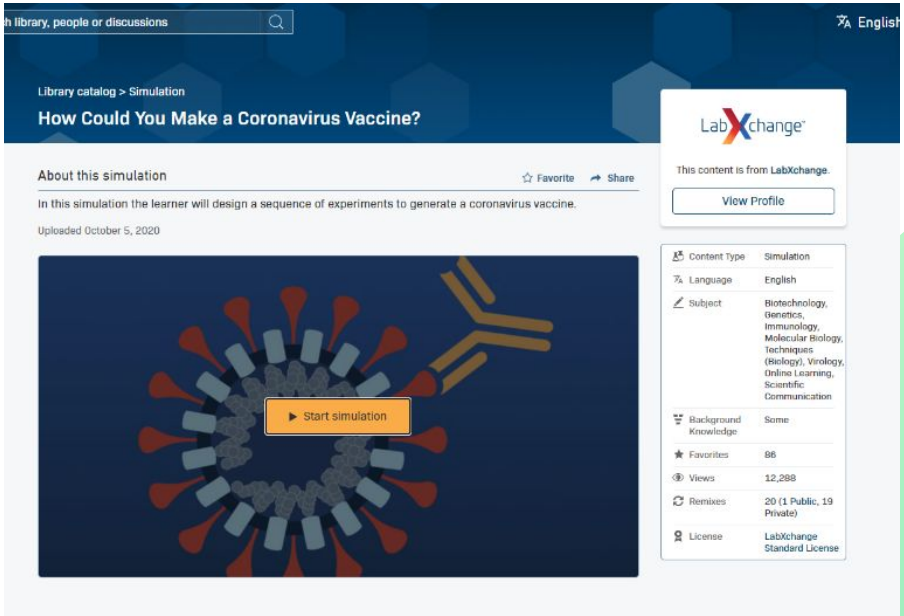
Read about mRNA Vaccines HERE



Watch to learn about mRNA Vaccines HERE

Make Your Own Vaccine

Follow the directions on this simulation linked HERE to make a Covid Vaccine. This will walk you through definitions and reasoning behind vaccines. Keep in mind that you can start over and ask for help! Click start simulation to begin and choose level one.



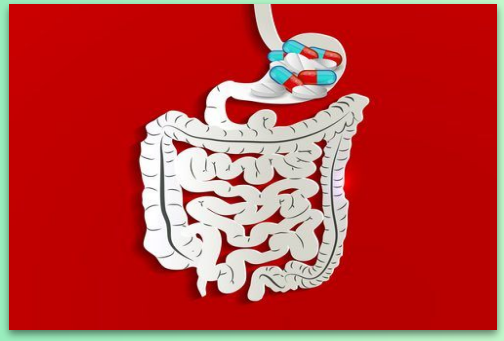
What is Medicine?

Medicines can be chemical compounds, byproducts of organisms (like fungus), or even synthetic substances created by inserting genes into bacterias. Medicines typically work in one of four ways:

1. Halting the spread of invading germs
2. Killing cells to prevent them from multiplying
3. Replace missing/low naturally occuring body chemicals
4. Help parts of the nervous system to control a body function

Click HERE to learn more!

How do Medicines Work?



When a medicine is inserted into the body, usually through ingestion (like a pill) or into the bloodstream (like a shot), the medicine is absorbed into the bloodstream and travels throughout your body. The medicine or pain reliever can find the damaged cells because of a chemical called prostaglandin. When a cell becomes damaged, they release that chemical. The nervous system detects the high amounts of prostaglandin and transmits a message to the telling it where the body is damaged. The pain relievers are than sent to that area to heal the cells. When the pain reliever heals the cells, the cells will stop releasing prostaglandin, singling the brain to stop sending pain messages.

Antibiotic Resistance