

DNA EXTRACTION FROM BUCCAL (CHEEK) CELLS

Learning Objective:

- Students will be able to describe what DNA is and where it is within the body
- Students will have a basic idea of the importance of DNA (building block for the body)

Motivation:

DNA contains all the information that makes you, you!

- Who has heard of DNA before?
- Why would we want to see DNA?
 - We are we always want to know more about what makes each person unique, what determines how we look, and even why some of us might get sick. If we know more about ourselves, we might be able cure or prevent diseases.

Biology:

- Why are we looking at DNA in the biology group?
 - Biology is the study of life. Everything from physical structures of organisms to the complicated processes going on inside an organism to how they have changed over time. DNA is the code that contains all of that information.
- What jobs can you do if you study biology? Since biology is the study of life, so much is possible if you want to study biology!
 - Doctor, nurse - treat people when they are sick
 - Dentist - teeth and mouths can tell a lot about how a person lives and if they are sick
 - Veterinarian - treat sick animals
 - Zoologist - study all types of animals
 - Pharmaceuticals - create medicines that make people better
 - Environmental or Conservation scientists - study the planet
 - Botanist - study plants

Important women in bio:

- Rosalind Franklin - discovered the structure of DNA.
 - Does anyone know what DNA looks like?
 - Kind of like a twisted ladder

Things to talk about during this activity:

- Where do you think DNA is inside you? Where do you think it is within the cell?
 - DNA is contained in your cells. It's in the center of each cell. In animals, plants, and fungi, (called "eukaryotes") it's contained in a structure called the nucleus.
- Which cells do you think have DNA in them? Bone cells? Skin cells? Blood cells? Brain cells? Which cells do you think don't have DNA in them?
 - Every single one of your cells has your DNA in it. Not only that! Each and every cell contains your entire set of DNA (called your "genome"). Even if it's a blood cell, it still

contains the information about the color of your eyes, your height, etc. it just doesn't "use" it. If that's not cool I don't know what is.

- How big do you think DNA is? Do you think we could ever see it with the naked eye?
 - DNA is tiny--microscopic! And you can't see that with the naked eye. The only way that we could ever see it without a microscope is if we have a LOT of it. So we need a lot of cheek cells for this experiment to work.
- What do you think each of the "reagents" (ingredients) in this experiment does?
 - Gatorade? It's liquid to get the cells out of your mouth. There's actually quite a bit of salt in it, which helps to remove the cells. Plus it tastes good!
 - Dish Soap? When you're doing chores at home, have you ever added a squirt of soap to a sink full of dirty dish water? Notice how the fat and gunk spreads out? Same idea here. Cells have a membrane that keeps the insides in and the outsides out (called the "phospholipid bilayer"), which is basically made up of fat. We use the soap to break that membrane down so we can get the DNA out.
 - Alcohol? Does anyone know what we mean if we say something is "soluble"? It means that something can dissolve into a liquid. Here, DNA is soluble in water (Gatorade), so we can't see it there. However, it is *not* soluble in alcohol. That way, we can see the DNA in the alcohol.

Science Fair:

Coach students to be able to describe:

1. What DNA is
2. Where DNA is in the body
3. Why we want to look at DNA
4. The experiment process and why this lets us see DNA

Each of these can be 1-2 sentences. Most importantly they (with help) will walk other students through the same experiment they did. This won't necessarily include all of the technical info, and it will not include the discussion at the end on how to improve the experiment.

Experiment:

Adapted from, among many other places:

http://www.pbs.org/wgbh/nova/education/activities/2809_genome.html

Materials:

- Blue Gatorade (~10 mL per student)
 - The DNA pieces/strands appear white--“G2” Gatorade is less cloudy, so dark colors of that brand may work better than regular Gatorade.
- 91% isopropyl alcohol, ice cold (~5 mL per student)
- Blue food coloring (or, match the Gatorade)
- Dish soap
- Small Dixie cups
- Clear beakers / clear plastic cups
- Glass stir rod / wooden skewer / coffee stirrer

Preparation:

- Put the alcohol in the freezer the night before and remove only when you’re ready to do the experiment. The extraction works better if the alcohol is ice cold.
- Add ~2-3 drops of the food coloring to each bottle of alcohol. This makes the DNA (which appears white) easier to see in the solution.

Procedure:

1. Swish with a mouthful of Gatorade for 1 minute, being careful not to swallow it.
 - a. Students can VERY GENTLY chew on the inside of their cheeks to release more cells. It won’t help to draw blood!
2. Spit the solution into the clear beaker or cup.
3. Add 1 drop of dish soap to the solution and gently swirl in the cup, or carefully stir, for 30 seconds to 1 minute.
4. Pour the alcohol slowly down the side of the glass so it forms a layer on top of the Gatorade solution.
 - a. The resulting layer should be approximately half the height of the Gatorade layer.
5. Leave the mixture undisturbed on the table for 2 minutes.
 - a. Students should be able to see DNA strings or clumps forming at the interface between the two layers.
6. Use the stirring stick to gently stir the solutions together, trying to collect any DNA chunks/strands on the end of the stick. A twisting motion tends to help remove the strands.
 - a. If some students don’t see DNA in their solutions, encourage them to experiment with the different reagents and share their results. Maybe it would help to add more soap? More alcohol? More stirring? Have them discuss with successful students and decide where the differences were