**![MC900371386[1]]() DNA Extraction Lab; (SB2 a,b,f)**

# Introduction: DNA…you hear about it all the time. DNA is used every day by scientists and lawyers to help in criminal investigation, paternity suits, cloning, etc. Your DNA is your “genetic fingerprint”—this means that your DNA is like no one else’s in the world! The procedure that we will use to see your DNA includes the same basic processes that researchers use to isolate, analyze, and manipulate DNA in a laboratory setting (although the DNA isolated here is not nearly as “pure” as the research lab version).

DNA is a nucleic acid made of carbon, hydrogen, oxygen, nitrogen, and phosphorous. DNA can be considered the hereditary “code of life” because it possesses the information that determines an organism’s characteristic and is transmitted from one generation to the next. You receive half of your genes from your mother and half from your father. Day to day, DNA’s job is to direct the functioning within the cells of your body.

DNA is in the nucleus of almost every cell in your body. The length of DNA per cell is about 100,000 times as long as the cell itself. However, DNA only takes up about 10% of the cell’s volume. This is because DNA is specially packaged through a series of events to fit easily in the cell’s nucleus. The structure of DNA, the double helix, is wrapped around proteins, folded back onto itself, and coiled into a compact chromosome.

Individual chromosomes can be studied using microscopes, but the double helix of a chromosome is so thin that it only be detected through innovative, high-tech procedures. Chromosomal DNA from a single cell is not visible to the naked eye. However, when chromosomal DNA is extracted from multiple cells, the amassed quantity can easily be seen and looks like strands of mucous-like, translucent cotton.

**Listed are the procedures for extracting DNA from your cheek cells and from a member of the Plant Kingdom, bananas! If you chose to perform extraction on another type of eukaryotic cell we can modify the method to suit your choice.**

We will first collect cheek cells by swishing a sports drink in our mouths and using our teeth to scrape cells off our cheeks. (The more vigorous and the longer that you swish, the more cells are removed, and the more materials you’ll have from which to extract DNA.) Then, we will lyse the cell membranes by adding a detergent based cell lysis solution, which allows the DNA to be freed. DNA is soluble in water, but much less soluble in alcohol. Thus, alcohol will be slowly added, and DNA will precipitate to the sports drink/alcohol interface, and you will be able to see your own DNA! The white, stringy material is thousands of DNA molecules stuck together (with some proteins too). We will then perform a similar extraction of eukaryotic DNA from a member of the Plant Kingdom, bananas! Now, write a purpose for this lab using the above information.

Purpose: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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# Materials

1 test tube

Half a banana

Plastic bag

Graduated cylinder

8mL lysis solution (soap solution)

10mL of Ice cold Isopropyl Alcohol

Plastic pipet

Moist paper towel piece or coffee filter

Stirring rod

iodine

Meat tenderizer (possibly)

Glass slide and cover slip

Microscope

# Methods

**Procedure (cheek)**

1. This procedure will collect some of the somatic cells that line the inside of your mouth. These cells are continuously being sloughed off by your cheeks. Swish 2 teaspoons (10 ml) 0.9 percent salt water in your mouth for 30 seconds. This amount of swishing will actually become quite laborious—hang in there!
2. Spit the water into your cup. Pour this into a large test tube containing 1 teaspoon (5 ml) of 25 percent liquid detergent.
3. Cap tube and *gently* rock it on its side for 2–3 minutes. The detergent will break open the cell membrane to release the DNA into the soap solution. Do not be too vigorous while mixing! DNA is a very long molecule. Physical abuse can break it into smaller fragments, a process known as shearing.
4. Open and slightly tilt the tube and pour 1 teaspoon (5 ml) fluid ounces of the chilled 91 percent ethanol down the side of the tube so that it forms a layer on the top of your soapy solution.
5. Allow tube to stand for 1 minute.
6. Place a thin acrylic or glass rod into the tube.
7. Stir or twirl the rod in one direction to wind the DNA strands onto the rod. Be careful to minimize mixing of the ethanol and soapy layers. If too much shearing has occurred, the DNA fragments may be too short to wind up, and they may form clumps instead. You can try to scrape these out with the rod.
8. After you have wrapped as much DNA onto the rod as you can, remove the rod and scrape/shake the DNA into a small tube containing the rest of the 95 percent alcohol. Your DNA should stay solid in this solution.

**Procedure (banana)**

1. Place one very ripe banana into a ziploc bag seal shut and squish for a few minutes to completely macerate the fruit and expose cells.
2. Add 8 ml of cell extraction lysis solution and squish for a few more minutes. Try not to make a lot of soap bubbles.
3. Filter through a moistened paper towel or coffee filter set in a funnel, and collect the liquid in a

clear tube or bottle. *Do not* squeeze the paper towel. Collect about 3 ml.

1. Add 6 ml of ice cold isopropyl alcohol to the banana liquid in the tube or bottle. Pour the isopropyl alcohol carefully down the side of the tube so that it forms a separate layer on top of the banana liquid.
2. Watch for about a minute. You should see a white fluffy cloud at the interface between the two liquids. Let the bottle stand undisturbed for 5 minutes to allow time for the DNA to fully precipitate out. During this time answer post lab questions.
3. Next you will use pipet to transfer your DNA onto a glass microscope slide. Make a wet mount of the DNA and view under a microscope. You might need to stain the DNA with iodine to help you visualize the DNA.
4. Rinse out all of your glassware and materials. Leave them in a neat pile on the lab station. Put the ziploc bag and paper towel in the garbage and return the room to homeostasis.
5. If you would like to repeat the DNA extraction process with other plants in the room please feel free to grab a couple soaking spinach leaves and follow the process again and compare the DNA of the two plants.

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Results**

Draw the liquids and solids as these appear in your beaker. Describe the appearance of the DNA (color, texture, quantity, how well it sticks to the rod, etc). Label the DNA in your drawing

Sketch the DNA under the three powers of magnification. If you have any questions about the microscope before using it and potentially breaking anything PLEASE ASK!!! Draw and label the field of view for each sketch.

**Questions**

1. What are the parts of DNA?
2. Would DNA from a different source look different? Why or why not?

1. Why does DNA appear as a viscous (thick) material?
2. Why would a solution become more viscous after lysis of cells?
3. Describe how long strands of double-helical DNA fit into the nucleus of a single cell.
4. What are the roles of each of the components in the lysis solution?
5. Why use banana as a source of DNA?
6. What are some other materials that would be a good source of readily isolated DNA? Can you propose any biological materials that would NOT be such good sources for DNA?
7. Name some parts from the banana cells that became trapped in the filter and discarded:

Name some parts of the banana cell that passed through the filter and were collected in the solution:

1. The smallest thread that can seen by the human eye is about 0.02 mm thick. Yet the diameter of the DNA double helix is much, much thinner: only about 2 nm. Can you estimate how many strands of DNA double helix would have to bundle together to add up to a diameter large enough to see? Hint: remember that it takes 1000 nm to equal one micrometer, and it takes 1000 micrometers to equal one mm.
2. Why can the mRNA strand made during transcription be thought of as a mirror image of the DNA strand from which it was made?
3. If a DNA segment has the nucleotides AGCCTAA, what would be the nucleotides of the complementary RNA strand?
4. Explain why DNA is referred to as your genetic fingerprint?