Western Sengineering Outreach

Modeling Lungs Grade 3-5

Meet Today's ENG HERO!

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Dr Carson is interested in using optical devices for biomedical imaging applications. He studies photoacoustic tomography as a method to detect breast cancer and develop camera systems to assist in the diagnosis of a variety of diseases. To learn more about Dr. Carson visit: https://www.schulich.uwo.ca/biophysics/people/bios/ieff_carson.html

Learning Goal:

Students will consider how the respiratory system works by creating their very own model of the lungs. Curriculum Connections: Grade 5 -Human Organ Systems

Materials Needed:

- A plastic bottle
- A straw
- An elastic band
- Scissors
- 2 balloons
- Play dough







Engineering and Science Connections:

Today we will become biomedical engineers. Biomedical engineers combine biology and engineering, applying engineering principles and materials to medicine and healthcare. The combination of engineering principles with biological knowledge have allowed them to develop revolutionary and life-saving concepts such as: artificial organs, surgical robots, advanced prosthetics, new pharmaceutical drugs, kidney dialysis.

Today we will be going through how the respiratory system works. This system is made up primarily of our lungs and windpipe.

We breathe in using a muscle called the diaphragm. When it flattens our lungs expand and fill with air. When we breathe in, air gets forced through our nose or mouth, down our windpipe, and into bronchi tubes in our lungs. These bronchi tubes branch out and get smaller and smaller, like the roots or branches of a tree.

At the end of the smallest branches of the bronchi are tiny air sacs called alveoli. These air sacs have a very thin, one cell thick wall that allows oxygen to be passed to red blood cells as they are passing by. There are hundreds of millions of these in our lungs.

The alveoli don't just pass oxygen to our blood, they also help to clean carbon dioxide gas from our blood cells. When we need to breathe the carbon dioxide out of our lungs, the diaphragm bows up and pushes the air back out, getting rid of the carbon dioxide. This makes room for fresh air with new oxygen to come back in on our next breath.

The nose does more for breathing than just providing a place for air to enter our body. It also helps to filter the air of dust and other stuff. It does this by using lots of hairs and mucus. It also helps warm up the air prior to getting to our lungs.

Video Recommendation: Respiratory System / The Dr. Binocs Show / Learn Videos For Kids

https://www.youtube.com/watch?v=mOKmjYwfDGU

Activity:

Before beginning let's do a small activity by breathing!

We will first start by inhaling through the nose for 5 seconds and then out the mouth for 5 seconds. Repeat this process 6 times. Can you feel your lungs expanding? Can you feel your diaphragm moving? Did this make you calmer? It should have, studies have shown that doing this exercise helps us relax. This breathing exercise combined with soothing music is what a lot of people call meditating.

Time to begin

Today's activity we will be creating a model of our lungs!

1. Carefully cut your bottle to about half the size.



2. Do not fill the balloon with air. Tie a knot (red arrow) on the one end of the balloon and cut off the fat end. The cut should be half of the balloon length.



3. Stretch the balloon around the bottom of your plastic bottle.



- 4. Put a straw in the neck of the other balloon and secure tightly with the elastic band but not so much that you crush the straw. The air must flow through, so test it with a little blow through the straw to see if the balloon inflates.
- 5. Put the straw and the balloon into the neck of the bottle and secure with the play dough to make a seal around the bottle, make sure that again, you don't crush the straw. Pull the bottom balloon and observe the inner balloon.



Debrief

As the knotted balloon is pulled it creates more space inside the bottle. The knotted balloon acts as the diaphragm. As the air comes down the straw and fills the balloon with some air to fill the space!. When you let go of the knot the space no longer exists, so the air from the balloon is expelled making it deflate.

The inner balloon is like our lungs. Inside the lungs are a network of tubes which allow air to pass though. Air is warmed, moistened, and filtered as it travels through the mouth and nasal passages. It then passes through a network of tubes, eventually reaching tiny sacs called alveoli which are where gas exchange occurs.

What Did You Learn?

- What Biomedical Engineering?
- What devices have Biomedical Engineers made?
- The Respiratory System
- What are our lungs used for?
- How the lungs work?

Future Learning

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- Research who respiratory therapists are and what do they do
- Look up what happens to the lungs when people smoke

Share your creations!

We would love to see what you made. Email as at <u>discover@uwo.ca</u> or tag us on social media.

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Thanks for discovering with us!