

What is DNA?

Skills

- o Estimation of lengths and sizes: size of DNA, size of a cells, amount of DNA in the body
- o Microscope use
- o Identification: identify nucleus in cell
- o Observation and comparison: observe physical properties of DNA, and compare DNA from different organisms
- o Chemistry: learn to extract DNA using household materials

Materials

- o A picture of a cell
- o 2m length of string
- o Microscope
- o Slides of onion and cheek cells stained with methylene blue
- o Bananas (1/4 banana per child/group)
- o Salt water
- o Liquid detergent (1 tbsp/child or group)
- o Rubbing alcohol (70-95% isopropanol/ethanol)
- o 2 drops pineapple juice
- o Stirring rod
- o Large bowl
- o Strainer/cheese cloth
- o Clear plastic cups
- o Blender
- o Strainer
- o Paper clips
- o Goggles and gloves
- o Eppendorf tubes
- o Plastic pipettes

Notes

Adult assistance will be necessary throughout the activity, but especially in the extracting DNA portion. Children should not be allowed to or should be very closely supervised when working with rubbing alcohol. Though it is not necessary, it is recommended to take extra safety precautions, using goggles and gloves, in this activity.

Activity three involves extracting one's own DNA, and children must rinse their mouths out with salt water. If they feel uncomfortable doing this, the club leaders can offer to allow the children to extract their DNA, and do the mouth-rinsing step for them.

Activity three has some waiting time. You can explain the nucleus in activity two, and have kids look at the cells under the microscope while they wait in activity three.

BACKGROUND

- We hear about **DNA** (that stands for **deoxyribonucleic acid**!) on the news and on TV all the time, but what is it? It's where the body stores all of its information: like a giant instruction manual telling your body everything from how it looks to how it works.
- How do our bodies store DNA? In the **cell**! Cells are the "building blocks" that all of your body parts are made out of. We have about 75 TRILLION cells in our bodies! They're so small, that about eight of them could fit on the tip of one strand of hair.
- What kinds of things have DNA? All living things!

Activity 1	Introduction
Materials	Picture of the cell, 2m lengths of string

- 1) Show a picture of a cell, and reiterate that it's really small!
- 2) Ask them what the length of DNA they think could fit in a cell. Give them a string that's two meters long and tell them that's how much DNA is in each cell—that means there are 93 billion feet of DNA in your whole body: enough to go from the Earth to the sun 1000 times!
- 3) Give groups of two or three a string and have a contest to see who can ball it up the smallest. Is that small enough to fit in a cell? Explain that DNA is really really skinny and very carefully twisted so it can fit into the tiny cell.

Activity 2	Where is DNA?
Materials	Picture of the cell, microscope, slides of onion cells and cheek cells stained with iodine

Prepare in advance: Take a swab of cheek cells and put them on a slide. Add a drop of water on top. Place the cover slip over the cells. Add a drop of .025% methylene blue next to the cover slip. Put a piece of paper on the other side, which should draw the stain under the cover slip and onto the cells.

- 1) Tell kids that the cell has a special compartment for DNA, called the nucleus. Show them the nucleus on the picture of a cell.
- 2) On a microscope, let kids look at slides of onion and human cheek cells (maybe their own?) dyed so that the nucleus is visible.
- 3) Have kids draw a picture and label the nucleus. Ask them about the differences between the cells. (For instance, onion cells are squarer).
- 4) Explain that DNA has its own special area of the cell that it never leaves because it's really important and we want to keep it safe.
- 5) Explain that all humans, animals and plants have a nucleus for their DNA.

Activity 3	Extracting DNA!
Materials	1/4 of a banana, salt, water, liquid detergent, rubbing alcohol,

	stirring rods, pineapple juice, strainer/cheese cloth, plastic pipette, paper clips, blender, bowl, clear plastic cups, Eppendorf tubes
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Prepare in advance: Make salt water: 1/4 tsp salt for every 1 cup water. (You need 1 cup/banana and also 1/4 cup per kid for swishing in their mouths).

This activity should be done in small groups!

Measurements are approximate.

- 1) Put 1/4 banana for every child/group doing the experiment in a blender. Add 1/2 cup salt water for every banana. Blend on high for 30 seconds.
- 2) Strain the banana mixture into a bowl. Explain that you have broken up the banana down into a banana cell soup. Strain the banana soup into a larger container.
- 3) Give each group about 1 inch of banana soup in the bottom of their cups
- 4) Have each group add **1tbsp detergent** and stir slowly with a stirring rod, only two or three times around, to mix. Try not to get it too bubbly.
- 5) With a pipette add a **few drops of pineapple juice** and swirl to mix.
- 6) Let the mixture sit and explain (using a picture or model of the cell) that the detergent and pineapple juice are breaking down everything else in the cell except for the DNA, making it easier for us to get the DNA out.
- 7) *Slowly* pour (HELP YOUNGERS) **rubbing alcohol** along the side of the cup until there is about half as much rubbing alcohol as banana soup (or a little more). **DO NOT MIX.** Let this sit for a few minutes until you see DNA, little white strands along the alcohol/banana soup interface (they may be covered in bubbles). (Here is where you can go look at the cells in the microscope). *Note: It won't work if the rubbing alcohol and the banana mixture mix, so be sure to pour slowly!
- 8) Bend the paper clip so that it has a hook on the end. **GENTLY** (do not let youngers do this...you may have to assist olders, too) stir around the DNA so that it clumps on the paper clip. Kids can touch this. Have them record observations.
- 9) Give kids about 1/4 cup salt water. Have them swish it around in their mouths and spit it back out into the clear cup. Explain that this contains cheek cells.
- 10) Repeat steps 4-8. After fishing out the DNA, if kids want to keep it, place it (scrape it off the paper clip) in an Eppendorf tube with alcohol.
- 11) Have kids record their observations about the DNA from the banana and from the cell. Do they look the same? Explain how all DNA is really similar: it's all made out of the same stuff like all instruction manuals use the same letters.

CONCLUSIONS

- DNA is like a giant instruction manual for our bodies, so we need to have a lot of it.
- DNA is found in the nucleus of the cell, and it's wound up so it can fit in a tiny space.
- All living things have DNA that looks very, very similar.