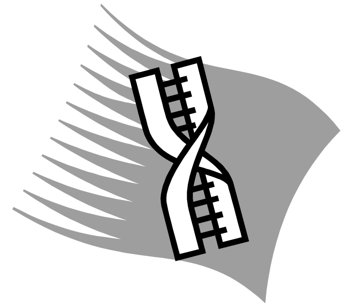
***Name*____________________**



DNA – The Stuff of Life

Materials:

Pea "soup"
Rubbing alcohol
Small beaker or cup
Measuring spoon
Meat tenderizer
Detergent
Test tube
Coffee stirrer

Procedure:

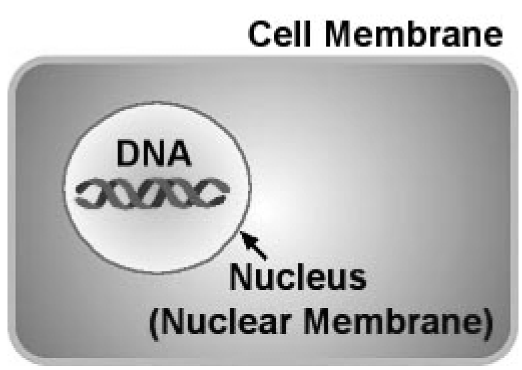
1. Fill your cup ½ full of "pea soup."

   The "pea soup" is dried split peas that have been mixed with water and a pinch of salt and blended together 20 seconds.

2. Put one small spoonful of liquid detergent in the cup with the pea soup and gently swirl to mix.

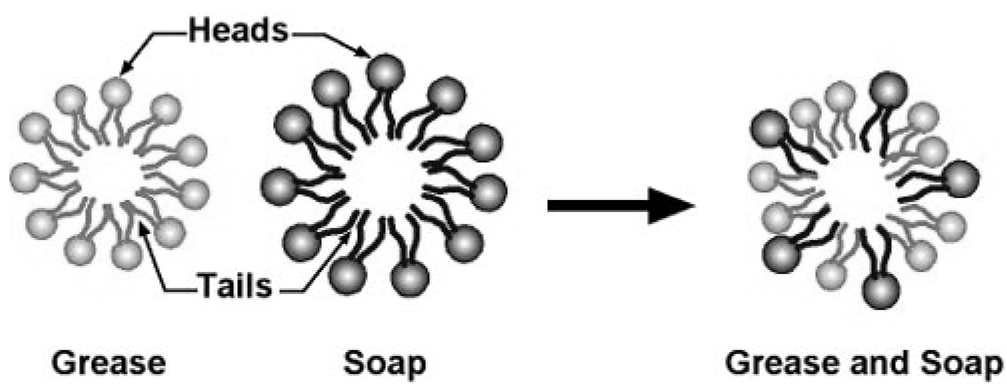
3. Let the mixture stand 10 minutes. Read this while you are waiting:

Blending the dried peas, water, and salt together separated the peas into separate cells. But each cell is surrounded by the cell membrane. DNA is found inside a second membrane (in the nucleus) within each cell. To see the DNA, we have to break open these two membranes.



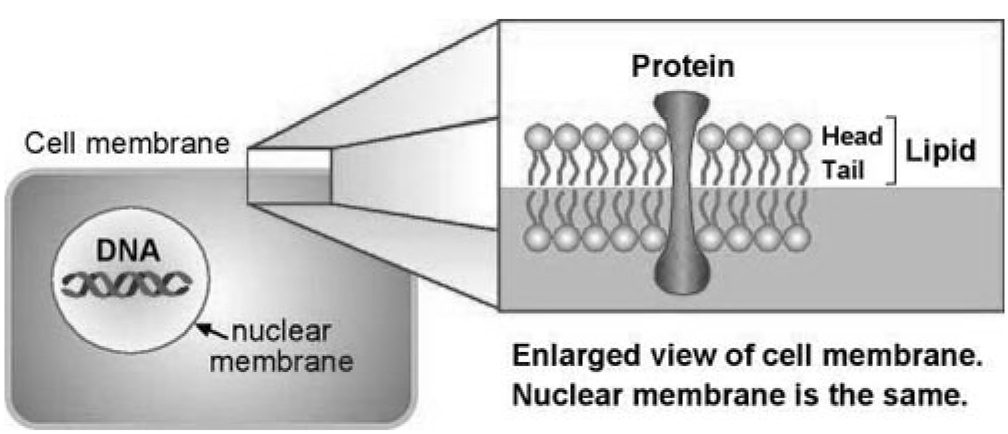
Investigation adapted from "How to Extract DNA From Almost Anything Living." Genetic Science Learning Center, University of Utah . http://gslc.genetics.utah.edu/basic/howto/

We do this with detergent. Why detergent? How does detergent work?
Think about why you use soap to wash dishes or your hands -- To remove grease and dirt - right?
Soap molecules and grease molecules are made of two parts: Heads which like water and Tails which HATE water.
Both soap and grease molecules organize themselves in bubbles (spheres) with heads outside to face the water and tails inside to hide from the water.



When soap comes close to grease, it captures it, forming a greasy soapy ball.

A cell's membranes have two layers of lipid (fat) molecules with proteins going through them. Fats act like grease in detergent.



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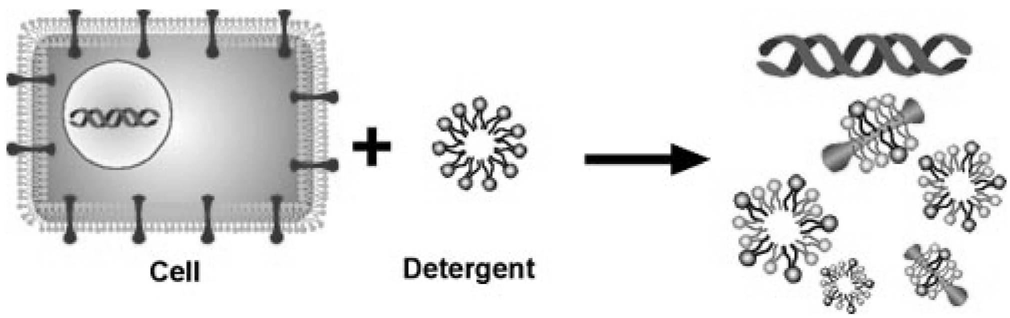
When detergent comes close to the cell, it captures the lipids (fats) and proteins.



Now, back to the investigation:

4. Pour the mixture into a test tube about 1/3 full.
5. Add a pinch of meat tenderizer to the test tube and stir ***very, very*** gently, then read this:

Enzymes are proteins that help chemical reactions happen more quickly.
Without enzymes, our bodies would come to a halt.

In this investigation, the enzyme we are using comes from meat tenderizer and its job is to cut proteins.
That is how it makes meat tender, by breaking up the protein in the meat.

After you added detergent, the cell and nuclear membranes had been broken apart.
So what was left? 1) proteins 2) carbohydrates (sugars) and 3) **DNA** .

The DNA in the nucleus of the cell is molded, folded, and protected by proteins.
The meat tenderizer cuts the proteins away from the DNA.

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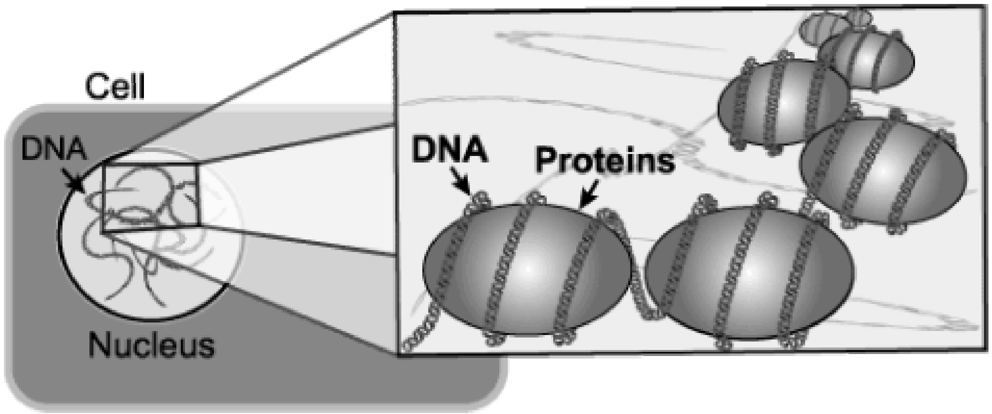

Now, back to the investigation again:

6. Tilt your test tube and slowly pour rubbing alcohol into the tube down the side so that it forms a layer on top of the pea mixture. Pour until you have about the same amount of alcohol in the tube as pea mixture. A stringy, "snotty" looking material will form where the pea soup mixture and the alcohol meet. This is DNA.

Alcohol is not as dense as water so it floats on top. Since two separate layers are formed, all of the grease and the protein that we broke up in the first two steps and the DNA have to decide:
"Hmmm...which layer should I go to?"

This is sort of like looking around the room for the most comfortable seat. Some will choose the couch; others might choose the rocking chair.

Well in this case, the protein and grease parts find the bottom, watery layer the most comfortable place to hang out, while the DNA prefers to hang out in the top, alcohol layer. DNA is a long, stringy molecule that likes to clump together.

Further Reading:

Deoxyribonucleic acid (DNA) is the genetic material present in all living organisms, from bacteria to humans. A single subunit of DNA is called a nucleotide and is made of a nitrogen-containing base, a sugar, and a phosphate

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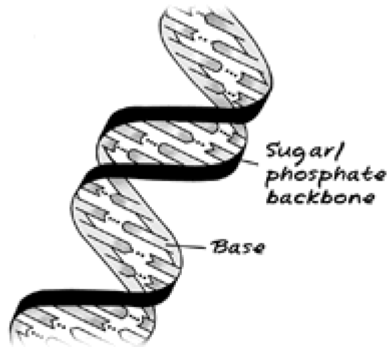
group. Hundreds of thousands of nucleotides are hooked together to form a chain, and two chains are paired together and twisted into a double helix to form the finished DNA molecule:



In organisms such as humans, DNA is paired with protein in structures called *chromosomes* that are inside the cell's nucleus.

DNA is material that controls the inheritance of eye color, hair color, height, and many other human and animal traits. DNA is a long but narrow string-like object. A one – foot long string or of DNA is normally packed into a space about the size of a cube 1/millionth of an inch on a side. This is possible only because DNA is a very thin string.

Our body's cells each contain a complete sample of our DNA. One cell is roughly equal in size to the cube described in the previous paragraph. There are muscle cells, brain cells, liver cells, sperm cells and others. Basically, every part of the body is made up of these tiny cells and each contains a sample or complement of DNA identical to that of every other cell within a given person. There are a few exceptions. For example, our red blood cells do not have DNA because they don't have a nucleus. Blood itself can be typed because of the DNA contained in our white blood cells.

A strand of DNA is made up of tiny building blocks. There are only four, different basic building blocks. Scientists usually refer to these using four letters for the four different building blocks. The letters are: A, T, G, and C. These four letters are short nicknames for more complicated chemical names: Adenine, Thymine, Guanine, Cytosine. Another way of referring to the building blocks or letters is to call them ***bases***.

For example, to refer to a particular piece of DNA, we might write: AATTGCCTTTTAAAAA. This is a perfectly acceptable way of describing a piece of DNA.

The order or sequence of the bases (letters) can ***code*** for many properties of the body's cells. The cells can read this code. Some DNA sequences code important information for the cell. Such DNA is called, not surprisingly, "coding DNA." Our cells also contain much DNA that doesn't code anything that we know about. If the DNA doesn't encode anything, it is called non-coding DNA or sometimes, "junk DNA."

The DNA code, or ***genetic code*** as it is called, is passed through the sperm and egg to the offspring. A single sperm cell contains about three billion bases consisting of A, T, G and C that follow each other in a well-defined sequence along the strand of DNA.

Both coding and non-coding DNAs may vary from one individual to another. These DNA variations can be used to identify people or at least tell one person from another.

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Analysis & Conclusions:

1. List 4 things that you might use as a source of DNA other than split peas.

A.	B.
C.	D.

2. List 4 things that would not be a source of DNA.

A.	B.
C.	D.

3. How does the detergent work in the procedure?

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4. Which “ingredient” do you think might have the most effect on the amount of DNA you extract? ***Explain your answer***.

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5. Describe an experiment to test your hypothesis (your idea in number 4).

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