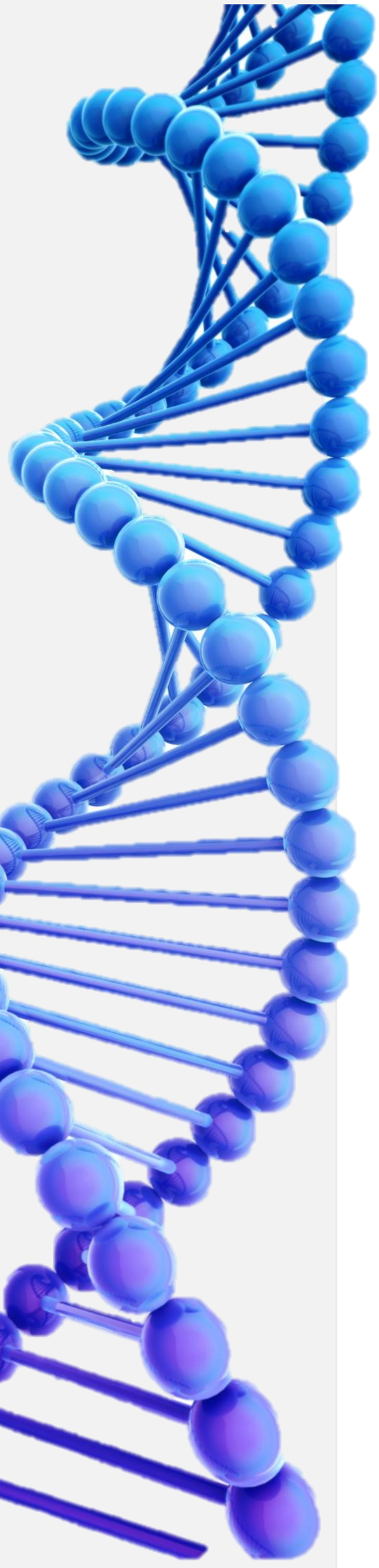
DNA EXTRACTION



Deoxyribonucleic acid (**DNA**) is a molecule that carries genetic information for all living organisms—people, plants, bacteria and even viruses. DNA is made of four chemical bases: **adenine** (A), **guanine** (G), **cytosine** (C) and **thymine** (T). These bases pair up together—A with T and C with G. These base pairs are arranged in two long strands that form a spiral called a **double helix**. The sides of the double helix are made of sugar and phosphate molecules. The genetic information in DNA determines what each organism becomes and what that organism looks like.

How does it work?

All living things contain DNA, however, some organisms have more copies of DNA than others. Strawberries contain eight copies—that is more DNA copies than people! Because strawberries have so many copies of DNA, it is easy for students to see what they extract; however, it is fun to experiment and see what DNA can be extracted from other fruits or vegetables.

In this experiment, students use sodium chloride (table salt), dish soap and isopropanol (rubbing alcohol). These three ingredients play an important part in the extraction process.

- Dish soap: Helps break apart the cell walls in the strawberry. Think about why you use soap when washing your hands or doing laundry—soap helps break apart the dirt so things can become clean.
- Sodium Chloride (Table Salt): Salt helps the DNA stick together. Without it, the DNA molecules would break apart and would be hard to see.
- Isopropanol (Rubbing Alcohol): DNA usually stays dissolved in water, but when salty DNA comes in contact with alcohol it becomes undissolved, this is called **precipitation**.

DNA Extraction in Agriculture:
Our scientists study the DNA of plants to determine how we can improve seeds so farmers can grow better crops. This technique helps us isolate and extract plant DNA so that we can study it in the lab. DNA extraction (followed by analysis) is used throughout our entire process from the early stages of discovery to the analysis and regulatory studies we conduct to check that our research and processes were correctly done.

Materials: Water, Salt, Dish Soap, Rubbing Alcohol (ice cold), Ziploc Bags, Coffee Filters, Strawberries or other fruits.

***Safety:** Rubbing alcohol, soap and salt may irritate eyes so it is recommended that safety glasses are worn.

Lesson Plan:
- **Step 1:** Make the extraction solution by mixing 2 cups water, 5 tsp. dish soap, and 1 ¼ tsp. of salt in a container (Tip: an old shampoo bottle usually works well)
- **Step 2:** Cut the strawberries in half and place ½ in a Ziploc bag. Then have students mash the strawberry thoroughly.
- **Step 3:** Add 2 tsp. of extraction solution. Mash the strawberry again.
- **Step 4:** Place a coffee filter into a new Ziploc bag and strain the strawberry juices through.
- **Step 5:** Add 2 tsp. of ice-cold rubbing alcohol to the strawberry juice. (Tip: if the rubbing alcohol is not cold, the DNA may not appear easily, try placing the rubbing alcohol into a refrigerator for a few hours prior to performing the experiment or keep the alcohol on ice)
- **Step 6:** Zip the bag and gently mix by rocking the bag side to side, until the DNA is visible in a white ball.
- **Step 7:** If desired, students can use a disposable pipette, wooden stick or a straw to collect their DNA. They can save it in a smaller separate container to show to others later.

Keep exploring by asking: What would happen if students used other fruits? What if a step in the process was skipped?

DYK: DNA was first isolated and identified by Swiss biologist, Friedrich Meischer in 1869. And, if you isolated and unrolled all the DNA molecules in your body, placing them end to end, they would reach to the sun and back several times!