**VANDERBILT STUDENT VOLUNTEERS FOR SCIENCE**

[**http://studentorgs.vanderbilt.edu/vsvs**](http://studentorgs.vanderbilt.edu/vsvs)

**See DNA**

**Outreach Lesson**

**Lesson written by: Eric Lu. Adapted from buildingwithbiology.org**

**GOAL:** To understand the role DNA plays in our bodies and to extract and visualize DNA.

**LESSON OUTLINE**

1. **Pre lesson Setup** 
   1. You will prepare wheat germ solution for the activity 30 min before the start of the activity.
2. **Introduction**
   1. Students will learn about what DNA is, its properties, and its purpose in our bodies.
3. **Visualizing DNA**
   1. Students will extract DNA from wheat using isopropyl alcohol and visualize DNA.
4. **Making a DNA Necklace** 
   1. Students will make a necklace or a bracelet with their extracted DNA.

**MATERIALS**

* Ice (either ice pack or ice cubes).
* Raw wheat germ (not processed)
* Hot water
* Meat tenderizer (powder)
* Dishwashing detergent (or shampoo)
* Plastic spoon
* Isopropyl Alcohol or ethyl alcohol (91%)
* Plastic container (for wheat germ solution)
* Dropper Bottle filled with alcohol
* 1.5ml clear microcentrifuge tubes
* 1ml transfer pipette
* Yarn
* Scissors

**Pre-Lesson Setup**

**Materials**

* Raw wheat germ (not processed)
* How water
* Meat tenderizer (powder)
* Dishwashing Detergent
* Plastic Spoon
* Plastic Container (for Wheat Germ solution)

**Procedure (To be done at least 30 min before the event)**

1. Add ½ cup of hot water to the container.
2. Add 1 spoon of wheat germ to the container.
3. Add Add ½ spoon of meat tenderizer to the container
4. Add a squirt of dish soap to the container.
5. Stir well.
6. Let mixture settle for 15 minutes.
7. Fill the dropper bottle with alcohol and place it into the ice to chill.

**II. Introduction**

***Ask Students*** if they’ve ever heard of DNA before.

***Ask Students*** if they know what DNA does.

***Explain to students*** that DNA stands for deoxyribonucleic acid and that it serves as the blueprint for all living things. DNA can be found in all of our cells and tells each of our cells what to do. It tells some of cells to detect light and help us see; it tells some cells to help us think, and it tells some cells to help our heart beat.

***Show Students*** the diagram of DNA and tell students that DNA has a structure similar to a curved ladder. This structure is known as a double helix.

***Ask Students*** if they’ve ever seen DNA before. The answer should be no because DNA is too small for the naked eye to see. Fun fact: If we took all the DNA from an average human body and stretched it, it would stretch 20 billion miles.

***Tell Students*** that today we’re going to make DNA visible by making it clump up!

**III. Visualizing DNA**

1. Use a pipette to bill a microfuge tube halfway with the wheat germ liquid.
2. Use the dropper bottle to add alcohol to the tube. Fill it so that it is almost all the way to the top.
3. Close the lid tightly (make sure you hear a “snap”).
4. Rock the tube back and fourth a few times (or shake it).
5. Look inside (preferably under a bright light). You should see tiny clumps forming; those clumps are DNA!

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1. **Making a DNA Necklace**
2. Ask the student whether they would like a bracelet or necklace.
3. Cut out the appropriate length of yarn.
4. Open the lid, and put a piece of yarn over the edge of the cap. Snap it shut again and tie the yarn!

**For VSVS Volunteers ONLY!**

**Purpose of dish soap:** Since the plasma and nuclear membranes of cells are made of lipids, it is essentially an oil and is insoluble in water. The dish detergent acts as an emulsifier and breaks the membrane down. This releases the DNA into the solution (the wheat germ liquid is basically a solution of DNA).

**Purpose of Meat Tenderizer:** Meat tenderizers contain proteases, which are enzymes that break down proteins. In meat, they break down the proteins that make up muscle, softening the meat in the process. In DNA extraction they break down the histones that the DNA is supercoiled around. This allows the DNA to be soluble and thus more likely to come out of solution when the alcohol is added.

To a lesser extent, the proteases in the tenderizer can break down DNase enzymes, which chop up DNA. Normally, the DNase is kept separate from the cell's DNA, but when you add detergent to the cells and break apart the membranes, all of the components can mix together and lead to unintended reactions.

**Purpose of the alcohol:** Since DNA is much more soluble in alcohol than in water. The DNA will migrate to the alcohol layer and condense. The alcohol is chilled to prevent the excess heat from breaking the fragile H-bonds in DNA (which are already weakened from being exposed to hot water).