Title: How does DNA look like?

Purpose of the Experiment & Synopsis:
It is a rare experience to actually see how DNA looks like. Therefore, to help kids to get closer to DNA, which is an important issue in modern science, we prepared an experiment from which kids can actually see how DNA looks like. From vegetables that we normally eat in our meals, DNA can be easily extracted.

Theoretical background:
Every life form is consisted of cells, and each cell has DNA. Therefore, in any living creature, we can extract DNA. DNA resides inside the nucleus of each cell; in the case of plants, double nuclear membrane, plasma membrane and cell wall surrounds DNA to protect it. DNA can be extracted from a cell, if all the surrounding membranes are broken and the DNA molecule is carefully filtered.

Materials:
One broccoli, 5 g of detergent, 2 g of salt, 100 mL of water, 100 mL of cold ethanol (keep below 0 degree Celcius for at least 40 minutes), a kettle, three beakers, metal bowl, coffee filter, knife, mortar and pestle

Procedures:
1. Cut broccoli into small pieces.
2. Using mortar and pestle, mash the broccoli as much as possible.
3. Put 100 mL of water and 2 g of salt into a beaker. Mix the solution with 5 g of detergent. Be careful not to produce bubbles while mixing the detergent and the salt solution.
4. Put mashed broccoli into the beaker. While being careful not to produce bubbles, mash the mashed broccoli again.
5. Put 60-degree-Celcius water into a metal bowl.
6. Dip the beaker inside the metal bowl. Be careful not to let water into the beaker. Let the beaker inside the bowl for 15 minutes. (The time must not exceed 15 minutes.)
7. Filter the liquid inside the beaker with coffee filter. Put the filtered liquid into another beaker.
8. Slowly pour cold ethanol along one side of the beaker.
9. After sufficient amount of time, observe changes in the liquid.

Explanation:
At first, mashing broccoli pieces with mortar and pestle breaks the cell wall that surrounds the broccoli cells. Then, the detergent destroys and decomposes the plasma membrane of the cells. Salt solution helps various proteins in the cell to be precipitated out. Ethanol produces

dehydration, which crystallizes the DNA molecules. We should be careful not to let the DNA molecules to be denatured: if the water inside the metal bowl is too hot, or the beaker is dipped in the water for more than 15 minutes, the nucleotides of DNA molecules can be denatured. The reason that the liquid inside the beaker is filtered with coffee filter is because the size of DNA molecules is relatively large; so, coffee filter, which structure is quite coarse, should be used.

Results:
Inside the liquid, white, jelly-like membranous material can be observed. When the material is pulled out using a tweezer, crystallized DNA can be observed.

Critical Thinking Question:
From what cell will the largest amount of DNA be extracted?