Community in the Classroom Presentation Plan

Lesson Name The science of respiration and blood circulation

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Grade Level 5 **Standards Connection(s)** Biological sciences: Respiration and blood circulation are intricately connected to provide cells and tissues with the proper nutrients for functioning organ systems.

Abstract:

Your opportunity to tell teachers and kids what's going to be fun and interesting about your visit!

Oxygen is vital to life. While humans can live for days and weeks without water or food, they can only last a short while without oxygen. As we inhale, we bring in oxygen into the body and release carbon dioxide as we exhale. Cells are in constant need of oxygen and nourishment. Even while you sleep, your heart never stops pumping blood. The lungs are the pickup place for oxygen and the dumping place for carbon dioxide, the body's exhaust gas. Even the lungs are continually at work breathing in and out what's essential for us to live.

Vocabulary/Definitions:

3 – 6 important (new) words

Respiration: The process by which multicellular organisms capture and excrete the gaseous fuel and waste of converting the chemical bonds of energy-rich molecules such as glucose are converted into energy usable for life processes.
Circulation: A biological process of the heart to move substances (e.g. oxygen and carbon dioxide) to and from cells.
Hemoglobin: Protein in blood that carries oxygen from the lungs to the rest of the body.
Bromothymol blue: Bromothymol blue is an acid indicator that will turn blue in basic/neutral solution and green/green-yellow in an acidic solution.
Litmus paper: pH indicator that turns red under acidic conditions (<4.5) and blue under alkaline conditions (>8.3).
Toxicology: The study of the adverse effects of chemicals on living organisms.

Materials:

What you'll bring with you

Bromothymol blue tablets to make solution (in large beaker) on-site.
Clear plastic cups, straws, timer, pH litmus paper, droppers.

What students should have ready (pencils, paper, scissors)

Blank pieces of paper to graph up results. Colored pencils.

Classroom Set-up:

Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed

Small groups of 4 would work well (space should be big enough for 2 people to be doing jumping jacks face-to-face). A desk or two would be helpful for the recording of data.

Classroom Visit

1. Personal Introduction: ____5_____ Minutes

Who are you? What do you want to share with students and why? How will you connect this with students' interests?

I am currently a scientist at The Buck Institute of Age Research where I study what happens to the brains of people with Parkinson's disease. I've also been very interested in how different things in the environment can cause diseases in humans, particularly brain disorders. So technically, I'm a neuroscientist but I want to stress that without the air that we breathe and the nutrients that the blood carry to the brain, normal functioning of the brain would not occur. There are many toxins and toxicants in the environment that we're constantly exposed to, so we'll also discuss how some of these things can affect our respiratory and circulatory systems.

Topic Introduction: _____5_____ Minutes

Big Idea(s), vocabulary, assessing prior knowledge. What questions will you ask to learn from students?

How are the two systems (respiration and circulation) connected?

Does anyone know what the air consists of? What are some of the anatomical features of the heart and lungs? What are some diseases that arise as a result of injury to the heart or lungs?

Fun facts: The heart circulates the body's blood more than 1000x a day. Laid end to end, all the body's blood vessels would measure 60,000 miles (that's like going around the world 2x). The size of your heart is about the same as the size of your fist. An adult's pulse rate is 70bpm while a child's may be from 90-120bpm. An elephant's pulse rate is 28bpm and a mouse's pulse rate is 500bpm. Lungs are about the size of a pair of footballs that fill the chest from neck to ribs when you're full-grown. The total surface area of the lungs is about 25x that of the body's skin surface. Lungs are the only organ in the body light enough to float on water (full of air sacs).

2. Learning Experience(s): _____25_____ Minutes

Demonstrations, hands-on activities, images, games, discussion, writing, measuring… What will you do, what will kids do? Describe in order, including instructions to kids.

Before the first activity, I will ask if students can identify some places where they could measure their pulse rates. And I will have them use either the radial (wrist) or carotid (neck).

Activity 1: How does exercise affect the heart rate?

Students will measure their pulse rate at rest, immediately, and 5min after doing 20 jumping jacks. I will be keeping track of the time, so 2 participants from each group could have their pulse rate measured and the other 2 would be the data collector.

Activity 2: How much carbon dioxide leaves the body?

Students will be given straws and ½ a cup of bromothymol blue solution in a clear plastic cup. They will be asked to take a deep breath and exhale into the straw, causing the air to bubble through the water for a couple of minutes (Be careful not to drink the water!). The students will then note the time it takes for the water to change colors. Then they're going to either run in place of do 20 jumping jacks and repeating the experiment to see if the time it takes for the color to change is longer or shorter. Litmus paper and plastic droppers will also be given to the students for them to test the pH of the solution at the beginning and at the end of the experiment.

The air you breathe out still has a lot of oxygen in it (~17%) but it also contains about 4% of carbon dioxide, which is one of the waste products of the body. Bromothymol blue is an acid indicator that will turn blue in basic/neutral solution and green/green-yellow in an acidic solution. When the carbon dioxide that you exhale mixes with the water, it forms a weak acid called carbonic acid and that should turn the bromothymol blue solution green/green-yellow.

The amount of carbon dioxide waste in the blood determines how fast you breathe. So the more you exercise, more energy is needed by your muscles and tissues to function. This energy is being made by cellular powerhouses called the mitochondria which use oxygen to make ATP, a source of energy that cells can use. In return, carbon dioxide is released and that needs to be exchanged with fresh oxygen as you breathe faster.

In order for scientists to make sense of their data and what their physiologically relevance is, they have to compile their numbers and run some statistical analyses. In our case, it's as simple as calculating the averages and

comparing them by categories (e.g. rest vs. exercise, girls vs. boys).

3. Wrap-up: Sharing Experiences and Building Connections _____10____ Minutes

Putting the pieces together – how will students share learning, interpret experience, build vocabulary?

Students will present the data (rest vs exercise; girls vs boys) collected from their group and present it to the class.

When and why does the heart rate increase?

What are some things that could affect basal pulse and respiration rate? Examples include exercise, gender, stress levels, health status (asthma), toxicants (cigarettes, asbestos). What are some examples of common air pollutants? Carbon monoxide, ozone (3 oxygen atoms), particulate matter, lead.

Hemoglobin's oxygen-binding capacity is decreased in the presence of carbon monoxide (which is a big component of cigarettes) because both gases compete for the same binding sites on hemoglobin, carbon monoxide binding preferentially in place of oxygen.

4. Close: _____5_____ Minutes

How can kids learn more? Thanks and good-bye! Clean-up.

Read and find out more about what are some common pollutants in the environment and think about how they could affect the heart and lungs and their function.

Breathing exercises can be used to promote relaxation (and sleep) and to decrease stress levels.

Physical exercise gives the heart a workout…the heart is a muscle, and like any other muscle, it will respond to exercise by becoming stronger. Be active!

TOTAL __50 – 60__ Minutes

Follow-up – After Presentation

Suggest students write a letter explaining "How we learned about _____?"
List or attach examples of activities, websites, connections for additional learning.
Attach worksheets, hand-outs, visuals used in classroom presentation.