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# CHAPTER 1

# PLANTS

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DISCOVER...

LEARN...

EXPERIMENT...

## DISCOVER: THE BIOLOGY OF A BANANA

You might eat a banana without thinking about where it comes from, but, biologically, bananas are very interesting. Here are some banana facts that you might find surprising.

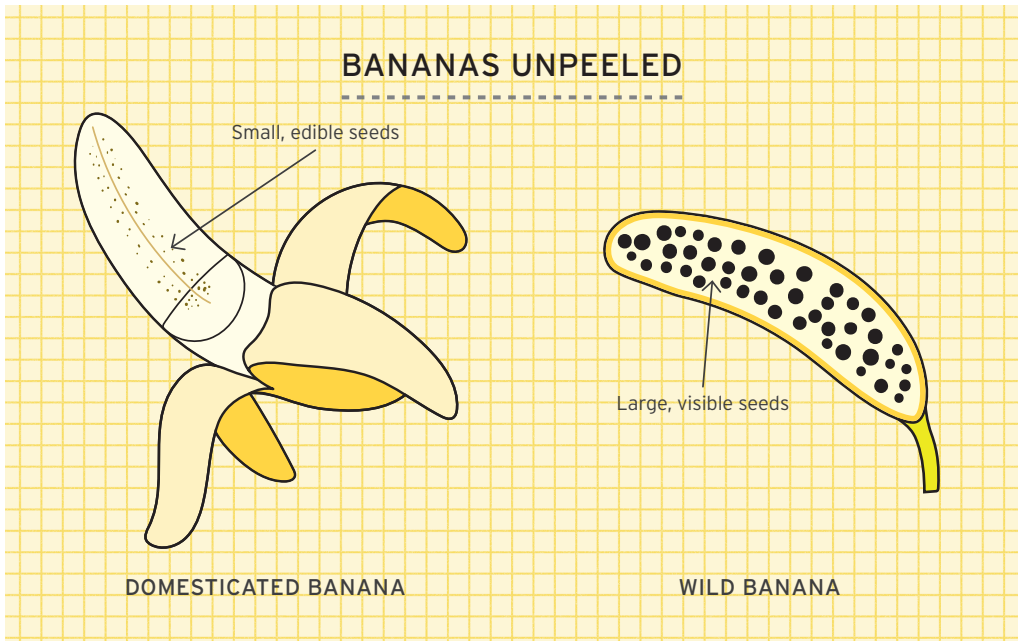
- **Bananas don't grow on trees**

The banana plant doesn't have a wooden trunk like a tree; it's made of banana leaves, which grow and curl around each other to form a stem.

- **Bananas are technically berries**

Botanically, a berry has an outer skin called the exocarp, a fleshy middle inside (the mesocarp) and then multiple seeds in the endocarp (the

part of the flesh in the very centre). Blueberries, kiwifruits and even eggplants are berries. A cherry, with one large stone, isn't a berry, and neither is a strawberry (because its seeds are on the outside) or a raspberry (which has many small sections, called drupes, each containing a single seed).



• **Banana plants don't grow naturally** Wild bananas are very different from domesticated ones. In particular, they have huge inedible seeds, and banana growers created more edible varieties by always choosing the plants with smaller seeds – until they became the tiny black spots you see inside bananas today. This means bananas can't be grown by planting seeds in the ground; they're grown from offshoots, and now almost all bananas are descended from two original species, *Musa acuminata* and *Musa balbisiana*. They're both very vulnerable to disease.

### BANANA-NOT

Banana-flavoured sweets often don't taste like the bananas we eat at home. That's because they're not made with actual bananas, but instead use chemicals called esters, which mimic the flavour. Some varieties of bananas, including the rare Gros Michel, have a sweeter taste that is closer to the flavour you get in banana sweets. (Find out more about esters on pages 118-119!)

• **Bananas grow pointing upwards!**

While you imagine bananas hanging downwards on a plant, the stem of the banana is actually at the bottom, and they grow upwards in bunches that can weigh over 45 kg (100 lb.).

### CAUTION: BANANAS ARE RADIOACTIVE!

Bananas contain high levels of potassium, which is slightly radioactive. There's not enough radioactivity in a banana to hurt you, but you can measure other radioactive sources in terms of the Banana Equivalent Dose: the number of bananas you'd have to eat to get the same dose of radiation.

- You're exposed to about 100 bananas of radiation per day.
- A CT scan is about 70,000 bananas.
- The radiation in 3,500,000 bananas is enough to kill you.



# DISCOVER: THE STRUCTURE OF CELLS

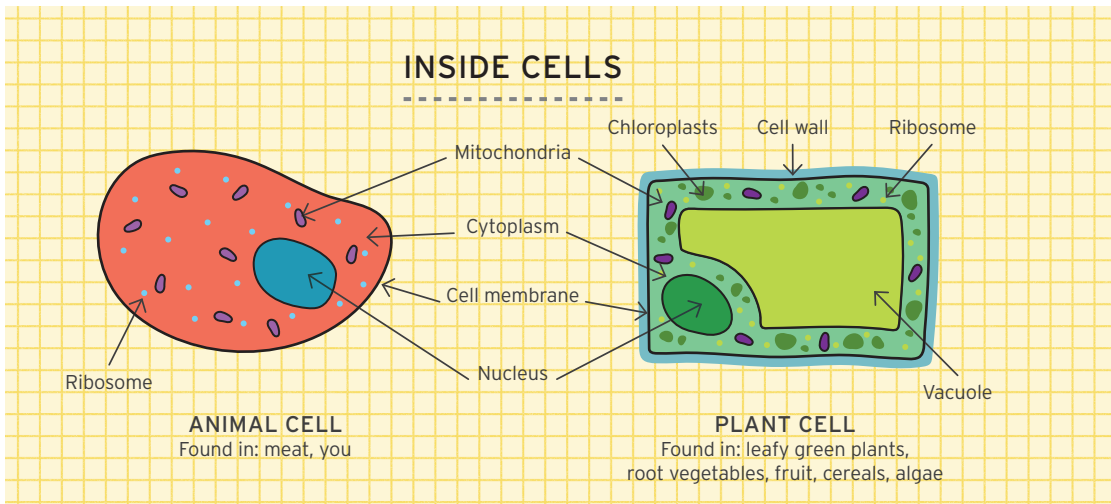
In biology, cells are the building blocks of everything: plants, animals, fungi (like yeast) and bacteria are all made from different types of cells. Here are the main kinds of cell you might see.

## PARTS OF THE CELL

- **Nucleus:** This is found in all plant and animal cells. It's where the cell's DNA is stored, and it functions as the 'brain' of the cell, giving it instructions about what to do and how to grow.
- **Cytoplasm:** All cells are filled with it – a jelly-like fluid, made mostly of water and salt, which fills the cell and holds all the other parts in place.
- **Cell membrane:** All cells have one. It wraps around the outside and holds everything in. It's made from a double-

thick layer of proteins and fat molecules.

- **Mitochondria:** These are tiny organelles – specialised structures suspended in the cytoplasm. Mitochondria produce energy for the cell by converting oxygen into carbon dioxide, known as respiration.
- **Cell wall:** Plant cells are surrounded by a thick wall made from cellulose – a type of sugar – which holds the shape of the cell rigid. It's the reason why plant stems are stiff and can hold themselves upright. Some bacteria

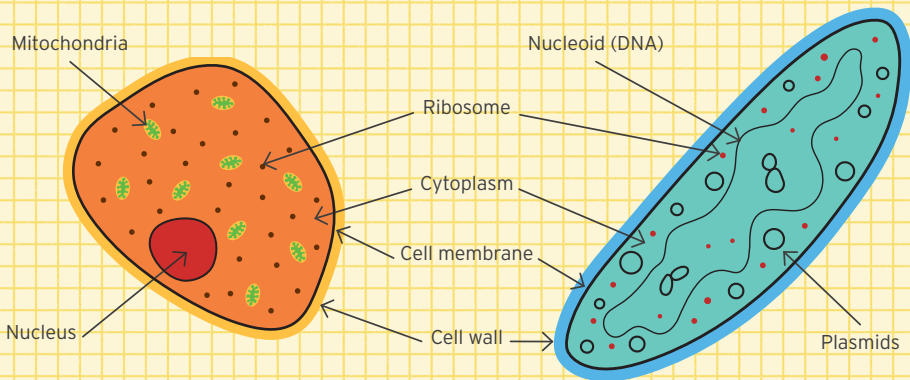


and yeast cells have a different type of cell wall, made from a mixture of proteins and sugars.

- **Vacuole:** This is a bubble inside a plant cell used for storing nutrients or waste products. When a plant hasn't received enough water, less fluid is stored in the vacuoles, so the cells get smaller and the plant droops and wilts.
- **Chloroplasts:** Only found in plant cells, these contain molecules of a green substance called chlorophyll, which is why plants look green. They're used by the plant cell for photosynthesis – converting energy from light, along with water and carbon dioxide, into sugars the cell needs, and oxygen that's released into the air.

- **Ribosome:** These are tiny particles of protein used to join together molecules called amino acids to make other proteins. They follow instructions from the nucleus to work out what to make.

- **Plasmids:** Found in bacteria cells, these are circular loops of DNA. Since the bacteria cell doesn't contain a nucleus, its DNA is stored loose in the cytoplasm.



**YEAST CELL**  
Found in: bread, vinegar

**BACTERIA CELL**  
Found in: your digestive system,  
yoghurt, sauerkraut, miso

# LEARN ABOUT: BANANAS

Even if you eat bananas every day, you might find there are things you don't know about them. For instance, a lot of people are surprised to hear that a banana is technically a berry. (See page 29 for more about the different categories fruits fall into.) See how much you know, or can guess, about bananas in this multiple-choice quiz.

## QUICK QUIZ: BANANAS

- What happens when you put a banana in water?
  - It will float
  - It will sink
  - It will dissolve
- How big are wild bananas compared to the domesticated varieties we eat?
  - Bigger
  - Smaller
  - The same size
- Which of these metals is found in a banana?
  - Iron
  - Potassium
  - Magnesium
  - All of the above
- What is a banana plant's trunk made from?
  - Wood
  - Bamboo
  - Banana leaves
- Which of these is a term used to refer to a bunch of 10-20 bananas?
  - Hand
  - Foot
  - Squid
- What proportion of our DNA do humans share with bananas?
  - 10%
  - 50%
  - 90%
- Which of the following is it claimed banana peel can do?
  - Relieve itching
  - Whiten teeth
  - Attract butterflies
  - Polish shoes
  - Remove splinters
  - All of the above
- Which of these is not part of a banana?
  - Endocarp
  - River carp
  - Exocarp
- What's the world record for the most bananas peeled and eaten in one minute?
  - 8
  - 17
  - 25
- Which of these fruits is in the same botanical category of fruit as a banana?
  - Cherry
  - Blueberry
  - Raspberry



# LEARN ABOUT: PARTS OF A CELL

Which of the following are found in which types of cells? Look at the diagrams on pages 12–13 if you're not sure, and tick the boxes.

## CHECK THE BOXES

CELL PART	ANIMAL CELL	PLANT CELL	YEAST CELL	BACTERIA CELL
MITOCHONDRIA				
CHLOROPLASTS				
CELL MEMBRANE				
NUCLEUS				
CELL WALL				
PLASMIDS				
CYTOPLASM				
RIBOSOMES				
VACUOLE				

Which types of cell (animal, plant, yeast or bacteria) would you expect to find in each of these foods, or use in making them? There might be more than one.

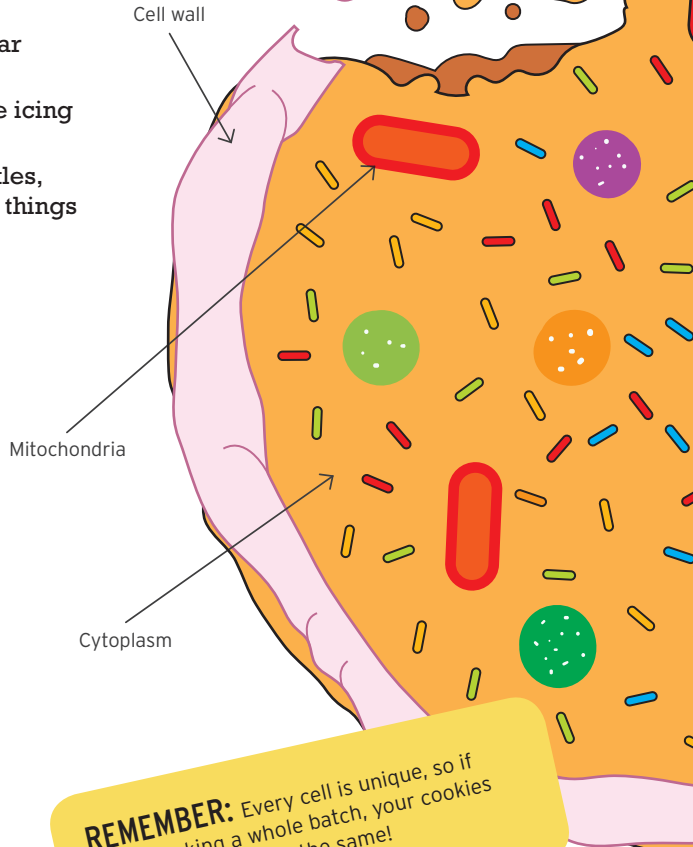
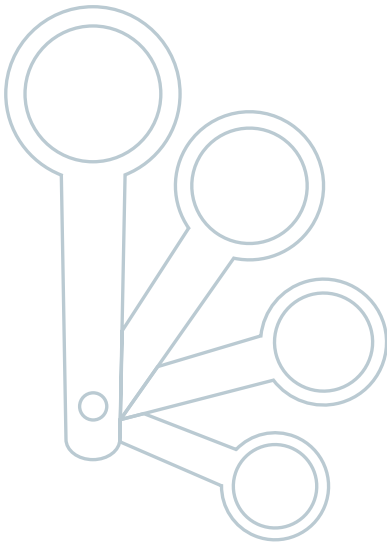
1. Roast lamb
2. Dressed salad
3. Cheeseburger with lettuce
4. Strawberry yoghurt
5. Chicken wings

## EXPERIMENT: MAKING CELL COOKIES

A great (and delicious) way to remember all the parts of a cell is to decorate some cookies to look like different kinds of cells. Pick your favourite type of cell from pages 12–13 – or do them all! Use the diagrams to see what you'll need to include.

### YOU WILL NEED:

- Plain cookies (round, rectangular or uneven shaped)
- Different colours of ready-made icing in squeezable tubes
- Different sizes of sweets, sprinkles, chocolate chips and other tasty things to stick on



**REMEMBER:** Every cell is unique, so if you're making a whole batch, your cookies don't have to all look the same!

## WHAT TO DO:

**1.** Wash your hands and make sure all your equipment is clean. Decide what type of cell you're going to make – animal, plant, yeast or bacteria – or maybe make one of each!

**2.** For each of the parts of the cell you want to make, decide which type of decoration is going to represent it. You could use icing to pipe a cell wall around the outside, a large sweet for the nucleus, green gumdrops for the chloroplasts, a marshmallow for the vacuole and sprinkles for the tiny ribosomes.

**3.** Use icing to stick the sweets on the cookies in the right arrangement.

**4.** Share and enjoy delicious cell cookies! Ask people if they can identify what all the parts are.



## CELLS IN YOUR CELLS

Cookies are usually made with flour, sugar, butter and eggs. Most of these ingredients don't include any cells - sugar is made up of sugar molecules, and butter is a mixture of fats and proteins. Flour is made by grinding up wheat kernels, and is a mixture of starches, sugars and proteins. But the egg contains the most interesting biology (read all about it on pages 78-79).

Along with egg white (which is mainly water, with a little protein), and egg yolk (high in fats and protein), the egg also contains a blastodisc - a small white dot on the surface of the yolk, which contains around 20,000 cells. These are what might have grown into a chicken if the egg had been fertilised and incubated, instead of being made into cookies. So if they were made with egg, your cell cookies could contain the remnants of actual cells!