

# DNA Extraction - Background

This activity should be part of the standard repertoire of any teacher who teaches genetics. It is essential for students to prove to themselves that DNA exists and that it can be extracted from any cell. Strawberries are used in this activity because they are octaploid, meaning they have 8 copies of every gene rather than the usual 2; thus providing prodigious quantities of DNA to extract. Naturally, strawberries are also relatively inexpensive and readily available. Other sources of DNA to experiment with include kiwis, bananas, and calf thymus.

The DNA molecule is an invisibly thin, very long strand. The DNA found in each human cell is almost 2 meters long. If all the DNA in a human adult (that's 100 trillion cells) were laid end to end, the DNA would stretch 113 billion miles. That would take you to the sun and back 610 times. Even though DNA is invisible to the naked eye, no microscopes are needed! The reason is that you release so many DNA strands that they tangle together into a thick cable, visible without magnification. For example, it would be the same as if you took a thin piece of thread and held it up on the far end of the hallway. You probably wouldn't be able to see the thread from that distance. However, if you took the thread and tangled it up with a hundred thousand other threads, you would be able to see the tangled clump from far away because there is so much of it.

The process itself is fairly straightforward. First the cell walls are broken open by smashing the strawberries in a ziplock bag. Next, detergent is used to dissolve the cell and nuclear membranes. The membranes are made of lipids (fat) and the detergent will cut through the membrane just like it cuts through grease on a dirty plate when washing dishes. Some salt is present in the detergent solution in order to match the osmolarity of the cells.

Now you have a big mixture of smashed cell walls, dissolved membranes, loose DNA and random other cell parts. This mixture is filtered through paper towels. Finally, you take advantage of the fact that DNA is soluble in water but not in alcohol. In fact, alcohol makes DNA clump together. Thus a layer of alcohol laid on top of the filtrate. Any DNA that contacts the alcohol will clump together, pulling the rest of the DNA strand along behind it. Soon you should see gossamer white strands of DNA bubbling their way up from the red strawberry extract.

The DNA may be collected by twirling a bamboo skewer or glass stirring rod in the solution. The DNA will spool itself around the skewer and can be pulled out of the solution. To keep some DNA, students may fill an eppendorf tube with alcohol and place their spooled DNA into the container. Lay the string on the hinge holding the cap to the tube and close the lid. The string forms a necklace with the eppendorf and enclosed DNA as a pendant. Top off the alcohol in the pendant and you can keep the DNA indefinitely.