# 5-Minute DNA Extraction

**Background**

DNA is ubiquitous - it can be found in every cell of every living thing and almost everywhere on the planet. However, we rarely come face-to-face with the molecule itself - and it's not because DNA is difficult to find or isolate! In this exercise, we'll show you how to isolate your own DNA with little more than some dish soap, table salt, high-proof alcohol, and a bit of your own saliva.

**Materials**

- Test tube and cap
- Saliva
- Several drops of dish soap
- A pinch of table salt
- Contact lens cleaning solution or pineapple juice (optional)
- Isopropyl alcohol
- Wooden stick

**Methods**

**Step 1**: **Salivation...GO!**

Add approximately 1 mL of saliva to the test tube.

*The DNA is inside of the cells in your cheeks which are constantly being sloughed off and are present in saliva. For best results, work your tongue against your cheeks and teeth as you think of a big juicy grilled steak/tofu cube/dim sum or chocolate chip cookies.*

**Step 2: Add a couple drops of soap**

Add 1-2 drops of soap to your tube of saliva. It doesn't take much!

*Now that we have some saliva to work with, the first step is to break open the cells it contains. We can do this by mixing in a couple of drops of the dish soap. The detergents in the dish soap destabilize the membranes of the cells, spilling their contents into the rest of the solution of saliva. This includes all of the cytoplasmic and nuclear proteins, sugars, and nucleic acids (DNA and RNA). However, all of this stuff is still dissolved in the saliva. The rest of the steps will cause the DNA to aggregate and precipitate out of solution.*

**Step 3: Protease (OPTIONAL)**

Add a few drops of contact lens multi-purpose solution (or pineapple juice)

*Now that we've busted open the cells, they've spilled their guts all over the place in our saliva solution. In this step we will get rid of as much of the protein part of those guts as we can. A protease is a type of enzyme that can break down other enzymes. Meat tenderizer, pineapple juice, and soft contact lens cleaning solution all contain (different) proteases. A tiny bit of any of those should reduce the amount of protein that precipitates out with our DNA later on.*

**Step 4: Salt**
Add a pinch of table salt to the soapy saliva. Mix the solution in the tube for a minute by gently flicking or inverting the tube.

*Although we have freed the DNA from the cells, it's still dissolved in the solution. To get the DNA to precipitate and solidify, we need to do something about each DNA molecule's negatively-charged phosphate backbone. When we dissolve the table salt in the solution, some of the positively-charged sodium ions will interact with the negatively-charged regions of the DNA molecules and effectively shield other nearby DNA molecules from their repulsive force - this will help them all aggregate and clump together in the next step.*

*To visualize the idea here, imagine the resistance you feel when you begin to push the south poles of two magnets together - this is sort of like what's going on between the individual DNA molecules. Now imagine inserting the north pole of a third magnet between the south poles of the first two - the resistance is reduced. The north pole of the third magnet is sort of like the sodium ion in our solution.*

**Step 5: Add Isopropyl Alcohol**
Add 5-6 mLs of the isopropyl alcohol and gently invert the tube to mix (make sure you have the cap on).

*DNA is hydrophilic (meaning "water loving") so it will remain in solution while in water. DNA is not soluble in alcohol however, so the addition of alcohol will cause the DNA to come out of solution and appear as a solid. As you gently invert your tube, you should see some cloudy, snot-like white stuff suddenly appear. This is your DNA precipitating out of solution!*

**Step 6: Spool your DNA**
Use a wooden stick to spool your DNA and lift it out of the tube. Insert the stick into the DNA precipitate and gently swirl it around, rotating the stick at the same time. You're trying to wind the filaments of precipitated DNA around the tip of the stick. You can slowly lift the stick out of the solution. These snotty strands are your DNA!

**Step 7: Resuspend your DNA (Optional)**
Transfer your DNA from the stick into a new tube of water and gently mix.

*DNA is soluble in water (hydrophilic) therefore it will go into solution and the only thing you will see is the water. When scientists isolate DNA, they perform a very similar procedure of breaking open cells with detergent, degrading the proteins with protease, adding a salt solution, using alcohol to bring the DNA out of solution, and resuspending the pure DNA into water (or a special buffer to protect the DNA). At this point the forensics scientist is ready to further analyze the DNA!*