Robogals Science Challenge

Minor Challenge Set #3
STEM Field: Biology
Level: Junior
Challenge Name: Give Your DNA A Twist
Project Cost: 0-20 USD
Materials Required:

- Small Soft Sweets with 4 different colours or shapes
    - e.g. jelly babies or sour patch kids
    - Alternatives; marshmallows, beads, modelling clay

- 2 Long string-like sweets
    - e.g. strawberry pencils or licorice
    - Alternatives; string, pipe cleaners, modelling clay

- Cocktail Sticks
    - Alternatives; uncooked spaghetti, string, pipe cleaners,

Safety:

- Adult supervision advised to help put together the DNA

Duration:

- The challenge takes approximately 1 hour to finish, however, the time guideline is an estimation only, and students and mentors can complete the tasks around their schedules

Introduction:

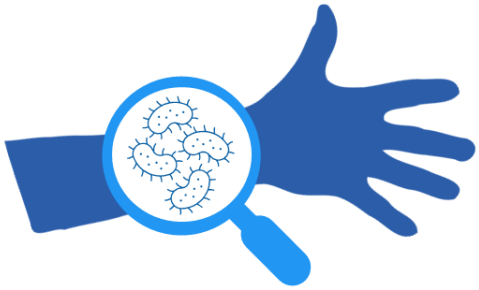
What do you, a flower and a ladybird have in common? You're all made of cells!

But you don't look like a flower, why?

You are different from a flower, a ladybird, and even your best friend because of your DNA.

In this activity you will be able to create your own DNA strand and twist it into shape. You can make your DNA out of most any material you can find. If you make your DNA out of tasty food, you will be able to eat it afterwards!

Where do you find DNA?
If you zoomed into your arm, you would see you are made of lots of tiny cells.



Every living thing is made of cells including plants, animals, and you.

Inside every cell, you can find DNA.

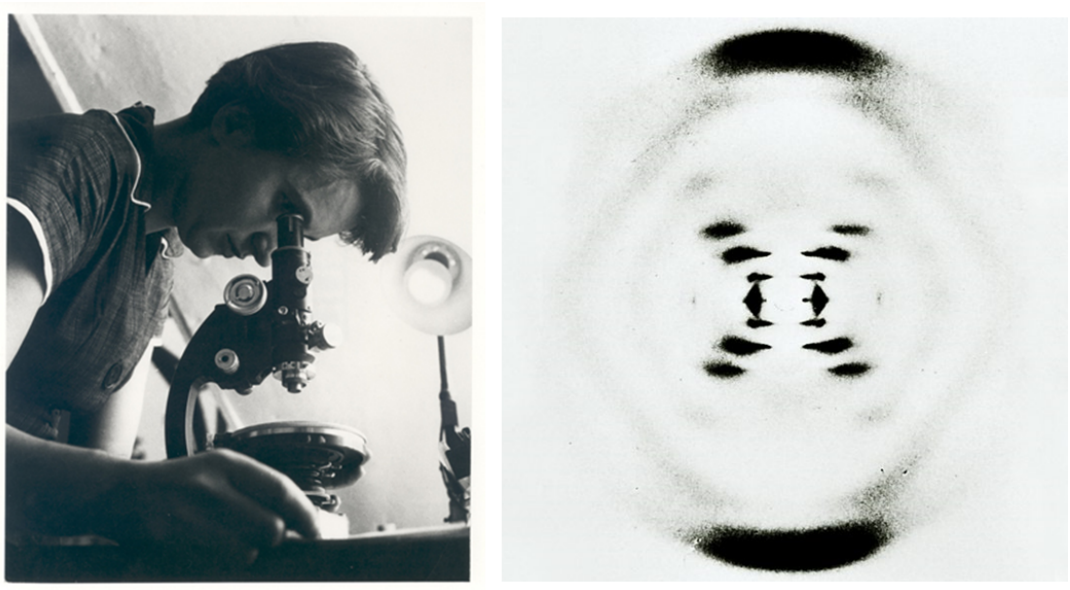
What does DNA do?
Your DNA tells your hair what colour it should be, and tells your hands which one you like to write with. DNA holds the **instructions** that give living things their unique traits.

Everyone has DNA. Your DNA makes you **unique and special**.

What does DNA look like?

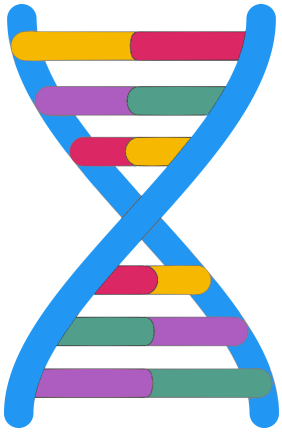
We know what DNA looks like thanks to **Dr Rosalind Franklin**.
As part of her research, the first ever photograph of DNA was taken!
This photo led to the discovery of the shape of DNA.

From the photo below, what shape do you think DNA has?



Rosalind Franklin and a Photo of DNA

DNA has 2 strands. These 2 strands twist around each other.
This shape is called a "**double helix**". Think of it as a twisted ladder.



DNA has **2 strands**, these are the **sides** of the ladder. They are held in place by the **4 bases.** These bases pair up and make the **rungs** of the ladder.

The **4 bases** are A, T, C, G. They come in pairs:
A pairs with T; C pairs with G.

DNA is very thin, much thinner than your hair.
It is also really long. It's 2 metres (6 feet) long!

Its **double helix** shape helps it fit inside every ***tiny*** cell. DNA can fold or coil itself into more complex shapes. This makes the shape of DNA very small, and can easily fit in any of our cells!

Instructions:

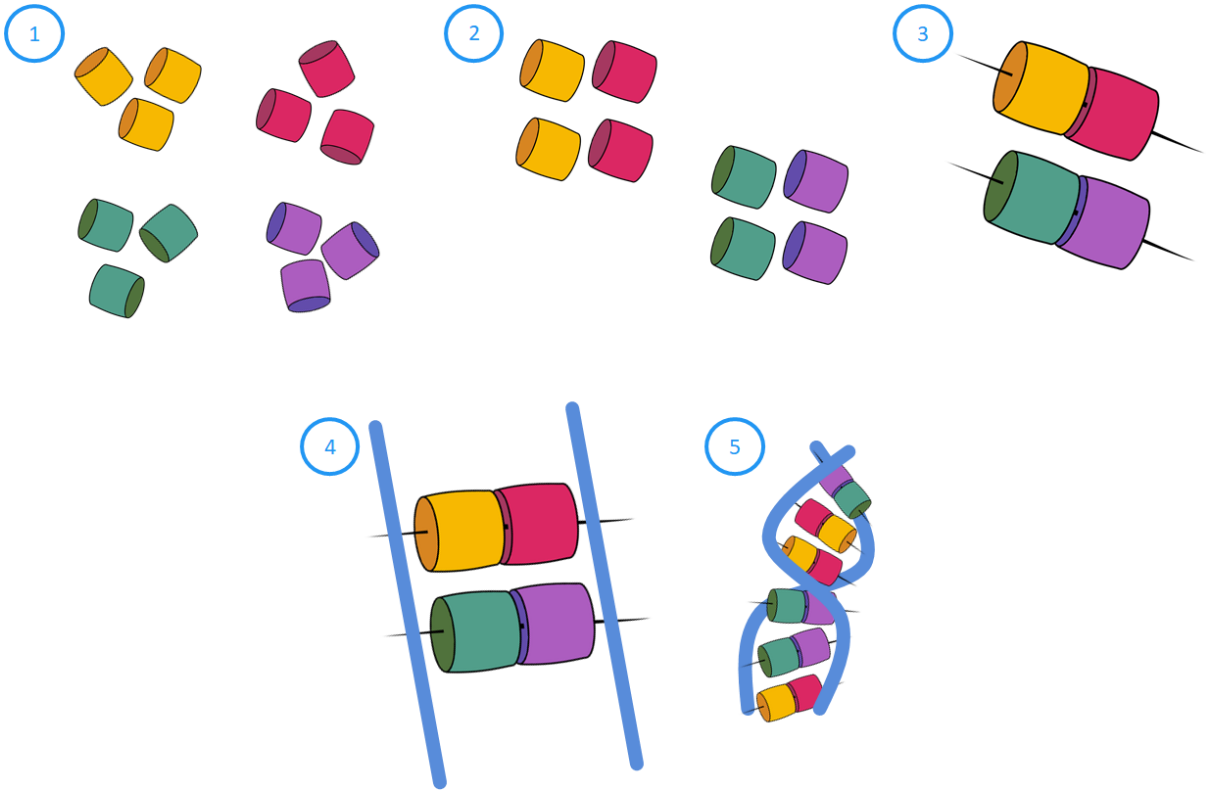
1) Sort you small soft sweets into colours (or shapes).

2) Pair your sweets so that one colour always matches another e.g. yellow and red, green and purple.

3) Push each pair onto a cocktail stick.
    - If you are using spaghetti to hold the bases together, break the long spaghetti into smaller pieces, approximately 9 cm in length

4) Attach your paired sweets to the two long sweets to make a “ladder” shape.

5) We know that DNA has a **double helix** shape. So the last step is to give your DNA a *twist!*



Extension - Extracting DNA

If you enjoy learning about DNA, you can attempt the Biology - Intermediate project where you learn how to extract DNA.

Reflection Questions:

- Are there any improvements you would make to this challenge?
- What real world application/s can you apply this challenge to?
- What are the key science and engineering concepts that relate to this challenge?

- DNA is inside every cell in our body. But it is very, very long! How can DNA fit inside our cells? Look at the DNA you made and think about its **double helix** shape. Can you make your DNA smaller?
- Here are some statements about DNA. Can you do some research and tell us if they are true or false? If a statement is FALSE, can you tell us the correct answer?
    - Statement 1: About 90% of the DNA of each person around the world is the same.
    - Statement 2: Red blood cells in humans contain DNA.
    - Statement 3: About 8% of our DNA consists of ancient viruses.

Submission Guidelines:

- Submit a photo of the experiment setup. Include a short summary that addresses the reflection questions.

> Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your parent or guardian first.

- The submission form is on the Minor Challenges page: https://sciencechallenge.org.au/index.php/minor-challenges/
  Fill out the details and make sure you upload your submission.

Learn More! Resources:

- Investigating DNA can help protect endangered species of animals.
  Click on the link below to read more about scientists around the world and how they use DNA to protect animals!
  Around the World with DNA | AMNH

- If you enjoyed this activity you might be interested in "Molecular Biology". Read more about what molecular biologist Rob DeSalle has to say in the link below:
  Being a Molecular Biologist: Rob DeSalle | AMNH

- If you're interested in DNA, you might be interested in "genetics". Find out more in these videos interviews with geneticist George Amato:
  Meet the Geneticist: George Amato | AMNH

Bibliography:

- Structure of DNA - DNA - KS3 Biology Revision - BBC Bitesize [online] Available at: https://www.bbc.co.uk/bitesize/guides/zp7thyc/revision/1 [Accessed 15 Mar. 2022].
- Make a DNA model - American Museum of Natural History [online] Available at: https://www.amnh.org/explore/ology/genetics/make-a-dna-model2 [Accessed 15 Mar. 2022].
- Rosalind Franklin's Life - The Rosalind Franklin Institute [online] Available at: https://www.rfi.ac.uk/about/rosalind-franklin/ [Accessed 15 Mar. 2022].