Pipe Cleaner Protein Models: Helices and Beta Sheets

What we're doing

Proteins are long chains of amino-acids that twist and fold into different shapes that allow them to fulfill their special function within living cells. Today you will make two of the characteristic structures seen in proteins: a **spiral** (called an alpha helix) and a **zig-zag** (called a beta sheet). You will make these shapes from pipe cleaners.

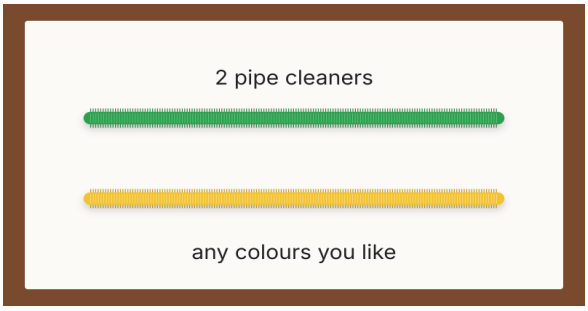
You need:

- 2 pipe cleaners (any colours you like)
- Sticky tape (optional, to fix models to the card)

Step 1: Get your pipe cleaners

1. Take two pipe cleaners.
2. Gently straighten them out.

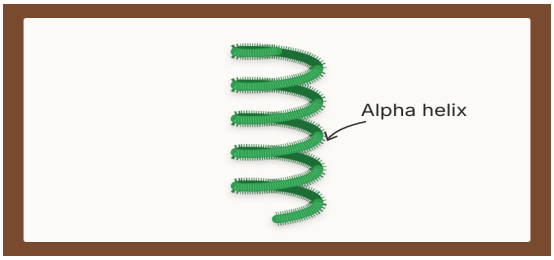
Each pipe cleaner represents a protein chain: lots of tiny building blocks (amino acids) joined in a line.



Step 2: Make an alpha helix

1. Wrap one pipe cleaner tightly around a pencil to make a spring.
2. Slide the pencil out. The spring keeps its shape!
3. Put it on your card and label it **alpha helix**.

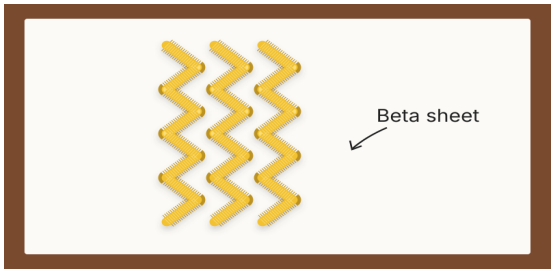
Science fact: real helices always twist the same way, like a screw.



Step 3: Make a beta sheet

1. Fold the other pipe cleaner into 3 equal pieces and cut it (ask a grown-up to help), or use 3 short pieces.
2. Bend each piece into a zig-zag.
3. Lay the 3 zig-zags side by side, close together.
4. Label it **beta sheet**.

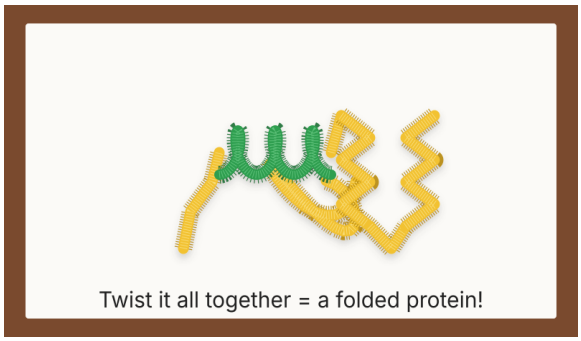
Science fact: one zig-zag is a beta strand. Strands lined up side by side make a sheet.



Bonus: Try to fold the protein in different ways!

1. Twist the end of your helix onto one of your zig-zags to join them.
2. Bend and twist everything into a ball shape.
3. Label it **folded protein**.

This is how a real protein looks: helices and sheets folded together into one shape. The shape determines the protein's job and function.

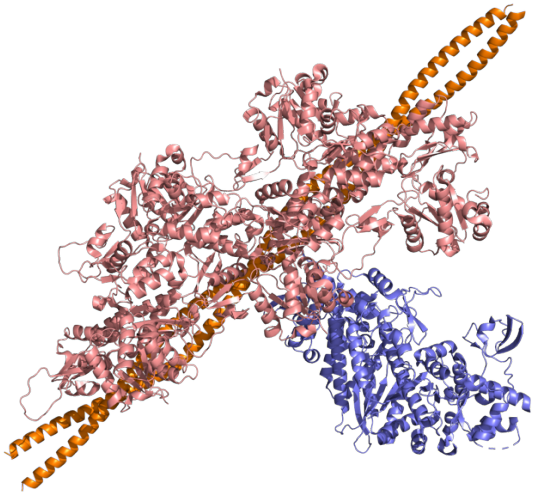


An example of real life!

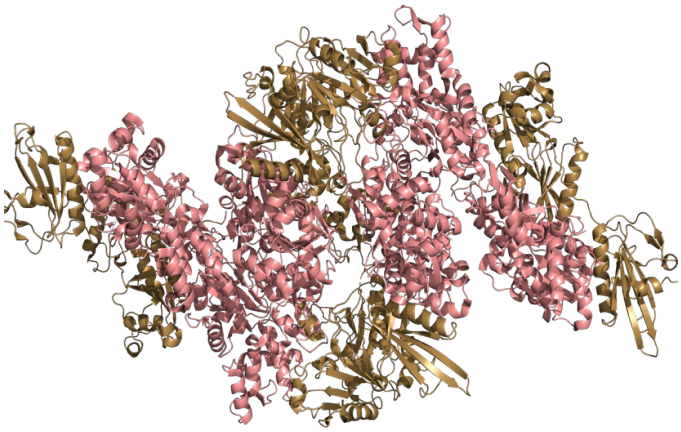
Actin is a protein found in many of our cells. Individual actin molecules join together to form long, thin strands called **filaments**. These strands do different jobs depending on which proteins work with them.

In the gut, the cells lining your intestine have tiny finger-like bumps called **microvilli**. Inside each bump, a protein called **villin** helps bundle actin strands together so the bump holds its shape. All those little bumps give your gut more surface area to absorb nutrients from food.

In the heart, a protein called **tropomyosin** runs along the actin strands and helps control when **myosin** can grip them. During each heartbeat, myosin uses energy from ATP to grab the strands, pull them a little, and let go. This happens over and over, helping the heart squeeze and pump blood.



Actin-tropomyosin-myosin complex



Villin-actin complex

Want to play a folding game at home?

Scan the QR code to play!

Protein folding

Antibiotic design