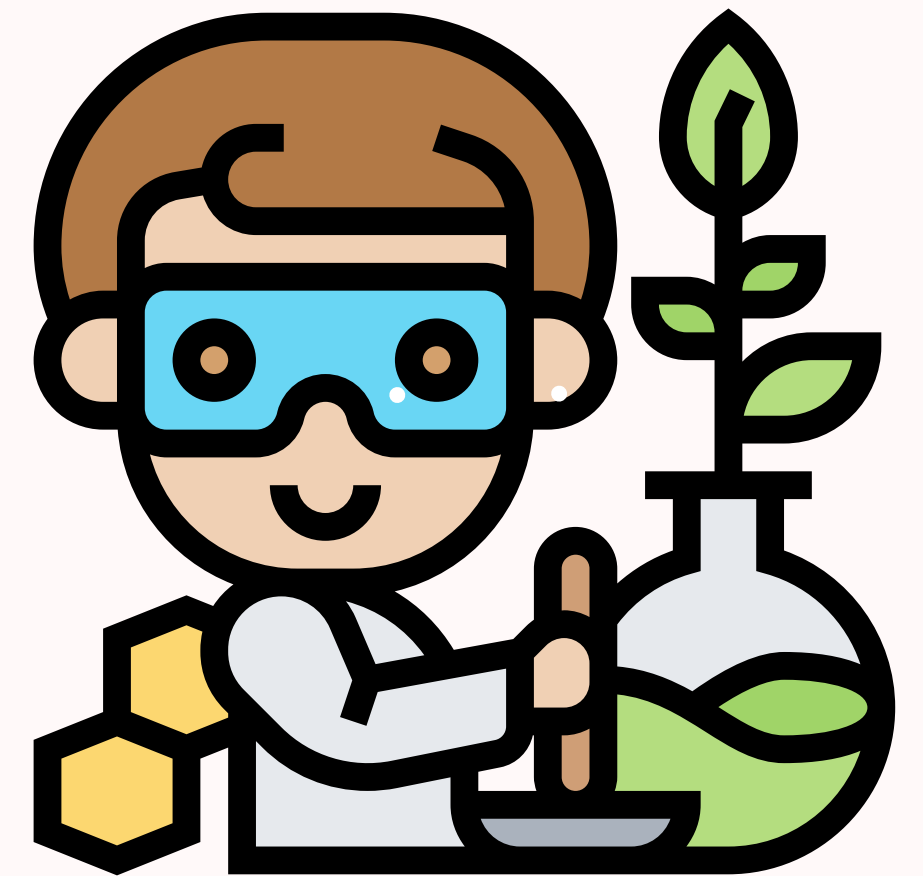
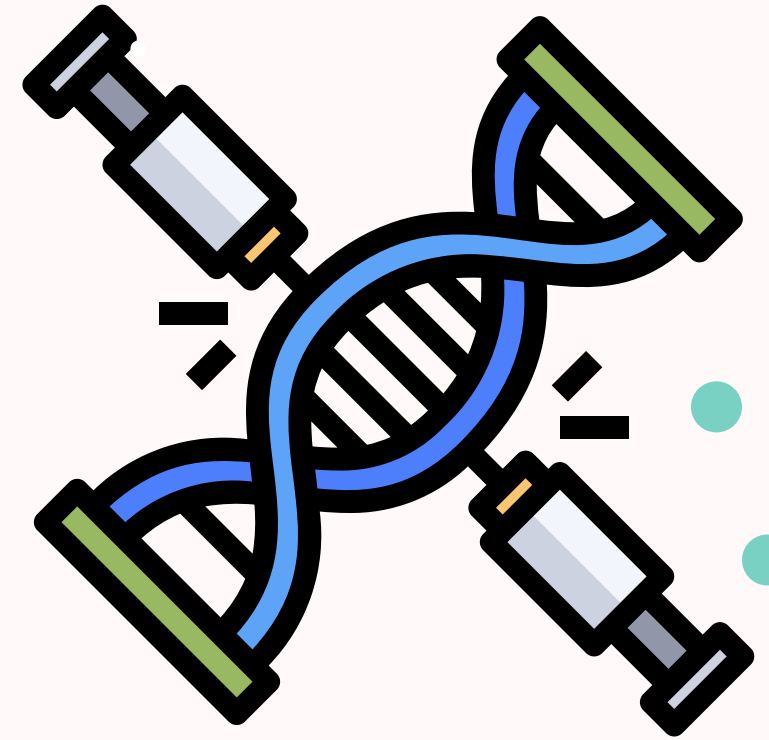
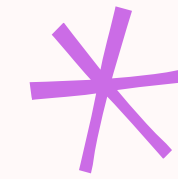


GMOomg!

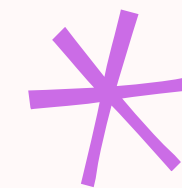
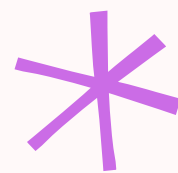
National Science Week 2021



Welcome!



Are you excited to learn about the future of
science?



What's on the agenda?

1

Introduction – who are we and what do we do?

2

GMOmg – what is a GMO food?

3

Science in the Kitchen

4

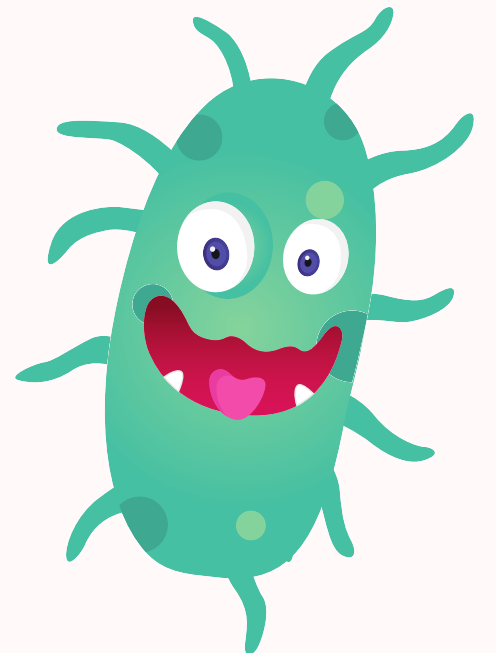
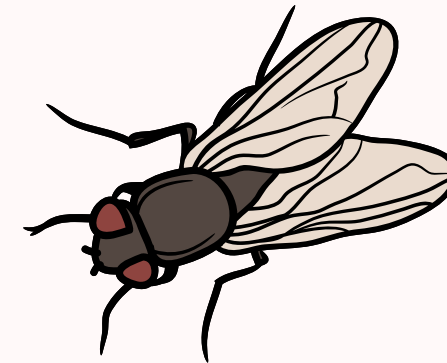
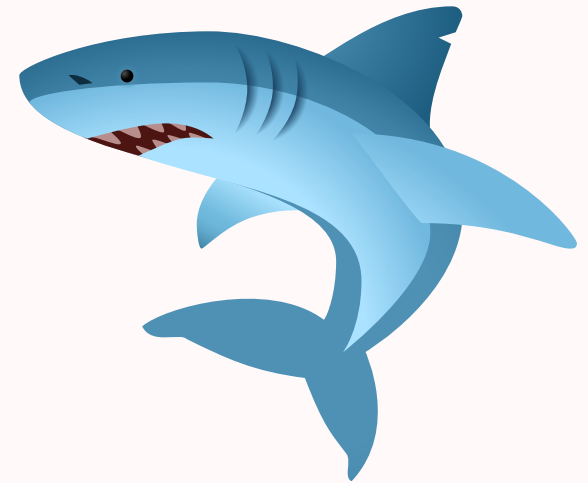
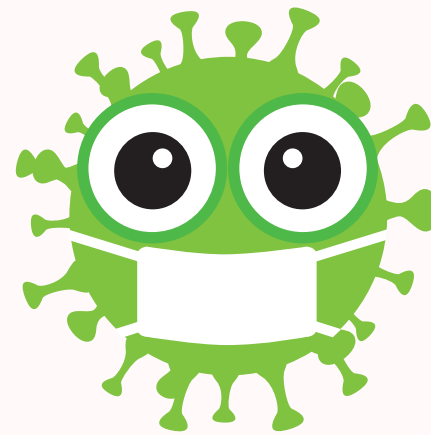
Quiz

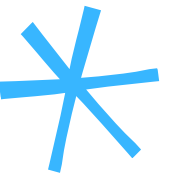


What do all of these things
have in common?



Go to www.menti.com and use the code:
XXXX XXXX





living things

animals

organism

cells

proteins

DNA

fungi

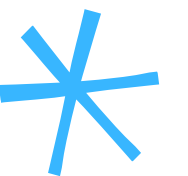
plants

virus

bacteria

RNA

nucleic acids



People, animals, plants, fungi, bacteria and viruses are more alike than you think...

- 1 They're all made of cells! Some are made of just one cell
- 2 They're all living organisms
- 3 They all have a genome
- 4 They are made up of special molecules like proteins and nucleic acids



Cells

All living things (organisms) are made up of cells...



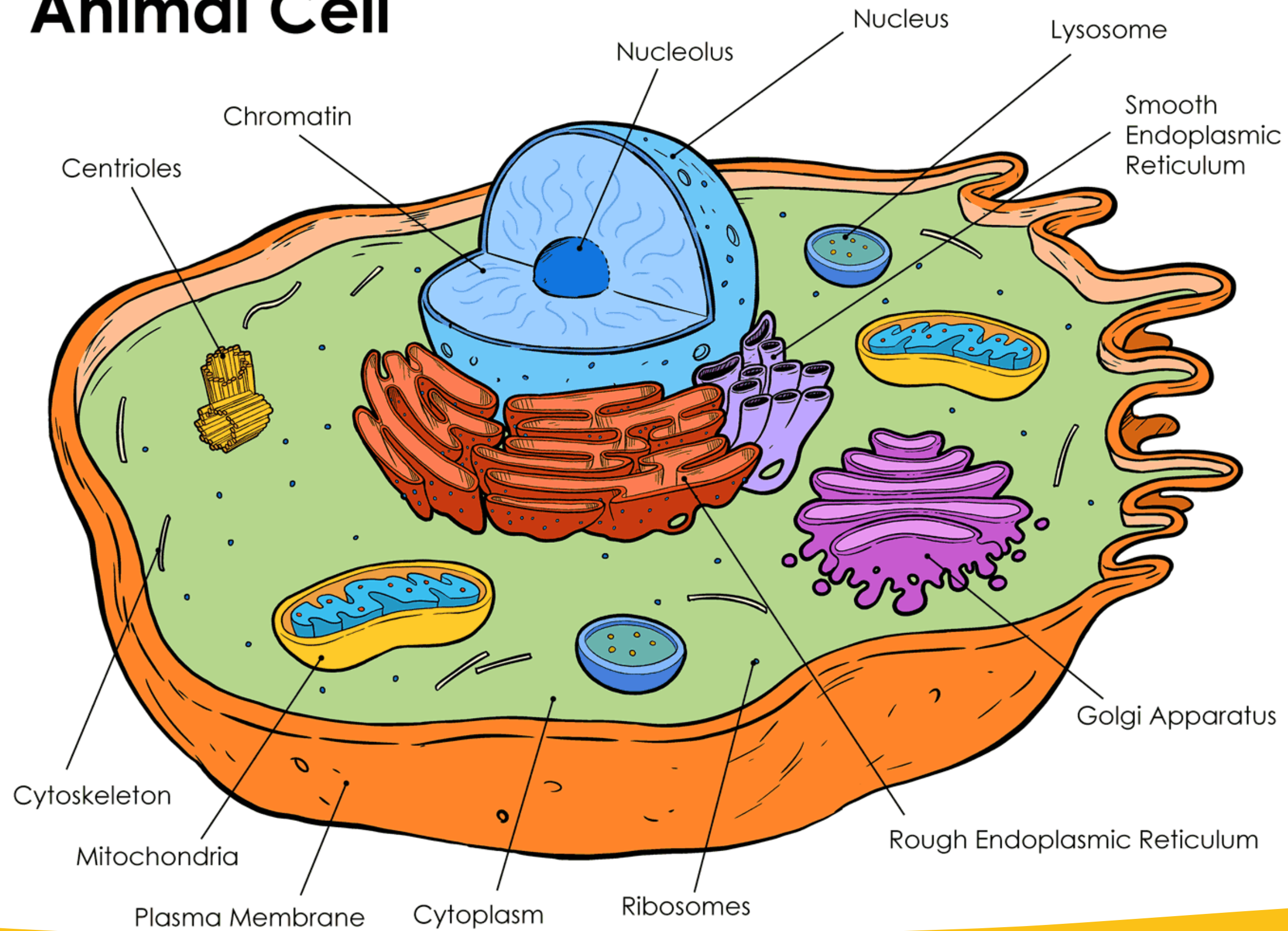
Humans are made of trillions of cells!

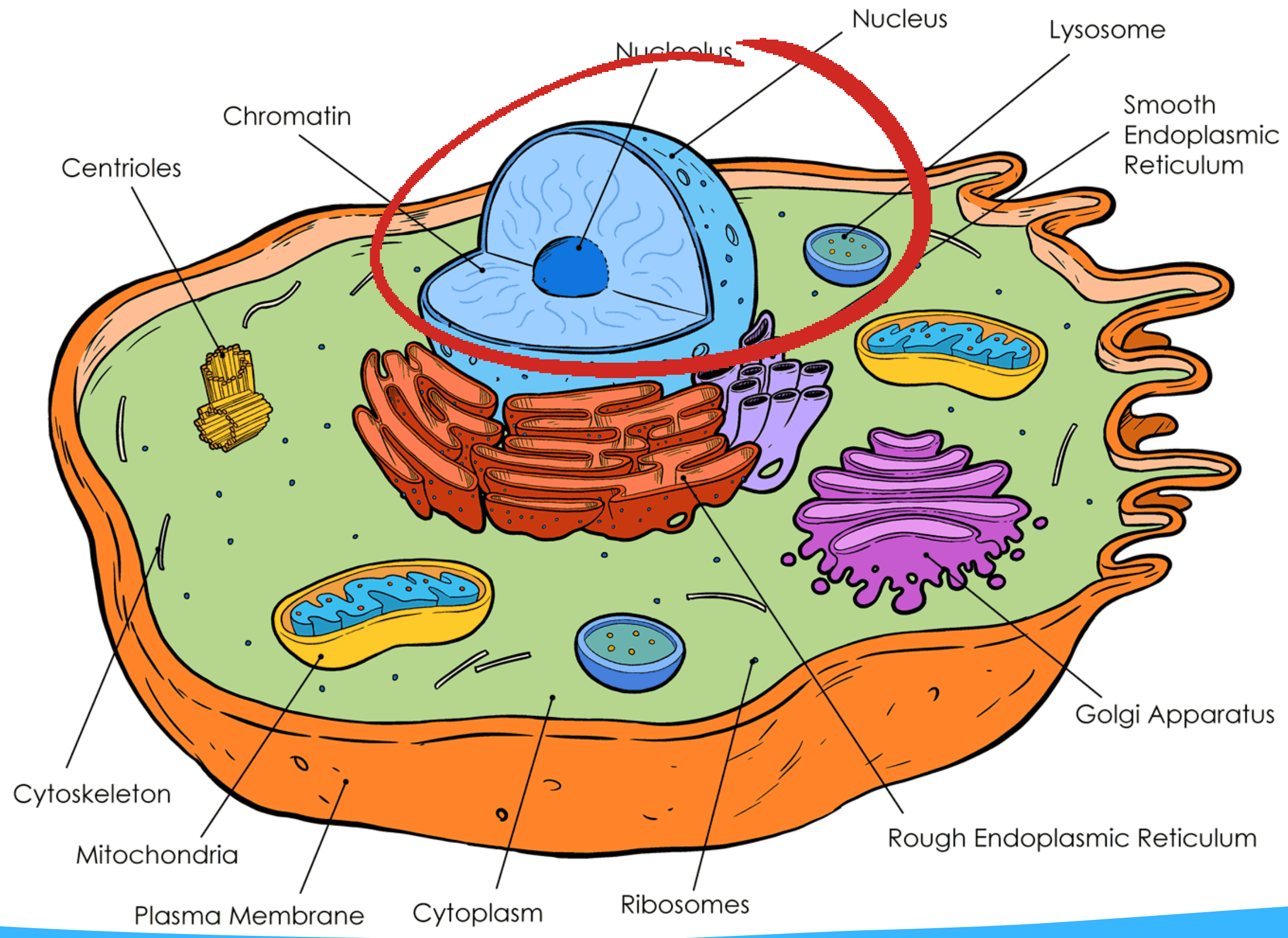
Every cell has a job to do - some help us detect light so we can see, some help us feel the heat or cold, some cells fight off viruses and disease, and others digest the food in our stomachs.

But how does each cell know what job to do?



Animal Cell





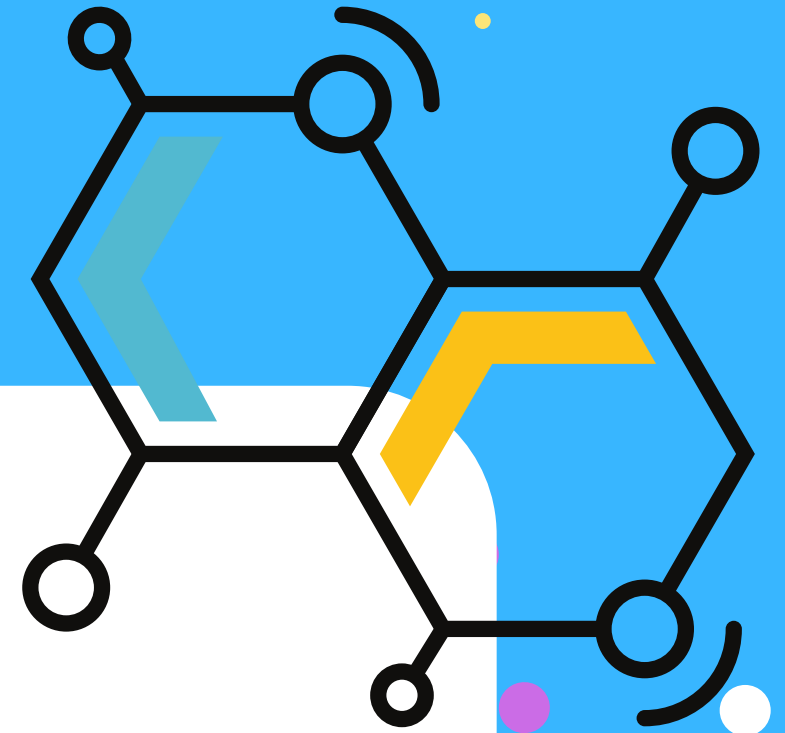


DNA!

What is DNA?

DNA is a very important type of molecule that tells our cells what to do.

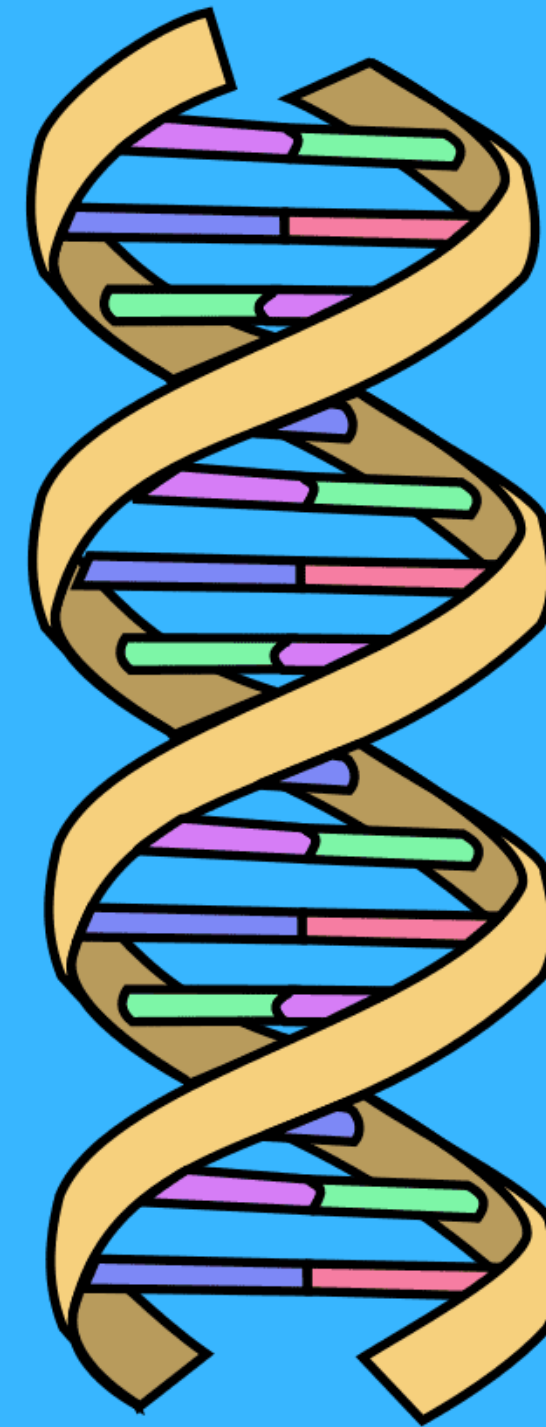
DNA is a bit like a computer – it is a very long set of instructions that tells every cell in body what job it is supposed to do – whether it be to a brain cell to allow you to think, or a immune cell to protect your body from a virus, or a muscle cell that helps you run fast.



DNA is written in a special language
made up of just four letters:

A, T, C, and G,

representing the nucleic acids
adenine, thymine, cytosine, guanine




DNA

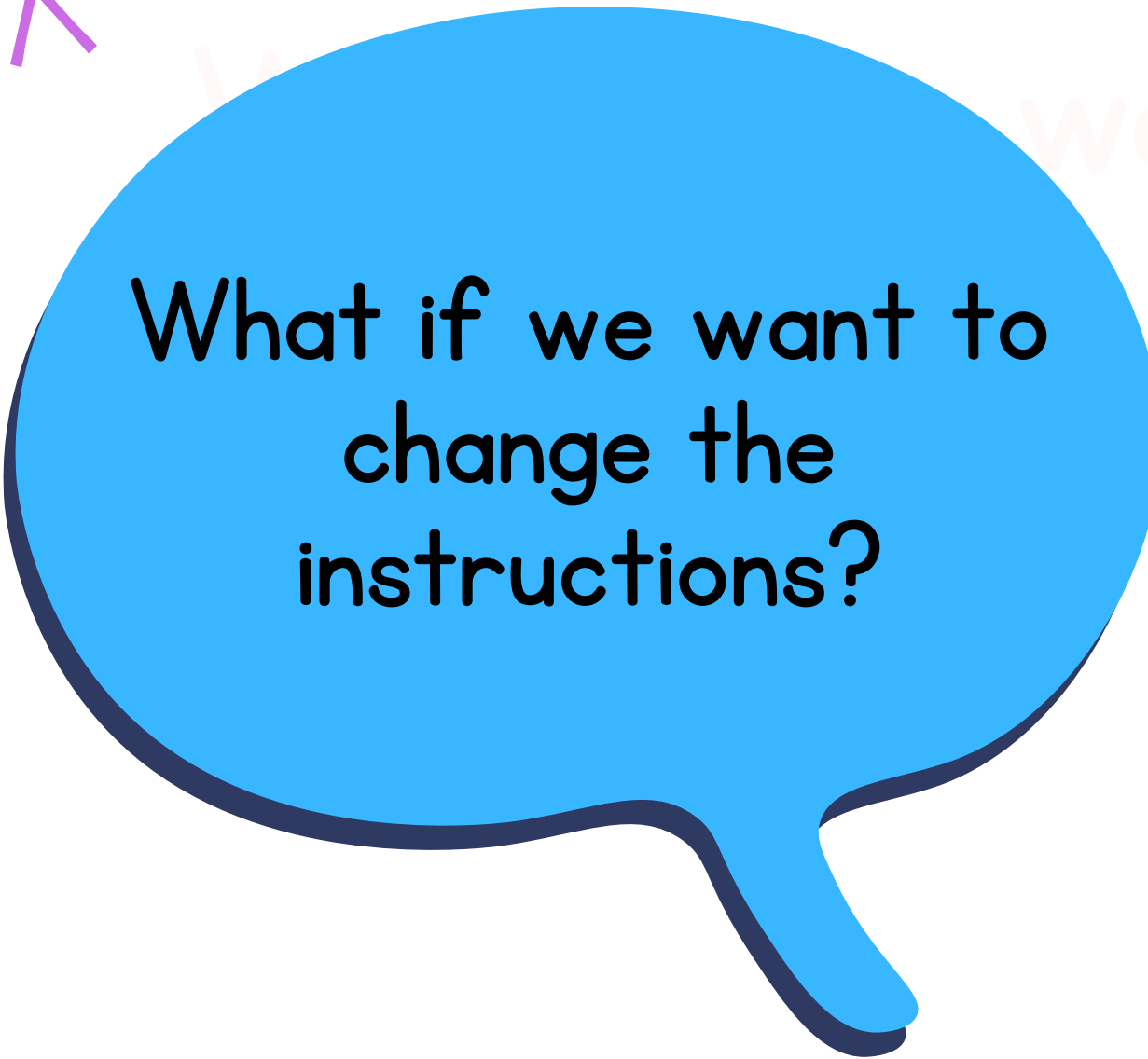

 = Adenine

 = Thymine


 = Cytosine

 = Guanine

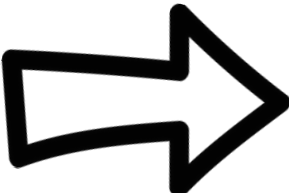
 = Phosphate
backbone




What if we want to
change the
instructions?



Scientists have developed some pretty
cool tools that allow us to change the
instructions that DNA gives cells by
rewriting the code!

This is called Genetically Modifying an
Organism  making a GMO!



What's a GMO?

GMO stands for "genetically modified organism" – plants, animals, bacteria or viruses that have had their DNA changed!

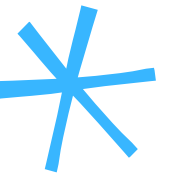
Scientists can take a trait from one organism and inject into another!

Let's take a closer look at how this is done...





What is the point of GMOs?



We can genetically modify (REMEMBER: this means to change the DNA)
plants to produce food that is:

resistant to insects

delayed ripening

provides more nutrients

resistant to viruses

cheaper to grow

different colour



Golden Rice

People with a rice-based diet can get very sick due to a vitamin A deficiency because rice seeds do not have vitamin A.

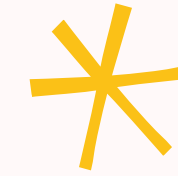
Vitamin A deficiency can cause vision problems and sometimes even blindness.



Solution?

Scientists took genes from bacteria and daffodils and inserted them into the rice genome to make genetically modified rice that contains vitamin A!





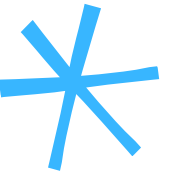
GMOs can be amazing tools to improve our health and make farming easier and cheaper...

But how do we make sure we're using GMOs for good and not to cause harm?



Why do you think it's
important to regulate GMOs?

Go to www.menti.com and use the
code: XXXX XXXX



1

Imported genetically modified soya that is found in chocolate, potato cups, margarine, mayonaise and oil

2

Imported genetically modified cottonseed oil found in mayonaise and salad dressing

3

Imported genetically modified corn found in cereals, bread, corn chips, gravy and corn syrup

4

Imported genetically modified sugar beet to make sugar



Do we have GMO
food in Australia?

Before any GMO is approved for consumption, it is investigated for its:

1

Nutritional content

2

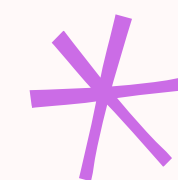
Toxicity

3

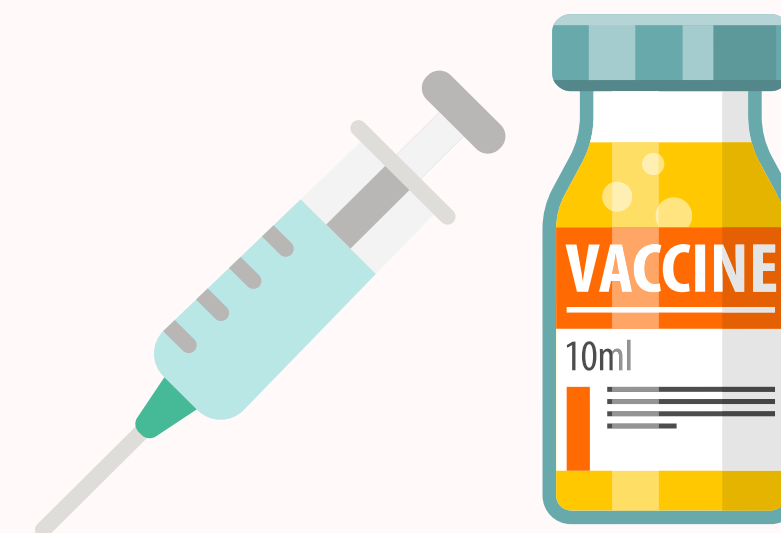
Any allergic reaction it may provoke

4

Whether there is any unintended side effects of the gene insertion



GMOs are used to make more than food!





Vaccines!



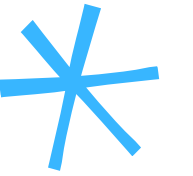
Scientists can genetically modify viruses to make vaccines!

The Astrazeneca COVID-19 vaccine is called a non-replicating viral vector vaccine – this means that they took a virus (Adenovirus), genetically modified it so it:

1) couldn't harm us and

2) carried the DNA to make the COVID-19 spike protein





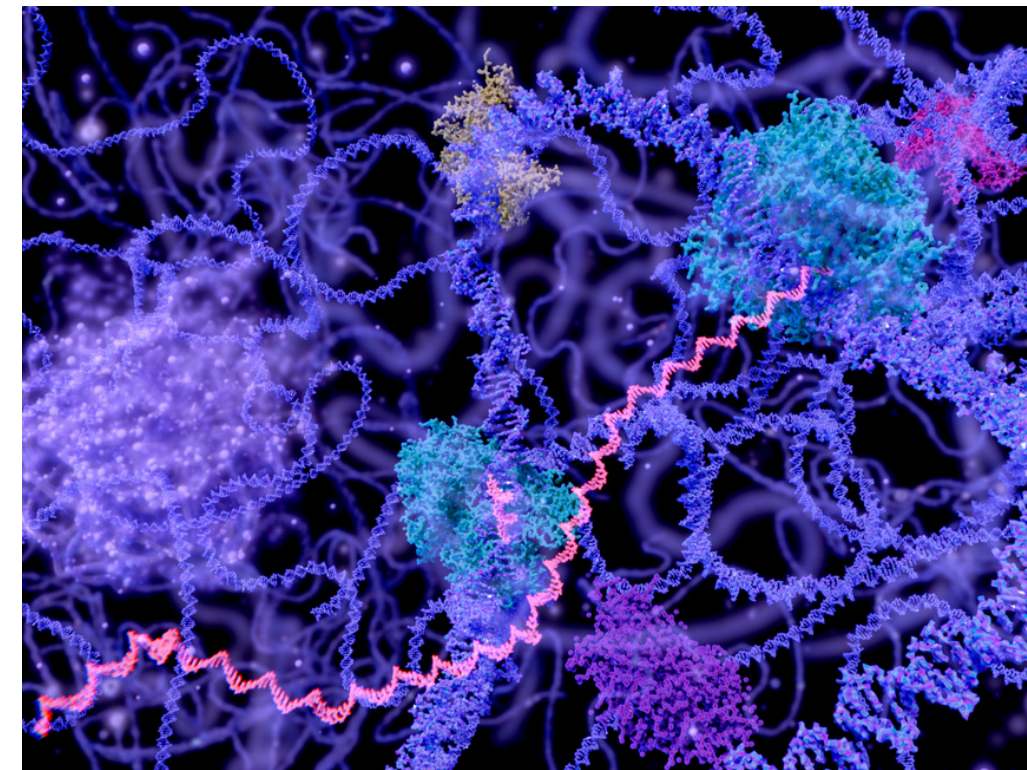
- 1 Take a virus and cut out its harmful virus replicating genes
- the bits that make it spread throughout the body!
- 2 Put a copy of the DNA for the COVID-19 spike protein into the gap in the viral genome
- 3 Inject the vaccine into your body so the safe genetically modified virus enters your cell
- 4 Your cells will then do all the work to read the DNA and make the COVID-19 spike protein
- 5 This tricks the immune system into producing special cells called antibodies and T-cells which recognise and attack COVID-19, to protect you if you later get a real infection



**How does a GMO
vaccine work?**

* What about the Pfizer mRNA vaccine? *

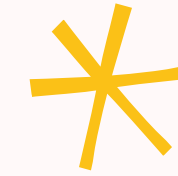
To understand how an mRNA vaccine works, we first need to understand what mRNA is!



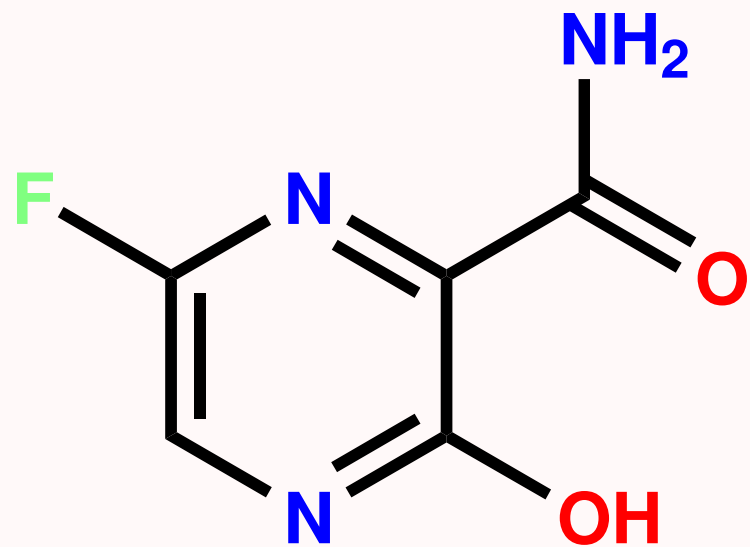
Imagine DNA is like a cookbook – a safe place to store all of the recipes
for every you need to make to run your body

DNA → RNA → PROTEIN





If DNA is the cookbook in our cells, then RNA is a copy of the recipe that is copied and taken to the cook so that the food can be made according to the recipe

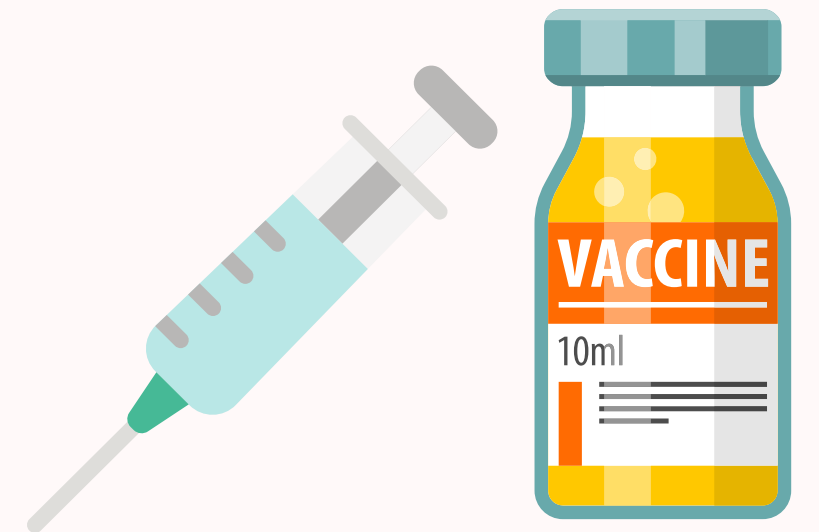


- 1 Take an mRNA (a type of RNA called messenger RNA) copy of the COVID-19 spike protein
- 2 Inject the vaccine into the body so the mRNA can enter your cells
- 3 Your cells do all the work to read the recipe and make it into protein to trigger the immune system

Just like the Astrazeneca vaccine, except there is no genetically modified virus needed and it skips a step - the cells don't need to copy the DNA into RNA because it's already been done for them!

How does an RNA vaccine work?

Any questions?



Science in the Kitchen!



Extracting Strawberry DNA

What do you need?

- Strawberries
- Knife
- Cutting board
- Spoon
- Zip lock bag
- 1 cup of dishwashing liquid
- 1/4 cup of salt
- 4 1/2 litres of water
- Paddlepop sticks
- Clear cup
- Methylated spirits
- Ice
- Toothpicks
- Cleaning cloth
- A parent/guardian/teacher to assist

1

Place the methylated spirits in the freezer for about an hour

2

Cut your strawberries into pieces with the help of a parent/guardian/teacher

3

Place half a strawberry into a zip-lock bag, remove the air and seal it. Squash the strawberry by rolling your fist over it.

4

Make a DNA extraction solution out of 280mL water, 1 tablespoon of dishwashing liquid and a quarter teaspoon of salt. Stir the ingredients together until the salt is dissolved.

5

Add 3 tablespoons of your DNA extraction solution to your ziplock bag and swish the mixture around.

6

Place the strainer over a plastic cup and pour the strawberry mixture over the filter to remove any strawberry chunks

7

Transfer the filtered liquid into a tall, slim cup

8

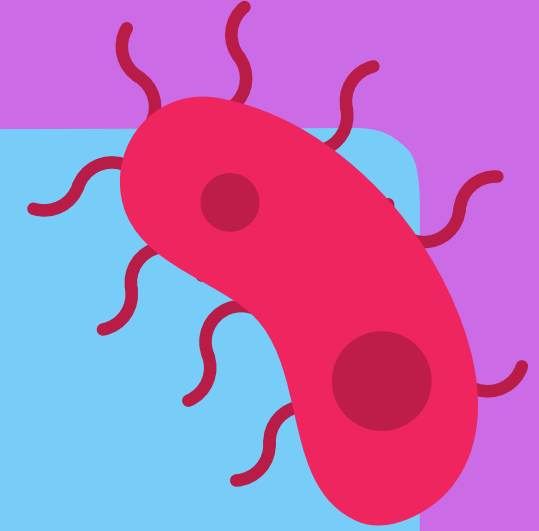
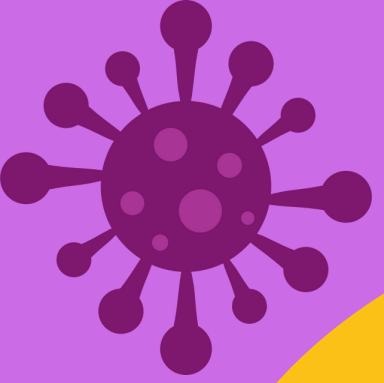
Ask a parent/guardian/teacher to tilt the cup and slowly and carefully pour an equal amount of the ice-cold methylated spirits into a cup so that it slides down the side of the container

9

Try to avoid mixing the methylated spirits and the strawberry juice and keep your eye out for bubbles appearing where the two liquids meet

10

Twirl a toothpick in the solution and pull out the snotty fibres to see the DNA from thousands of strawberry cells clumped together! There is so much DNA it is visible to the naked eye!



Science in the Kitchen!

Growing Bacteria at Home

What do you need?

- 1x teaspoon of beef stock powder
- 1x cup of water
- 1x teaspoon of gelatin
- Saucepan for boiling
- 2x Petri dishes or takeaway containers
- Spoon
- Sticky tape
- Permanent marker to label containers
- Warm spot to incubate your bacteria such as near a heater, a box with a desk lamp on top, or a spot near the sun



1

Pour 1 cup of water into the saucepan and bring to the boil with the help of a parent/guardian/teacher

2

Add the beef stock powder, sugar and gelatin to the boiling water and stir until the ingredients have dissolved

3

Cool the mixture for about 10 minutes - it still needs to be hot enough to stop the gelatin from sticking to the saucepan

4

Take the lid off your containers and have a parent/guardian/teacher pour an equal amount of mixture into each container

5

Immediately put the lid back on your containers and put them in the fridge for about four hours until the mixture has set.

6

Collect and plate your bacteria! We'll go through how to do this in the next slide...

7

Once the mixture has set, you can collect your bacteria! Bacteria is everywhere - in the house, in the backyard, on your hands...

8

To test the effectiveness of hand sanitiser, try placing your unwashed hand on the solid gelatinous mixture before immediately putting the lid back on. You can also rub a cotton swab on your unwashed hand and then run the cotton swab along the top of the mixture in a squiggly line.

9

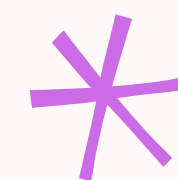
Then sanitise your hand, and place your sanitised hand on the mixture in your other container before immediately putting the lid back on.

10

Tape the containers closed and label them with a permanent marker.

11





Place the closed containers somewhere warm so that your bacteria can grow for 2-3 days, ideally a box underneath a desk lamp. You can still grow your bacteria at room temperature, but it may take a little longer. Make sure to never open the containers again and dispose of them correctly within two weeks.



Are you ready for a quiz?



Q1. Where is DNA stored?

-  a In strawberry seeds
-  b In the outer membrane of the cell
-  c In the nucleus of the cell
-  d In our blood

Q2. What is DNA made of?

a

Cells

b

Nucleic acids

c

Proteins

d

Chemicals

Q3. How many letters make up
the language of DNA?

a

Three

b

Four

c

Seven

d

Twenty-six

Q4. Which of these things isn't made of DNA?

a

Tomato

b

Dog

c

Person

d

Sand

Q5. What does DNA look like up close?

a

A long piece of string

b

A sphere

c

A twisted ladder

d

A circle

Q6. What is the name of the group of organisms that includes mushrooms?

a

Plants

b

Animals





c

Bacteria

d

Fungi

Q7. What can genetically modifying a plant NOT do?

-  a Change the colour
-  b Turn it into an virus
-  c Change the taste
-  d Make it produce extra nutrients and vitamins

Q7. Which of the following is not a letter in the language of DNA?

a

R

b

T

c

A

d

C

Q8. How many pairs of chromosomes does a human have?

a 22

b 23

c 46

d 44

Q9. Which two chromosomes do all male humans have?

a

ABC

b

XX

c

YY

d





XY

Q9. Which of these chameleon traits is a learned trait?

- a Standing on the scientist's finger
- b Sticking out its tongue to catch bugs
- c Having four legs
- d Changing color



Q10. Your DNA is:

-  A combination of half of each of your parent's DNA
-  Premium, High Quality DNA. Like, really good stuff.
-  given to you mostly by your dad if you are a boy, mostly by your mom if you are a girl
-  given to you either by your mom or your dad

GM0mg !

E	E	S	B	I	O	L	O	G	Y	T	H	A	S
D	O	T	E	D	O	C	Y	E	I	I	M	C	T
O	A	S	I	I	D	O	G	A	S	S	N	H	I
L	D	M	L	Y	S	O	O	N	C	N	O	R	G
B	E	N	D	E	C	R	L	A	S	O	I	O	E
A	S	C	A	D	I	G	O	A	T	I	T	M	N
C	A	L	E	S	E	A	N	M	R	T	A	O	E
T	B	O	A	B	N	N	H	I	A	C	T	S	N
E	E	N	R	B	C	I	C	C	W	U	U	O	E
R	B	I	E	T	E	S	E	R	B	R	M	M	L
I	A	N	R	W	O	M	T	O	E	T	M	E	R
A	N	G	N	E	O	R	O	B	R	S	S	A	O
D	D	R	A	S	U	N	I	E	R	N	N	G	E
R	S	E	R	I	O	O	B	T	Y	I	N	I	O

- BIOLOGY
- STRAWBERRY
- BIOTECHNOLOGY
- ORGANISM
- CHROMOSOME
- CLONING
- GENE
- AGAR
- CODE
- BASED
- MUTATION
- SCIENCE
- BACTERIA
- MICROBE
- INSTRUCTIONS
- DNA

Play this puzzle online at : <https://thewordsearch.com/puzzle/2661303/>

GM0mg! Word Search

This is a word search to accompany the USYD iGEM team's presentation for National Science Week.



National Science Week 2021 GMO Challenge

Design your very own GMO!

It could be:

- GMO food
- A GMO medicine or vaccine
- Maybe even a GMO animal!

Think about what organism you would want to modify, and what things you want to change?

Explain your design and draw a picture labelled with all of it's parts and send to your teacher to be emailed to our team for judging!

