Future Scientist Activity Pack (Year 3-Year 6)

CHILDREN'S MEDICAL RESEARCH INSTITUTE

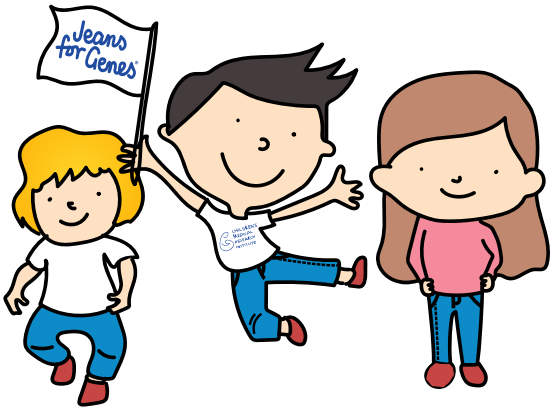
Jeans for Genes®

Finding cures for children's genetic diseases

What you and your school can do to help!

Jeans for Genes was created to raise money to help the scientists at Children's Medical Research Institute find treatments and cures for the 1 in 20 kids facing a birth defect or genetic disease.

You may think you don't know anyone with a genetic disease or birth defect, when in fact – there is one in every classroom across Australia! There are conditions that you may not be aware of, but also more commonly known conditions like cystic fibrosis and cancer.

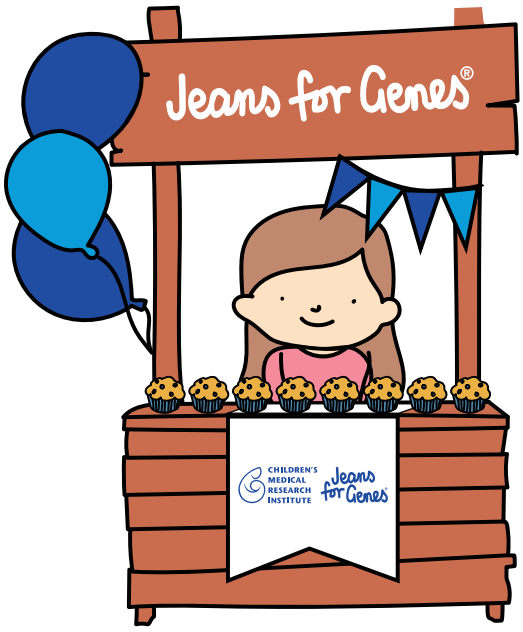


You and your school can help make a difference in the lives of kids who shouldn't have to think about getting liver transplants, taking dozens of medications, or getting their next dose of chemotherapy. We believe all kids should have a chance to just be kids!

Jeans for Genes Day is held in August but you can fundraising anytime that suit you.

There are lots of fun things you can do to raise money—from holding a denim mufit day to taking on our new 100 Skips a Day at School skipping challenge to selling blue baked treats. We have some great decorations on our website to liven up your space!

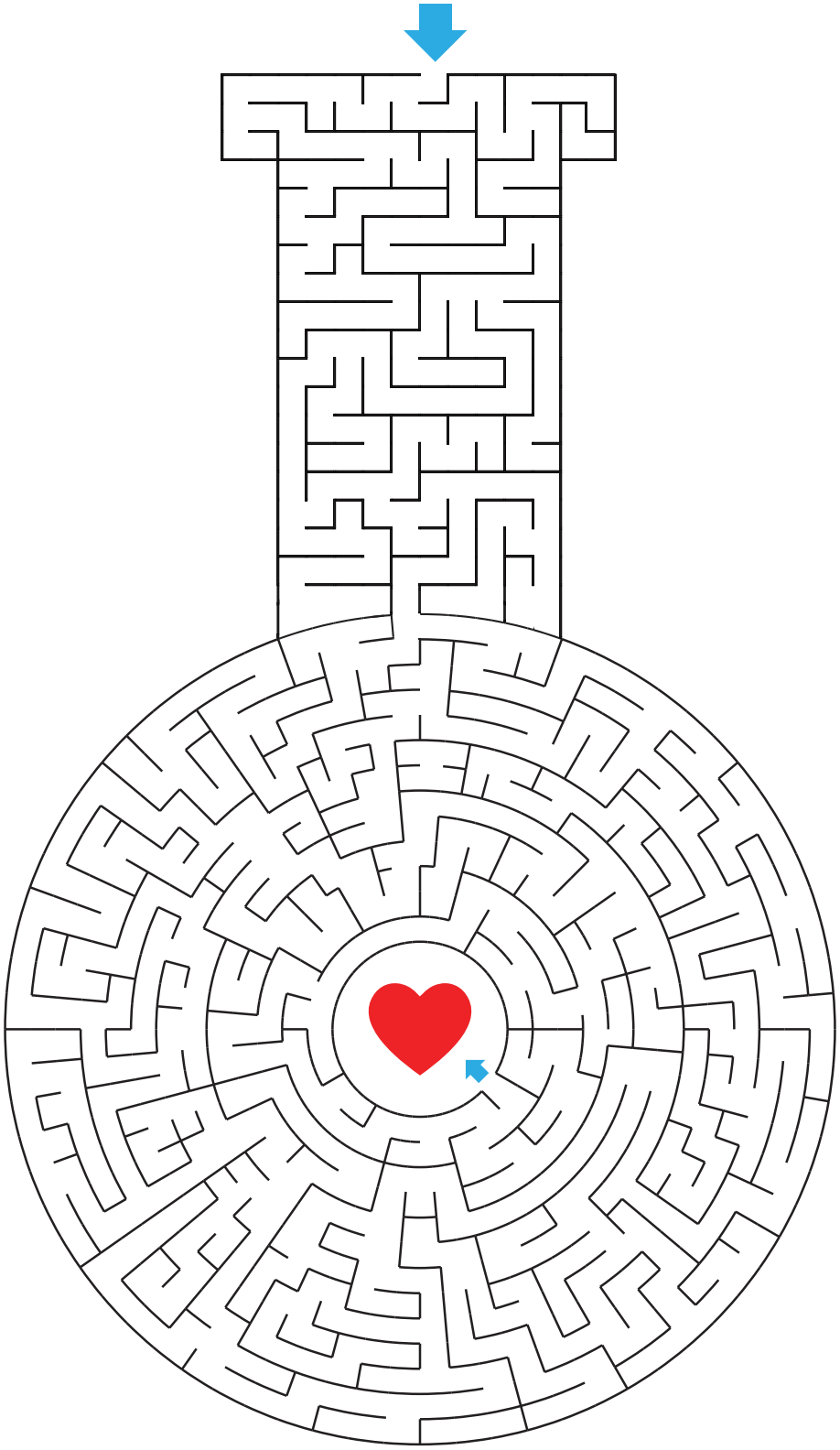
Find out more at **JeansForGenes.org.au** or get in contact with our team at **info@jeansforgenes.org.au**



Maze - Level 1

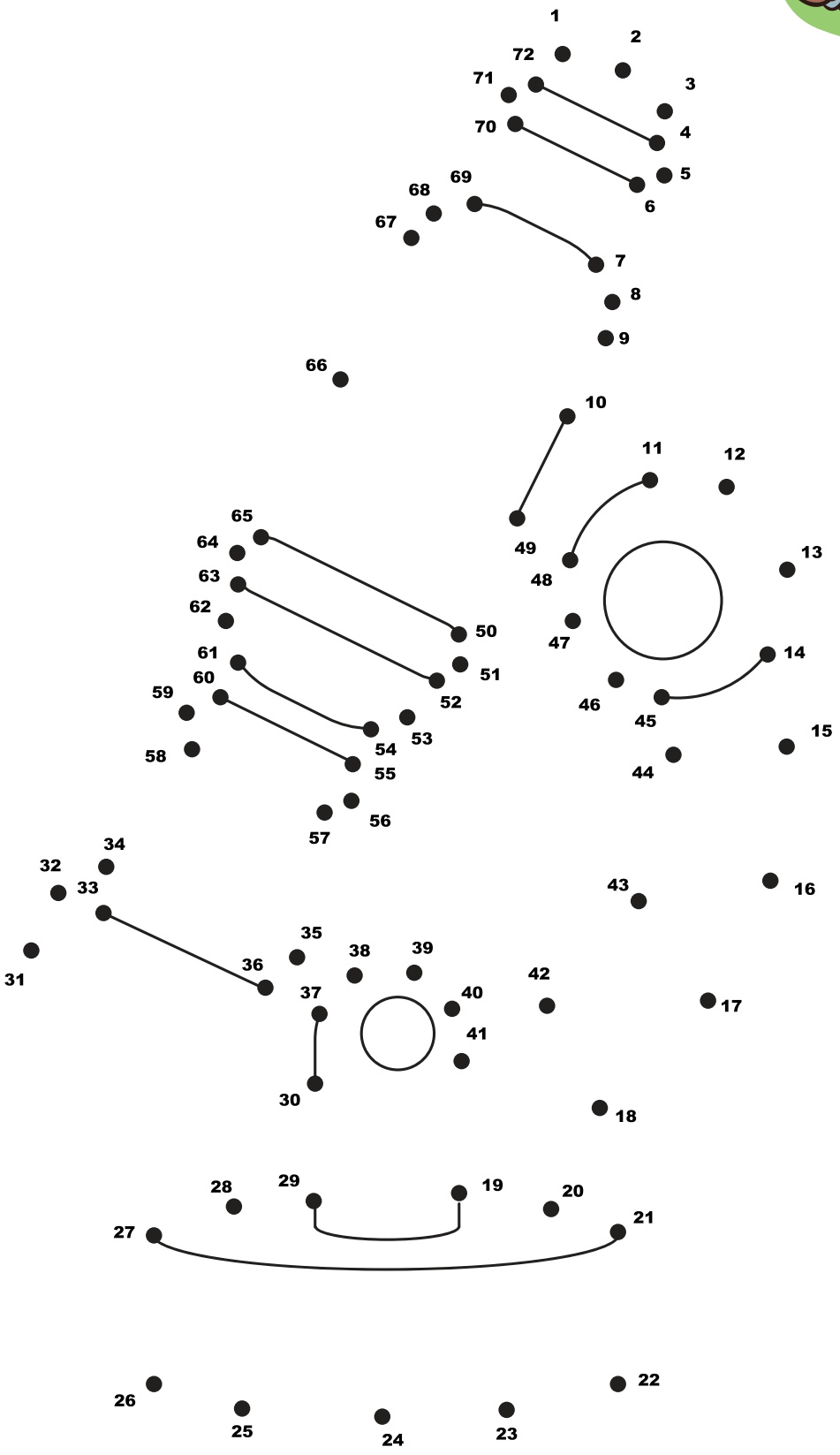
Help Sophie get better. Find her cure in the flask below.

Maze - Level 2



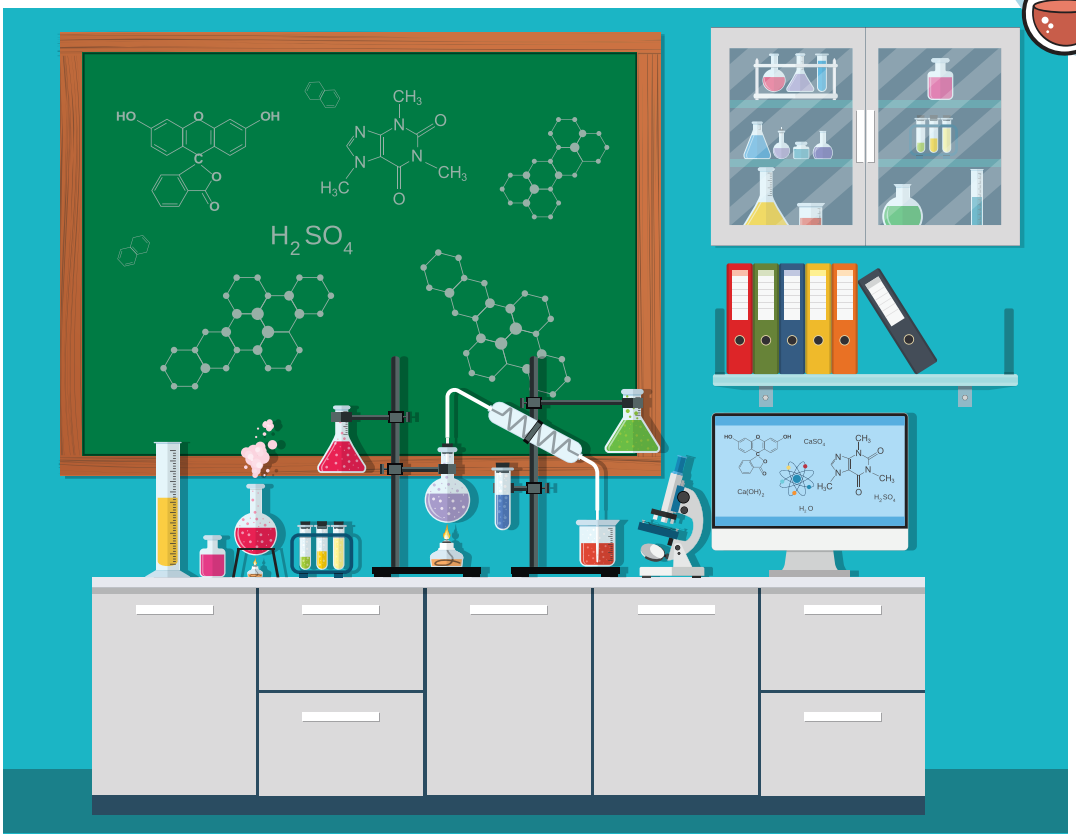
Join the dots

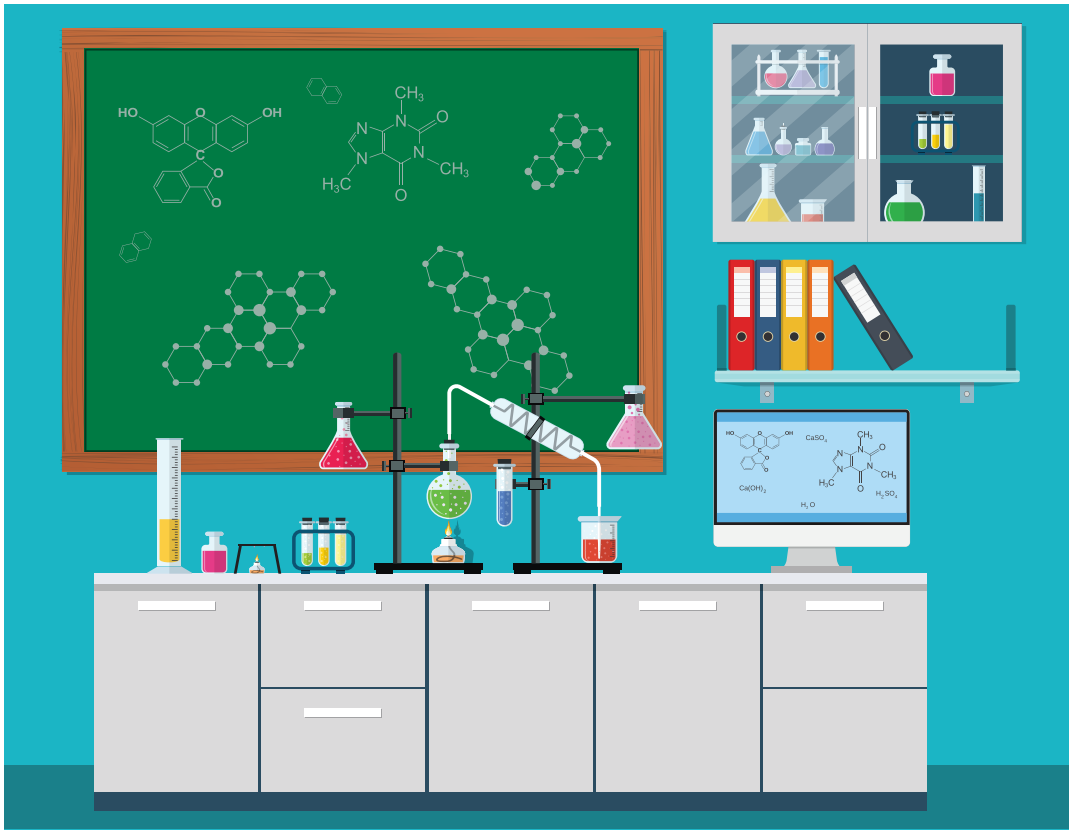
Alvin has a vital new instrument. Can you join the dots to find out what it is?



Spot the difference

Help Timmy sort out his lab. Can you find all 11 differences?





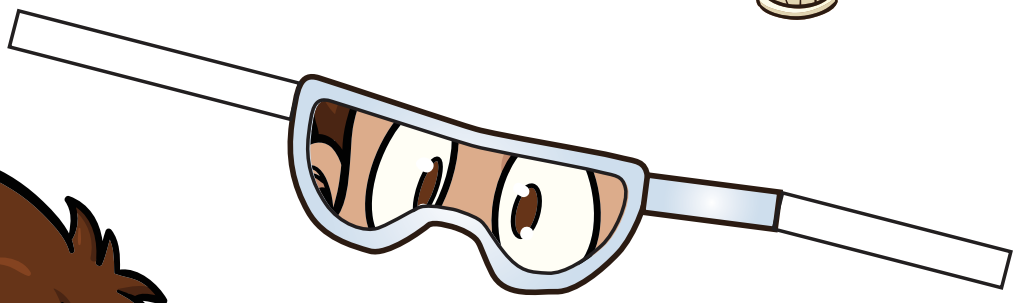
Colour by numbers

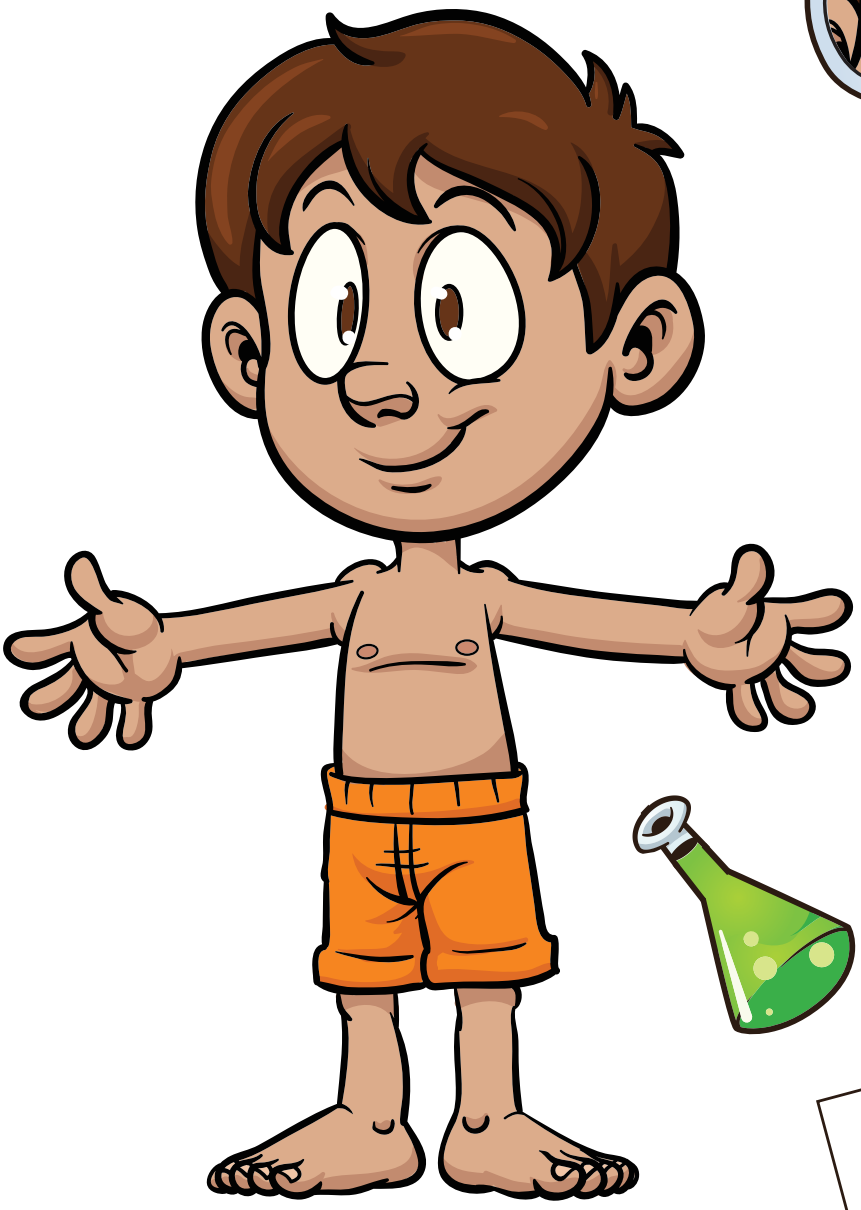
Can you help Katie colour her DNA?

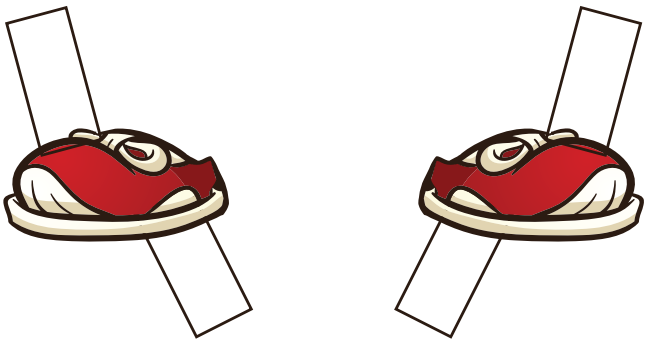
1	Red
2	Blue
3	Green
4	Pink
5	Purple
6	Yellow
7	Orange

Future Scientist - cut out doll

Can you help Gary get ready to do some research in the lab?

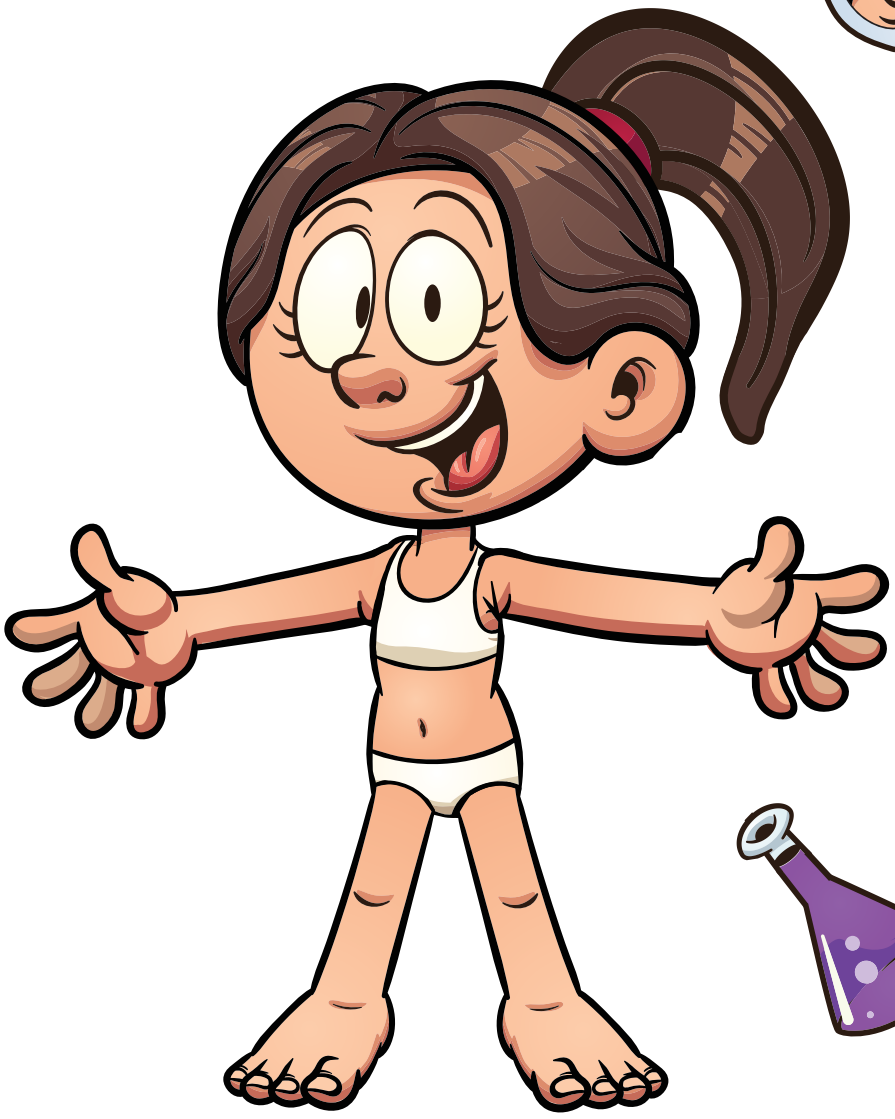


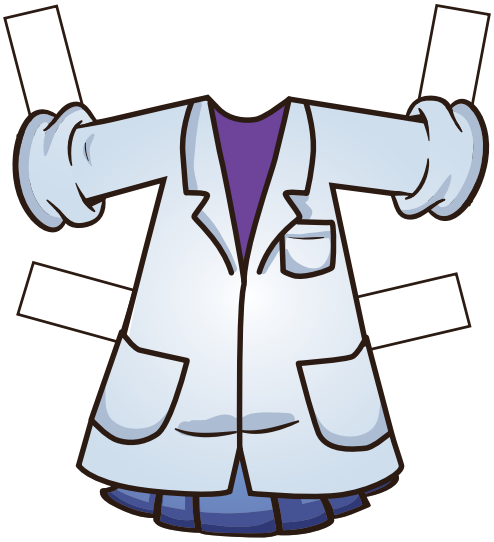


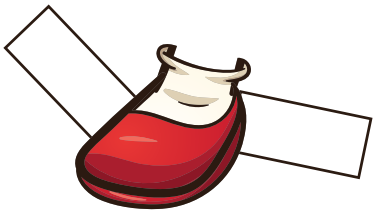


Future Scientist - cut out doll

Can you help Zoey get ready to do some research in the lab?







My lab

Find a word

Can you help Emma find all 18 science words?

biologist
gene
experiment
genetic disease
test
cell

cure
hypothesis
clue
mathematician
software engineer
computer

microscope
scientist
chemist
body
DNA
treatment

N	W	E	R	T	G	I	A	F	J	C	U	R	E	R	U	J	O	M	M
Q	B	O	D	Y	E	O	S	G	L	K	I	Y	D	T	H	K	L	M	I
B	L	T	Y	U	N	P	D	U	L	Z	X	Z	G	X	V	P	N	A	C
I	X	C	N	M	E	L	E	H	V	B	W	Q	F	C	I	C	B	T	R
O	T	P	S	J	T	Z	T	B	V	C	O	M	P	U	T	E	R	H	O
L	K	Y	C	D	I	J	N	H	W	M	S	A	E	R	H	L	R	E	S
O	N	F	I	X	C	Y	U	B	F	R	T	B	E	I	R	L	O	M	C
G	E	N	E	E	D	G	D	F	T	I	R	A	V	R	G	C	G	A	O
I	U	R	N	O	I	N	Y	N	C	X	T	Z	D	E	D	V	A	T	P
S	C	K	T	U	S	I	G	T	A	M	R	W	T	F	C	E	Q	I	E
T	P	I	I	H	E	Y	H	T	E	Z	C	S	Q	M	R	W	U	C	E
A	M	J	S	O	A	J	Y	N	L	D	E	M	X	G	D	E	F	I	I
G	O	P	T	V	S	U	T	S	T	T	Y	F	C	F	N	B	S	A	F
V	K	M	B	U	E	X	P	E	R	I	M	E	N	T	C	V	L	N	X
I	A	H	N	I	I	J	K	A	R	A	Q	W	G	D	H	C	W	P	W
M	L	J	O	K	O	V	N	J	P	I	E	U	M	S	E	S	S	M	K
L	H	Y	P	O	T	H	E	S	I	S	H	V	Z	X	M	Q	X	C	D
S	B	Z	P	S	O	F	T	W	A	R	E	E	N	G	I	N	E	E	R
Y	T	A	L	P	L	K	B	B	K	N	L	A	A	K	S	Q	A	W	Y
Q	H	Q	A	A	Z	P	M	Z	X	S	N	J	O	Q	T	Z	D	U	W

Code Cracker

Can you help Mr Beaker crack this DNA code?

The genetic code, represented by four letters (A, C, G, T), is found in our DNA and is responsible for how we look.

Do you have brown hair or blonde? Brown eyes or green?

If two people look different, it's because they have very slight differences in their genetic code.

More importantly, the genetic code is crucial for our body's ability to function—for life.

If there is an error in our code, it can cause a genetic disease like cystic fibrosis or cancer, which can make us feel unwell.

Despite only having 4 letters, our genetic code is VERY long and could fill a million pages - wow! By combining those 4 letters in different ways, the code provides all the instructions our bodies need to grow and stay alive.

Activity

The alphabet has many more than 4 letters (it has 26). See if you can use the 26 letters of the alphabet to crack the code below to find out what the secret word is.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

4	14	1		9	19		1	14		9	14	19	20	18	21	3	20	9	15	14					

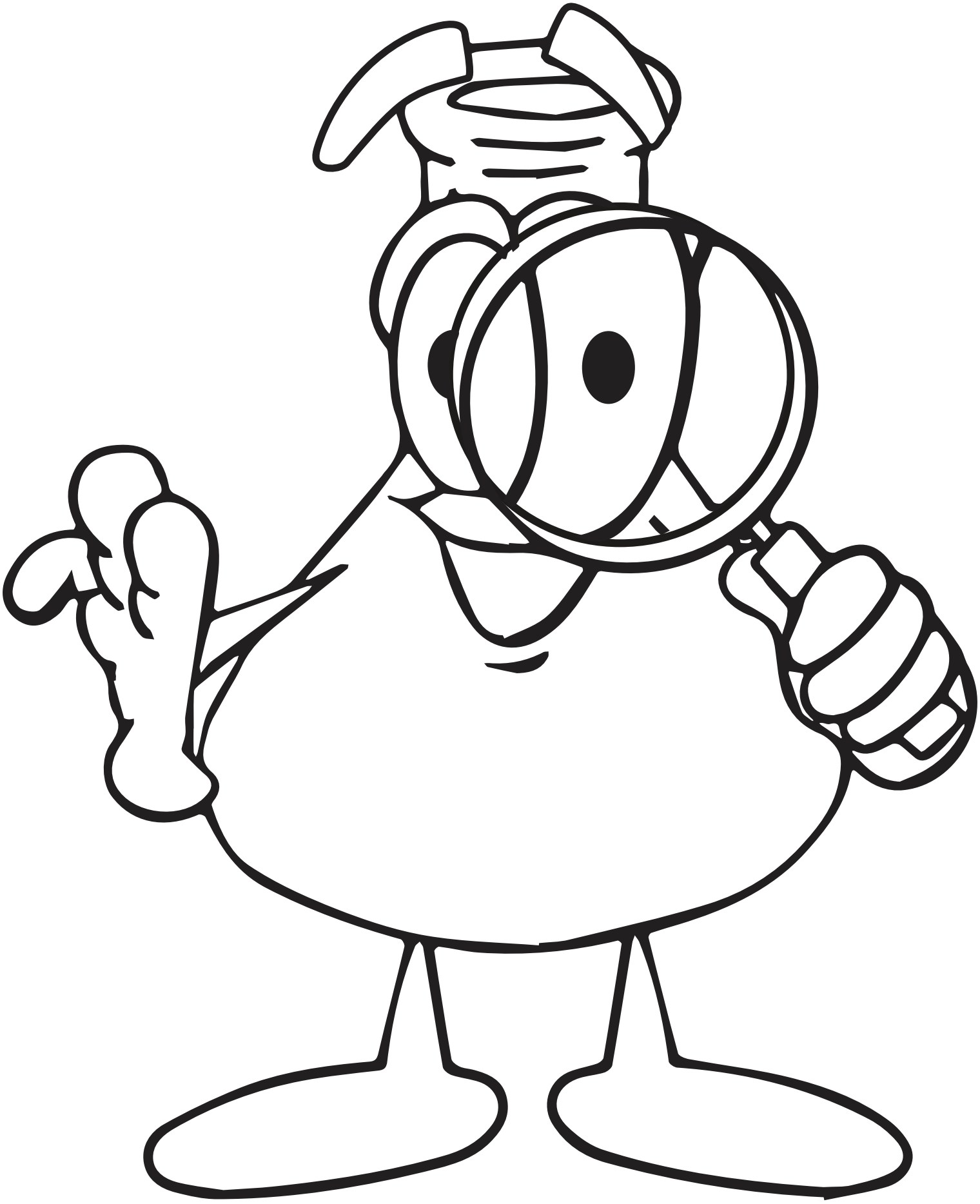
(13)	1	14	(21)	1	12		23	18	9	(20)	20	5	14		9	1		(1)		3	15	4	5		

20	8	1	(20)		15	21	18		2	15	4	25		3	1	14		18	(5)	1	4				

Secret Word: ___ ___ ___ ___ ___ ___

Imagine if it was 1 million pages like DNA!

Colour Me



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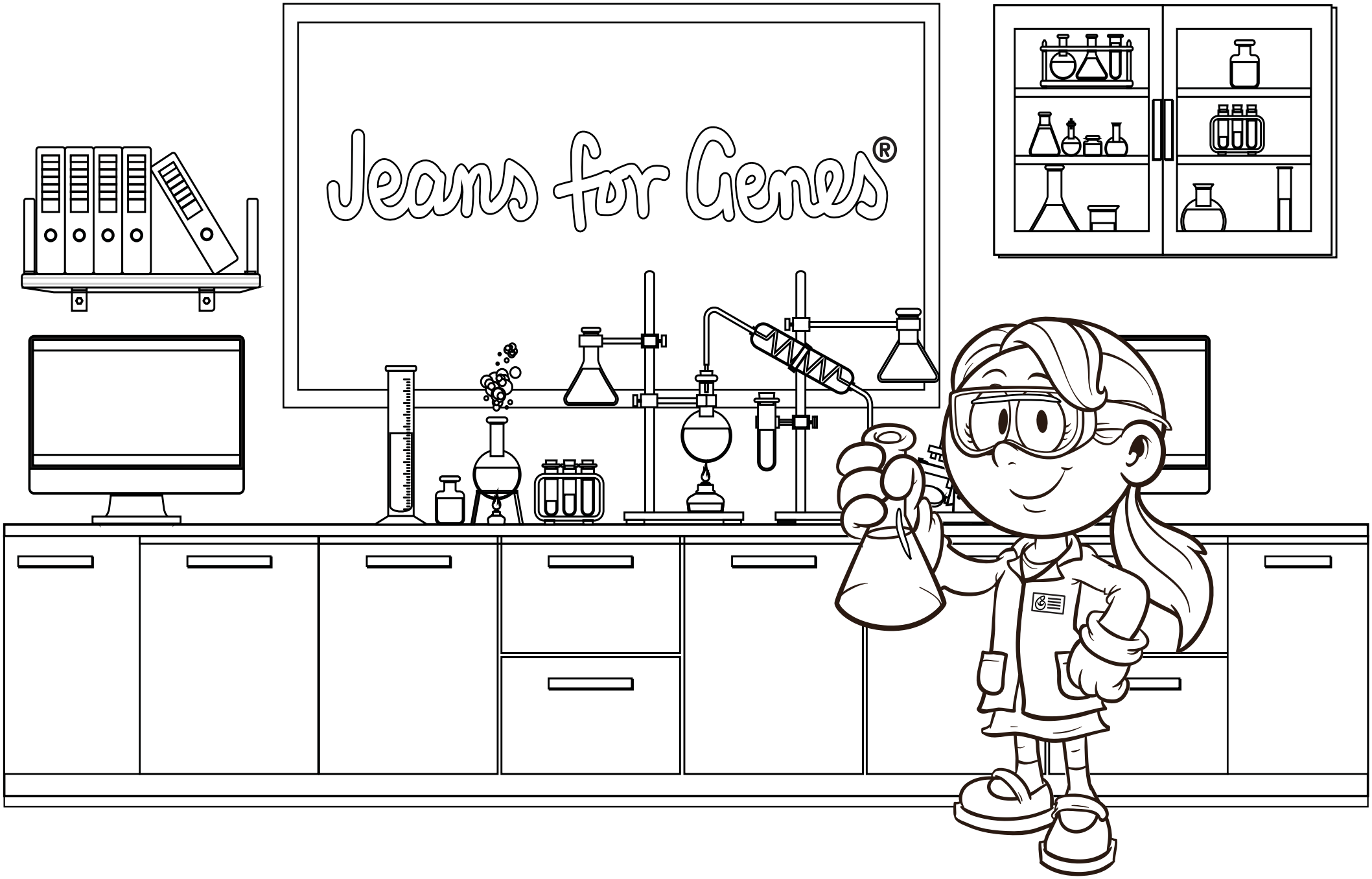

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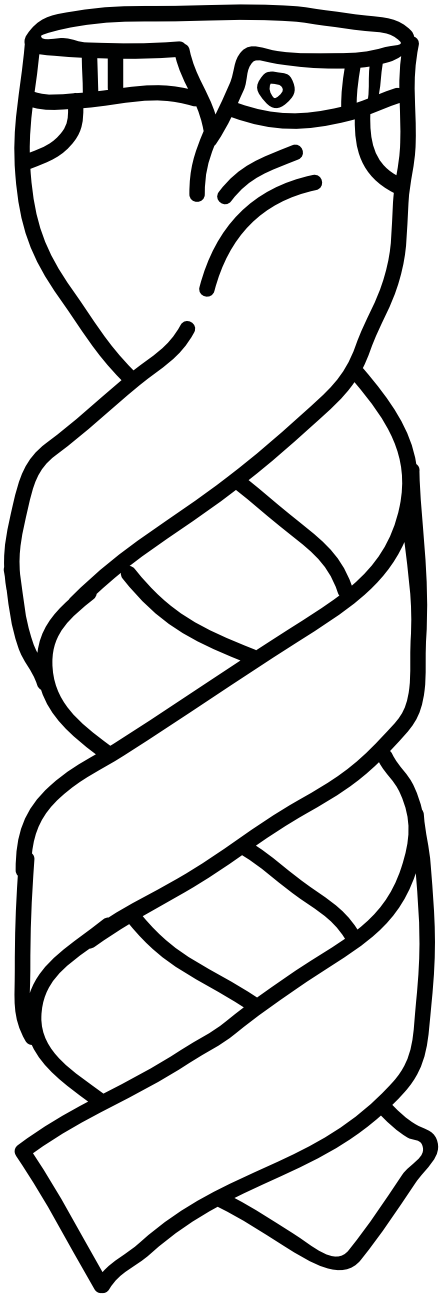
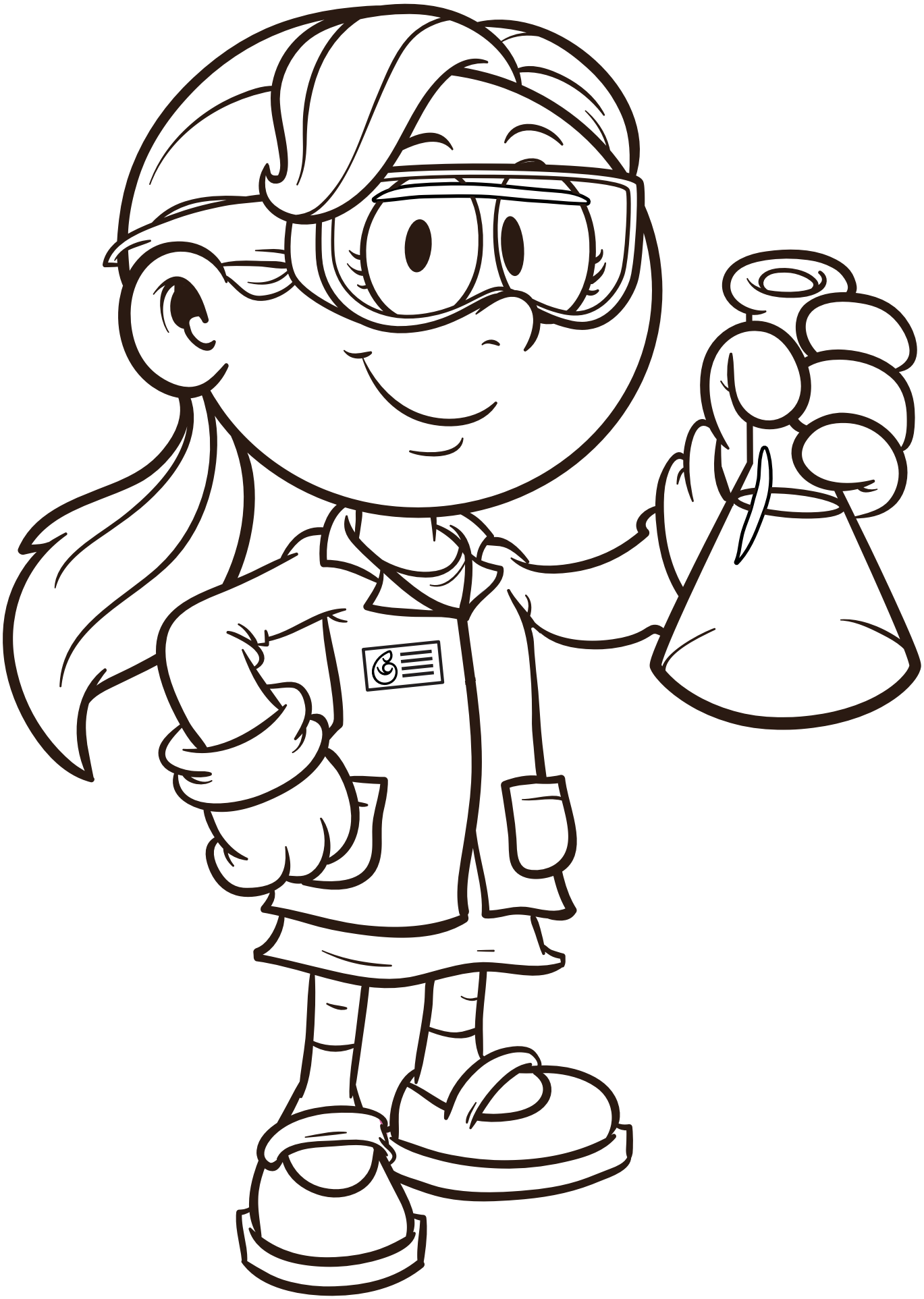


Jeans for Genes®

Colour Me



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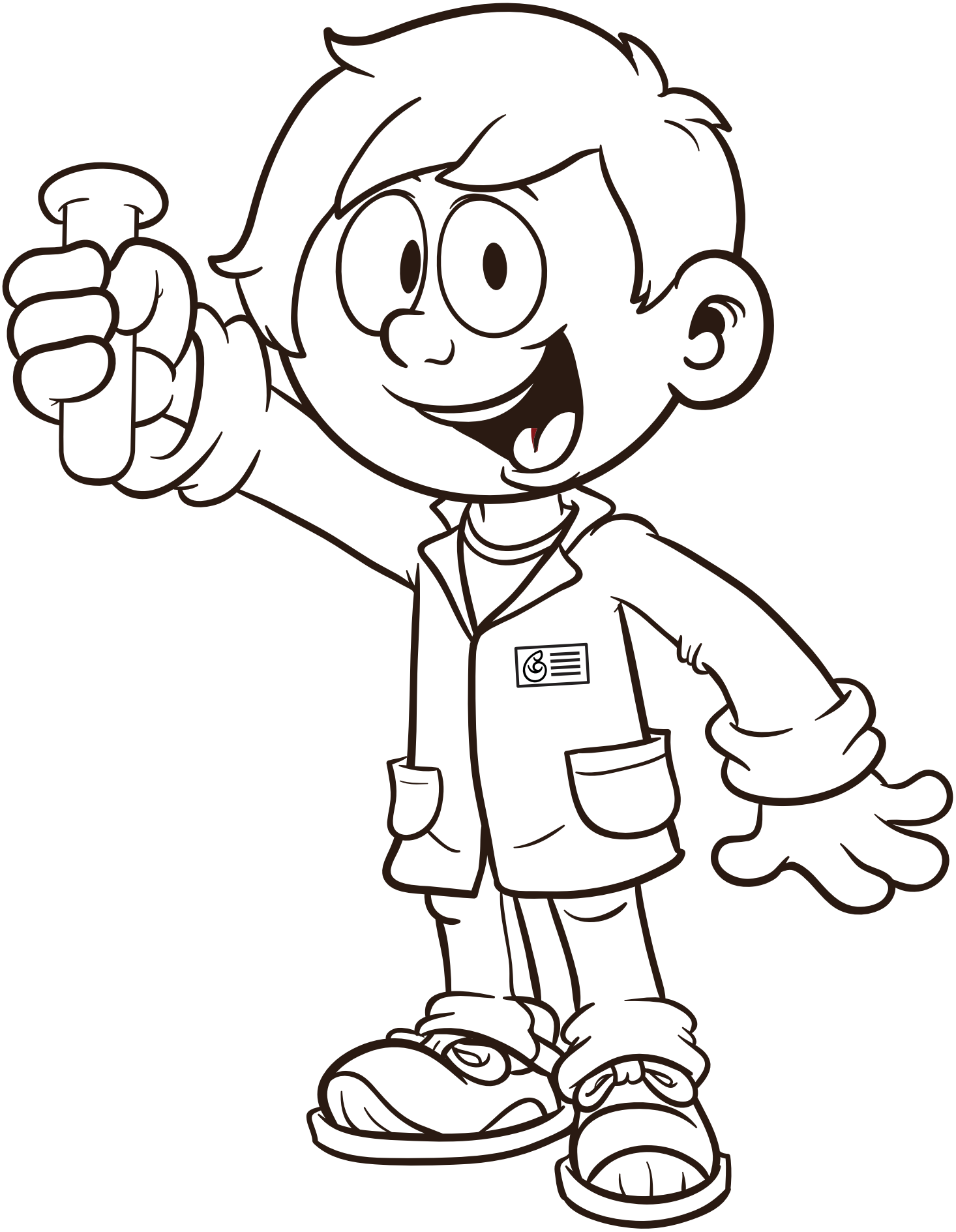

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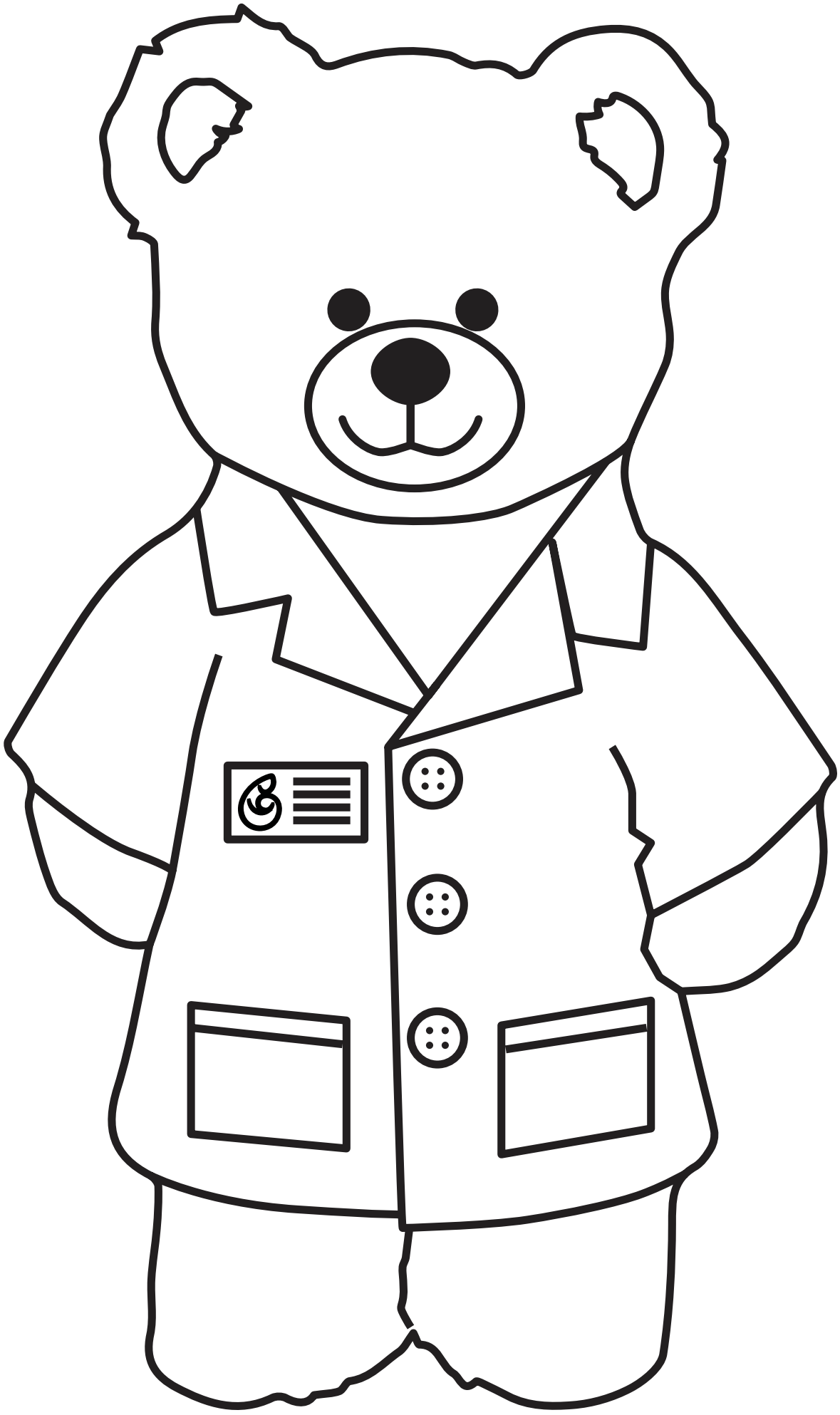
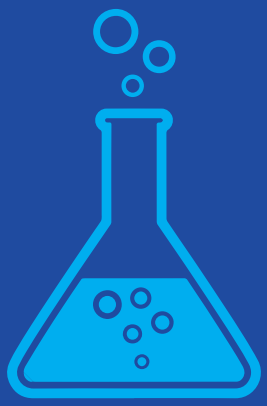


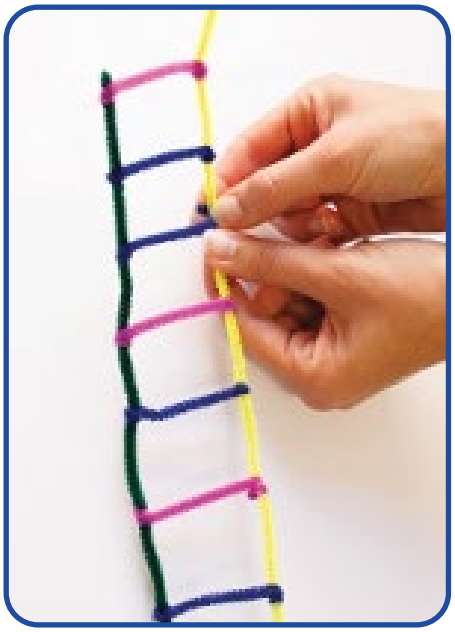


FUN EXPERIMENTS

Build DNA using pipe cleaners

This experiment requires:

- Set of pipe cleaners (different colours)



1. Use 2 long pipe cleaners for the sides of the ‘ladder’.

2. Cut 3cm long segments from other pipe cleaners until you have 6 or 7 segments (ideally of different colours)—wind together to look like the above images.

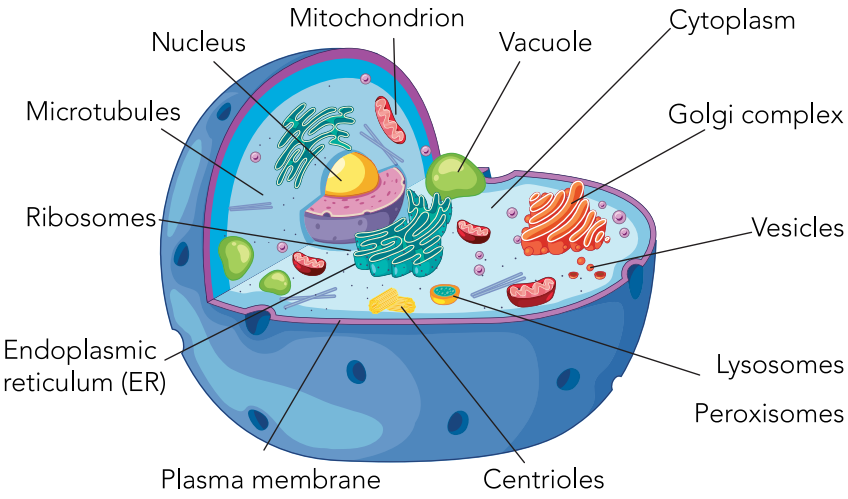
3. Then twist into a spiral staircase. This is what your DNA looks like!

4. Each rung on the ladder is a letter in the genetic code. Your actual DNA contains trillions of letters, and carries the instructions for making your entire body.

Craft Cells

This experiment requires:

- Modelling clay (multiple colours)
- Pom poms (ideally red, blue and green)



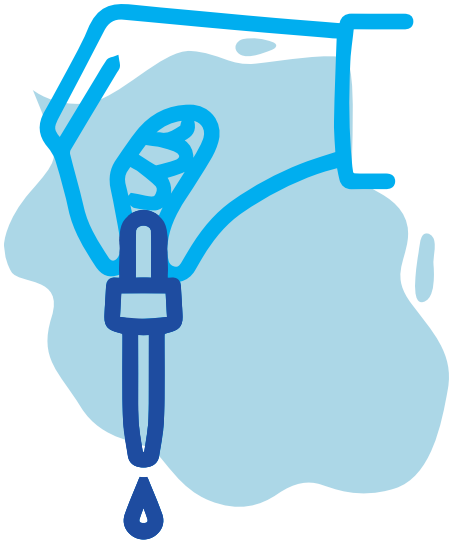
1. Create a flat circle of modelling clay.

2. Attach blue pom-pom for the nucleus in the centre (this is where the DNA lives, the instruction manual for the cell).

3. Use red pom-poms for ribosomes (the construction centres of cells), green for mitochondria (the energy source of cells).

4. If you want to craft your cell components out of modelling clay too, you can get more advanced like the pictures above (do a Google search to find out about each cell component).

Fine Motor Pipetting practice



This experiment requires:

- Conical tube (or smaller container)
- Squeezy pipette
- Culture plate
- Plastic beaker (or container)
- Food colouring
- Water

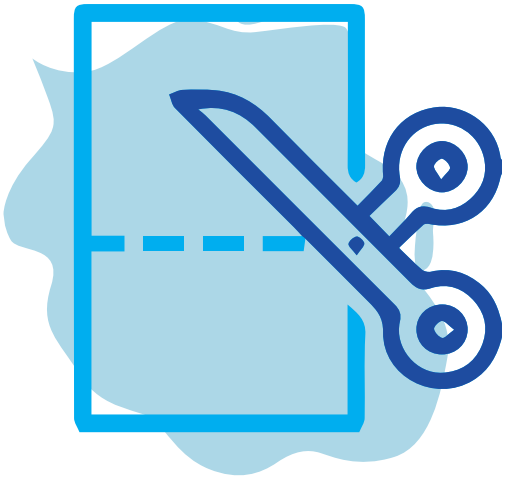
This is available as a kit at shop.cmri.org.au (while stocks last)

Get food colouring and dye some water. Kids can practice moving water from conical tube or beaker to culture plates using pipette only—no spilling!

Wear gloves for added difficulty in your practice.

See if you can draw a picture in your culture plate.

Create different body parts with your rainbow paper

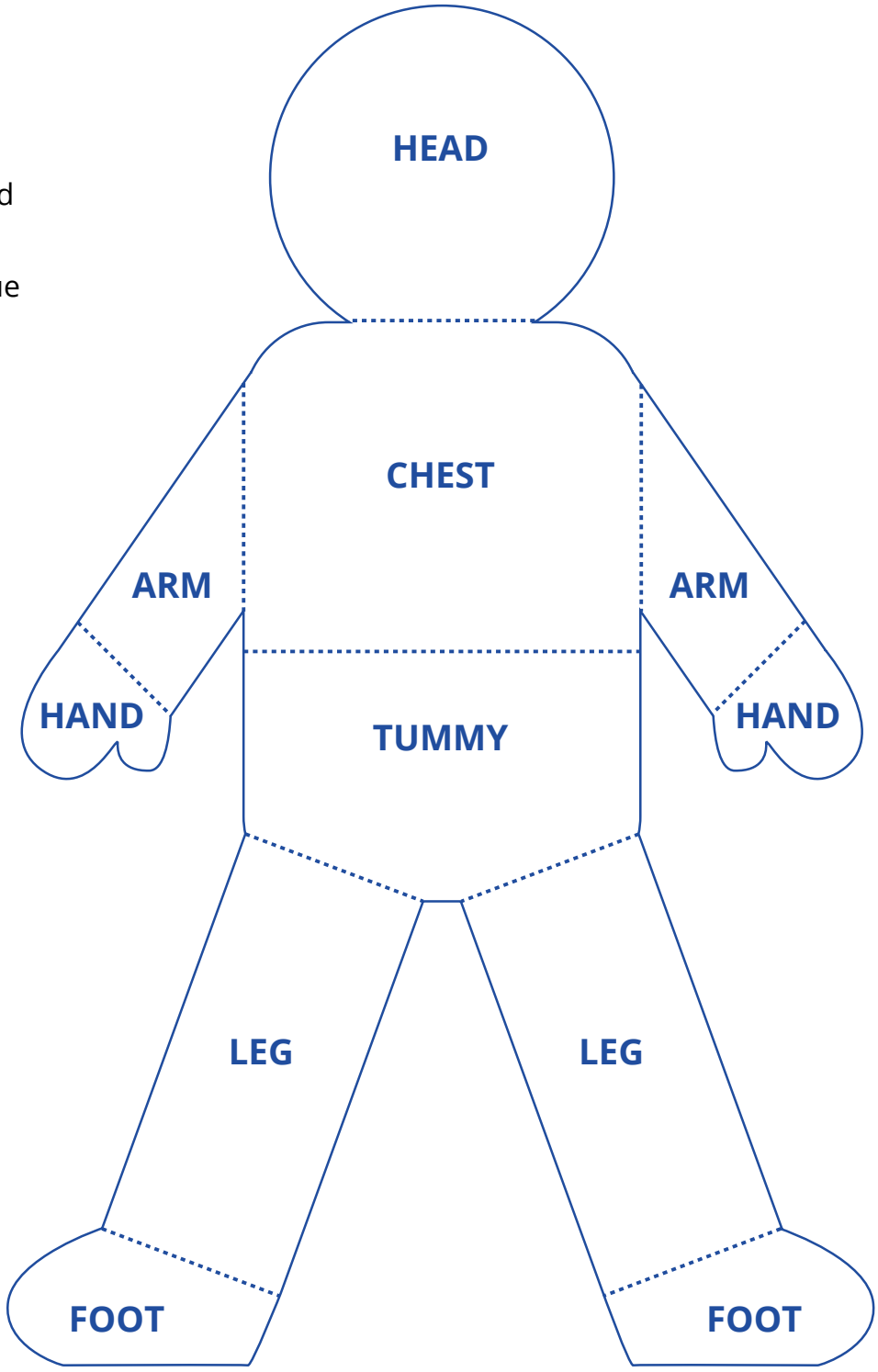


This experiment requires:

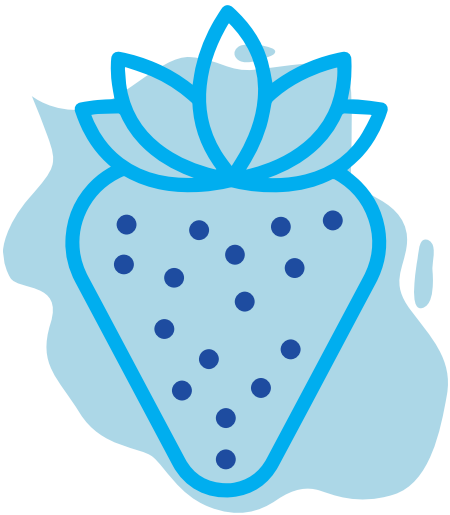
- Coloured paper (multiple colours)

Cut out different body parts in different coloured paper. Do different coloured eyes, hair, different sized lips and eyes and ears and noses...

Use these parts to create unique people. You'll see that no two people are the same, just like real life!



How to make DNA in your kitchen!



What you need

- 2 clear glasses
- A small funnel
- Coffee filter paper
- 2-3 small or 1 large strawberry
- 100 ml rubbing alcohol (like Isocol, found at the chemist)*
- 1 tsp salt
- 100 ml cold water
- Dishwashing liquid
- Toothpicks
- Chopping board and knife (or use your hands)

Watch this video of scientist Grady showing how this is done:

https://youtu.be/3NJo-UYL_HY

***Note:** once rubbing alcohol (isoproponal) is added, the mixture is no longer edible

How to make DNA!

1. Chop up strawberries and smash with the flat of the knife, or better yet use your hands to smash them. This is a great part of the fun for kids. (A food processor can also be used.)
2. Transfer the mashed strawberries to one of the glasses.
3. Dissolve salt in water and add to strawberry pulp.
4. Add a squirt of dishwashing liquid to the glass, swirl, and let sit for 1-2 minutes.
5. Place a coffee filter in the funnel and insert it into the second glass. Pour the strawberry mixture into the top of the funnel, so the filter retains the large chunks of strawberry. Only pink juice should run out of the funnel into the glass. Discard the filter paper and strawberry chunks.
6. Pour the rubbing alcohol into the glass of pink juice, and let sit. You'll see a frothy white material form near the surface. This is DNA!
7. Use a toothpick to fish out the long, goopy strands of DNA. It should have the same consistency as mucus. Kids can touch but not eat.

DNA in your kitchen (continued)

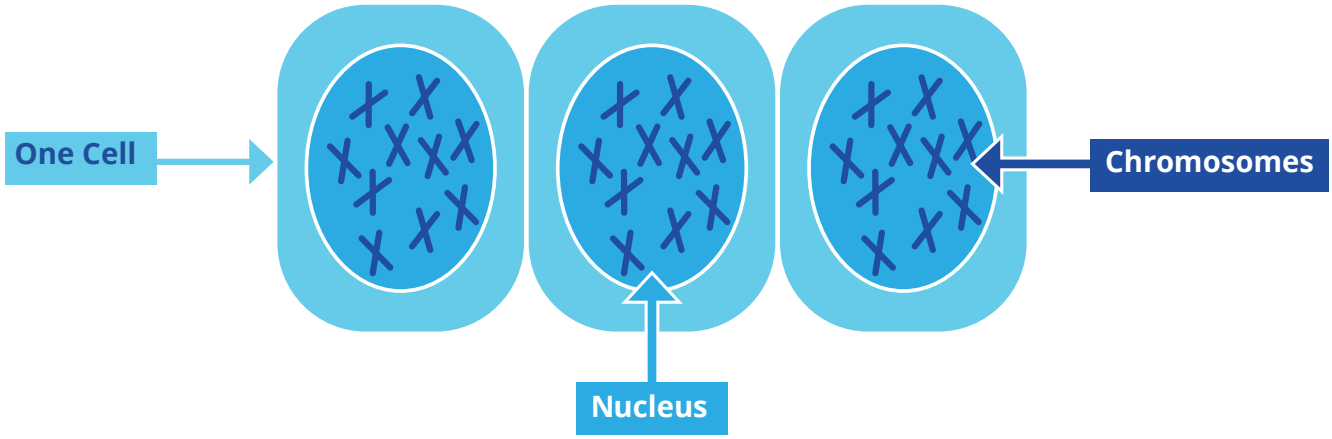
What's happening in science terms?

- Mashing up the strawberry breaks it into cells.
- Soap breaks open the cell membrane, like popping a balloon, releasing the cell contents, including DNA.
- By filtering the lumpy strawberry mixture, we remove most of the rubbish that is left when the cells are broken up. The liquid that we keep contains the DNA.
- Salt sticks to the DNA so you can see it (helps it precipitate).
- Alcohol dehydrates the DNA, helping it to clump together and 'precipitate' meaning it's no longer dissolved in water and becomes solid enough to see

So where did the DNA come from?

All living things contain DNA. Living things are made of tiny building blocks called cells. We can't see using our eyes, but we would be able to see them if we looked under a microscope. Your skin is made of layers of cells and strawberries are made of layers of cells too.

A single layer of cells



DNA is contained inside the nucleus of the cell, the cell's control centre, packaged into tiny structures called chromosomes

Inside our cells, and the cells of all living things - including strawberries - there is a collection of chromosomes.

Chromosomes are made of a very long strand of DNA. DNA is like a blueprint or instruction manual that tells our cells and our whole body how to work. Your DNA makes you human, a strawberry's DNA makes it a strawberry. If your DNA was switched around, you'd be a strawberry instead of a human!

DNA is normally far too small to see, even with a microscope. It is an incredibly thin but very long molecule. Adding alcohol to the top of the strawberry juice causes the DNA molecules to clump together. Eventually, enough DNA clumps together so that we can actually see it!

See the bacteria around you

Living things too small for you to see (bacteria, moulds, and viruses, which are also known as ‘germs’) are all around. They are on your body, in the soil, and on surfaces around your home.

While some germs can make you sick, most of these living things are harmless or even beneficial (you need bacteria in your gut, for example, to digest food).

While, individually, germs are too small to see, you can grow up ‘colonies’ or large groups of bacteria which are visible to the naked eye.

Let’s see what living things you have around your home and yard!

You will first need to make a surface and food source for your colonies to grow on. Scientists use ‘agar plates’ to do this, and you can make something similar in your home:

STEP 1: Make homemade agar plates

Agar is a firm, gelatinous substance at room temperature which is not broken down by bacteria, making it an ideal substrate for growing the organisms. Although agar is preferred, other ingredients such as gelatine can be used when no agar is available. You can make your own substitute agar plates or 'petri dishes' at home out of common kitchen ingredients.

Things you need:

- Soap
- Water
- Measuring cups
- Measuring spoons
- Saucepan
- Stirring spoon
- Sugar
- Beef stock
- Gelatine
- Plastic food storage bags
- Plastic wrap
- Sterile plastic or glass petri dishes OR Aluminium foil patty pans and cupcake pans to hold them OR mini foil pie plates

1. Wash your hands, your kitchen counter, and all dishes you will be using thoroughly. Although you will not be able to get totally sterile conditions, you should try to be as careful as possible to avoid introducing germs to your petri dishes.

2. Mix 4 cups of cold water with 4 envelopes of unflavoured gelatine in a saucepan. Stir in 8 tsp. of sugar and 4 beef stock cubes (4 tsp).

3. Heat the saucepan on medium low heat while continuously stirring it.

4. Turn off the heat when the mixture boils and allow it to cool for 3-5 minutes.

5. Fill sterile petri dishes 1/3 full of the mixture until you have used it up. If you do not have sterile petri dishes, place aluminium patty pans in a cupcake tray OR mini foil pie plates and fill them about 1/3 full of the liquid.

6. Place the agar plates in the refrigerator for 2-3 hours to allow the gelatine to cool and firm.

7. Cover your agar plates. If you are using patty pans or pie pans, cover the whole pan with plastic wrap or put each cup in a separate food storage bag. If you are using petri dishes, cover each with its top lid. Use your agar plates within 3 days.

WARNING: Avoid touching, breathing on, or otherwise coming into contact with any of your agar plates, since this can introduce bacteria, contaminating the plate

STEP 2: Now, LET'S GROW BACTERIA!

You need:

- your homemade agar plates
- paper towels or plastic wrap
- Cotton buds (optional)
- 35 to 37°C oven, or a warm spot behind the fridge or near a heater
- Sharpie or other permanent marker

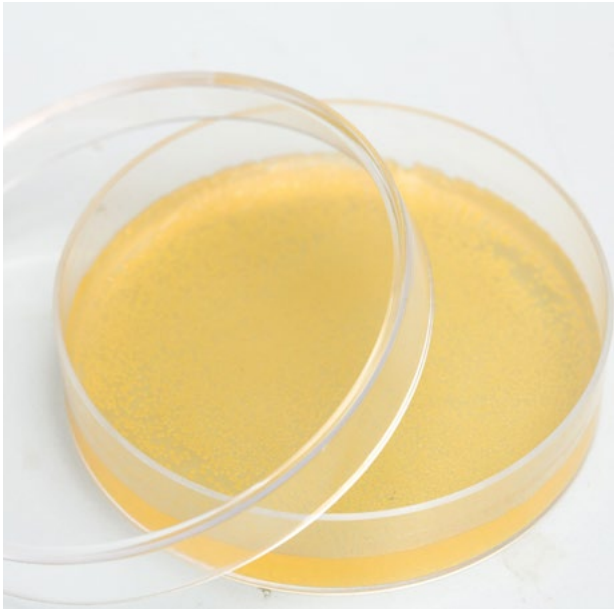
1. Choose several locations around your home and use the Sharpie to label the bottom of your plates accordingly. For example: garden soil, computer keyboard, sink taps, refrigerator handle, your mouth, kitchen table …. The choices are up to you. You can use one plate for each location but keep one plate, labelled 'control', which won't be exposed to any bacteria.

2. Take the cotton bud or a bit of paper towel and wipe across the surface your testing. Immediately wipe the cotton bud or towel across the surface of your agar plate. Don't push too hard and tear up your gelatine. Just brush enough to be sure you've transferred any bacteria to your dish. Use a separate cotton bud for each location: one for the computer, one for the sink etc.

3. Lightly cover your agar dishes with paper towels or a loose bit of plastic wrap (you want air to get into the plates so the bacteria can breathe and grow).

4. Place your plates in a warm place, at approximately 37 °C, overnight or up to 2 days, depending on how long it takes your bacteria to grow. This includes your 'control' plate.

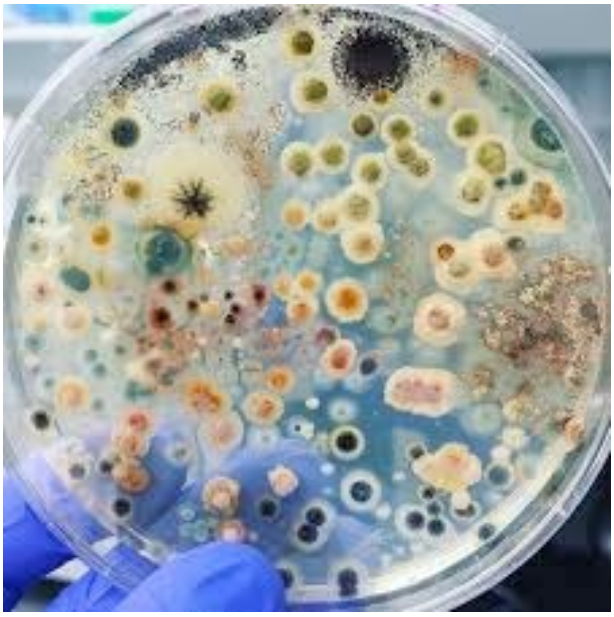
5. Check your plates! What do you see?



Control
Your 'control' plate should have nothing growing on it. If it's clean—well done! If something is growing on it, it means you contaminated the plate at some step along the way. As a scientist, you'd need to improve your sterile technique before being allowed to work in a lab.

Source: *Learning Center - Home Science Tools*

Bacteria
Circular growths are bacterial colonies. Each circle grew from a single bacterium.



Moulds
Fuzzy growths are mould. These usually grow from spores scattered in the air.

Source: *www.horiba.com*

The exotic
Sometimes your mould or bacteria are different coloured or smell strange.

These living things are always around you, and now you know who your housemates are!

Don't forget to throw away your plates after a couple of days or they will get extra yucky!

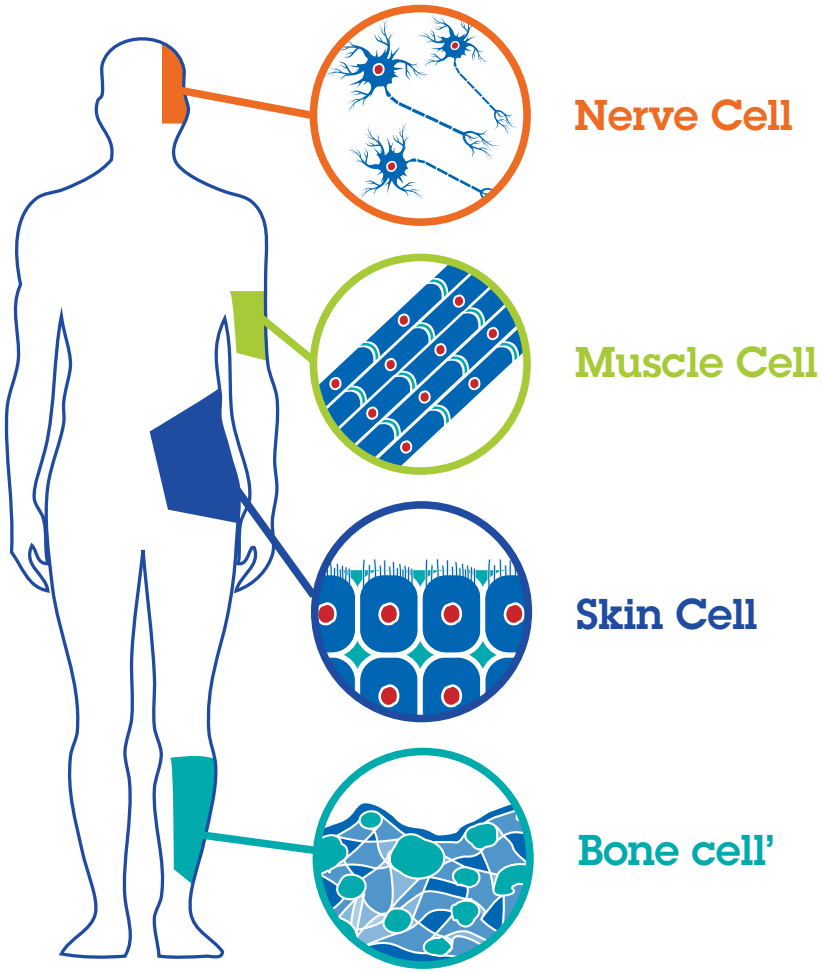
LEARN MORE

Children's Medical Research Institute (CMRI)

At CMRI, we have many different types of scientists working together to find answers. They mostly study genetic diseases.

A genetic disease is when something goes wrong inside our body and makes us feel unwell. The goal of our scientists is to find treatments or cures, so people feel healthy again.

Some example genetic diseases are: cancer, cystic fibrosis, and metabolic disorders. There are over 6000 different genetic diseases.



Our bodies are made of trillions of tiny building blocks called cells. There are many different types of cells that each have a different job to do in the body. E.g. nerve cells make it so we can think and feel. Muscle and bone cells allow us to move, and skin cells protect our bodies from the outside world.

Genes and DNA

What controls all the trillions of cells inside our body? What makes brain cells and muscle cells do what they're supposed to do? The answer is DNA! It is the 'instruction manual' or control centre for everything.

DNA stands for **'d**eoxyribo**n**ucleic **a**cid'. It is a chemical found inside the cells of our body and is very special because it carries information—all the information our cells need to live and pass on copies of our DNA to our children.

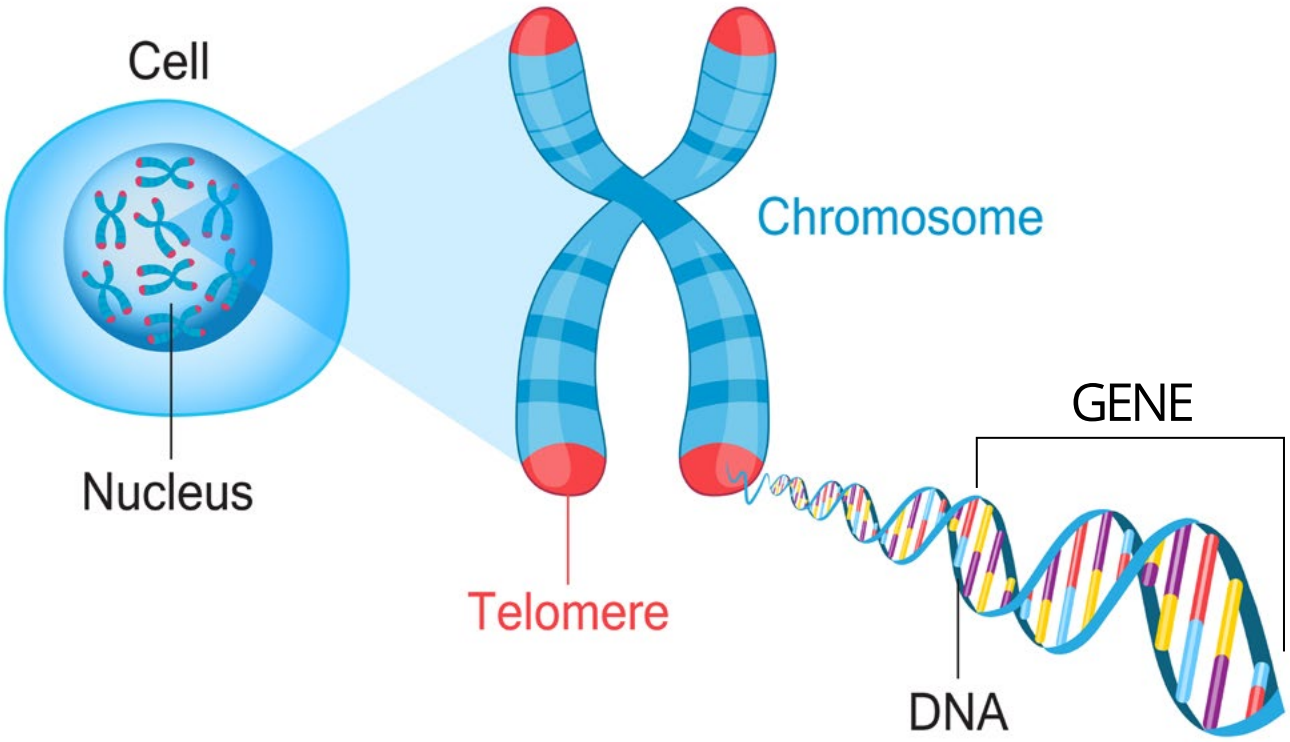
The information written in our DNA is like the letters in a book. A single letter on its own doesn't make much sense. Example: **C**

But when you put enough letters together, they mean something. Example: **CAT**

Genes are like words. They are the portions of DNA that make sense to the body.

Our bodies require a lot of information or genes to know what to do.

If you wrote out all the letters in your DNA, it would fill 1 million pages in a VERY large book.



Understanding Genes—Genetic Traits

Can you roll your Tongue?

How are your earlobes attached?

Have you got a hitch-hikers thumb?

What kind of hair-line do you have?

What other traits do you have? Think about...

- Eye colour
- Hair colour
- Curly, straight, or wavy hair
- Freckles
- Nose shape
- Dimples
- How tall you are
- Your skin colour

Write them down:

Activity

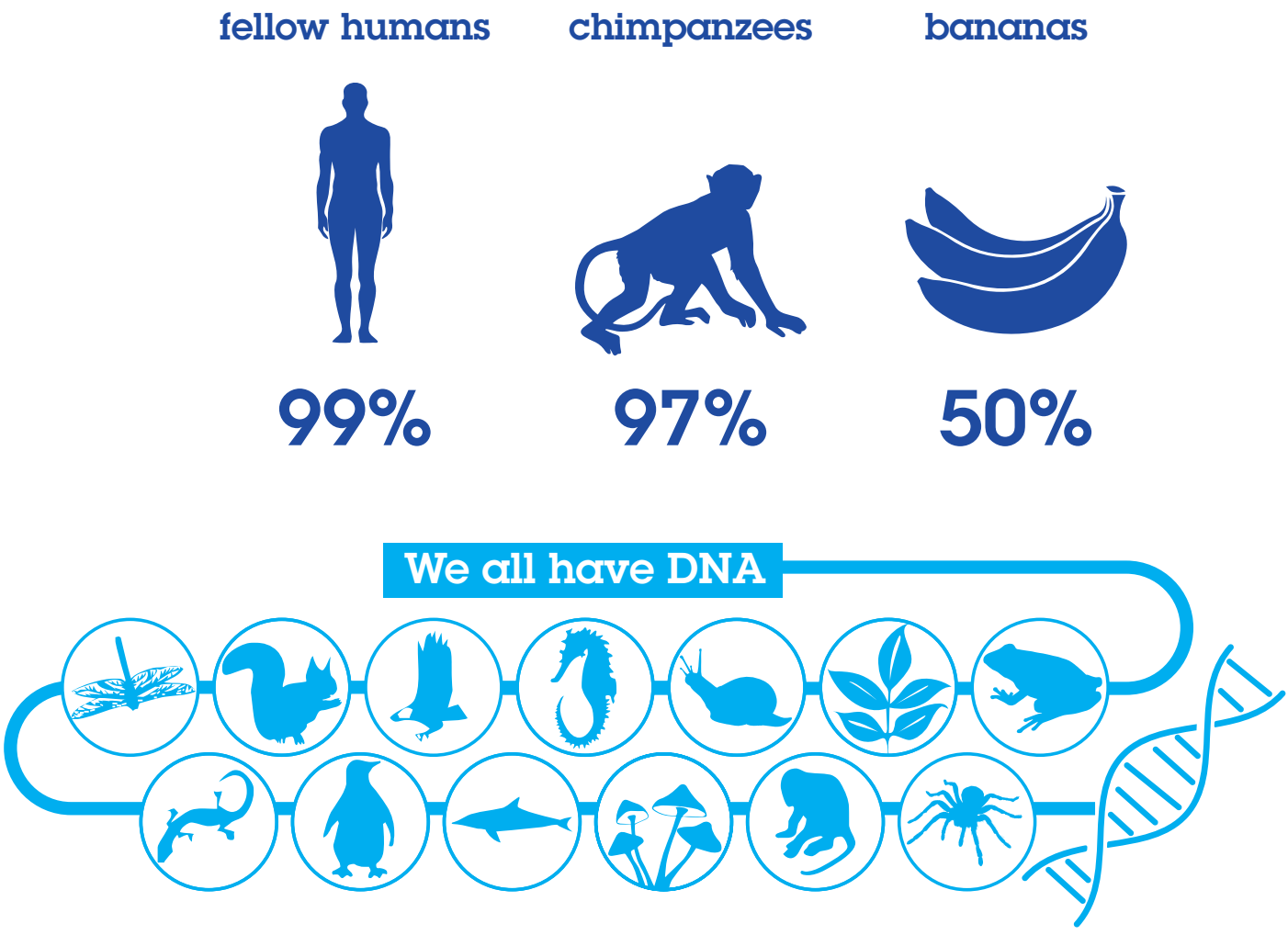
1. List as many things that you have in common with a family member and as many things that are different:

SAME AS FAMILY MEMBER	DIFFERENT FROM FAMILY MEMBER
e.g. blue eyes	*e.g. freckles*

All Earthlings have DNA in common

You don't just share DNA in common with your family. The DNA in your body is very similar to other humans and even to animals and plants! That's because we all got our DNA from a common ancestor (like a great, great, great... grandmother) millions of years ago. All life on Earth is related.

How much of our DNA is the same as



What is Science?

Vocabulary words in bold

Being a **scientist** is like being a detective. You search for **clues** to help you understand what's going on in the world around you. Doing **science** means using the **scientific method.**

The scientific method has several steps to help in the search for answers:

1. **Observe** how things work using your eyes and other senses, or with tools, like **microscopes**.

   Example: You see that leaves on a tree are green. You look at a leaf under a simple microscope and see that there are tiny lines in the leaf that are NOT green.

2. Come up with a **hypothesis**. A hypothesis is a story that you think explains what you've observed.

   Example: There are small structures within certain parts of the leaf that make it green.

3. **Test** your hypothesis using an **experiment**.

   Example: I will keep looking closer and closer at the leaf with more and more powerful microscopes, until I find the part of the leaf that makes it green.

4. **Analyse** your findings. Did your experiment work as you expected? If yes, then your hypothesis is correct. If no, then you need to look at all you've learned from your experiment and come up with a new hypothesis to test.

   Example: I looked up to 1000x magnification and saw hundreds of tiny ovals within the leaf that were green, while all other parts of the leaf had no colour. So, yes, my hypothesis was correct: there is a small structure within the leaf that makes it green.

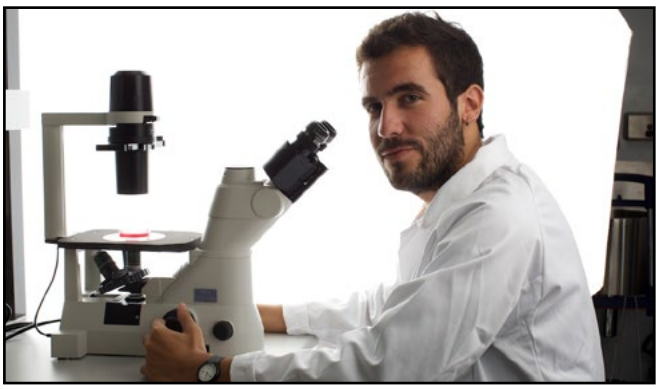
5. **Communicate** your results. Science works best when you share what you've learned with others. Ask more questions and read about what other people have discovered, so together you can find answers more quickly.

   Example: I tell people what I've found and that I am calling the green parts of the leaf I discovered 'chloroplasts', which means 'green' 'formed' in Greek. I ask other people if they have seen these and if they know more about what they do?

6. Usually answers lead to more questions, so you go through the process of **observe -> hypothesise -> test -> analyse -> communicate** over and over again.

Scientists

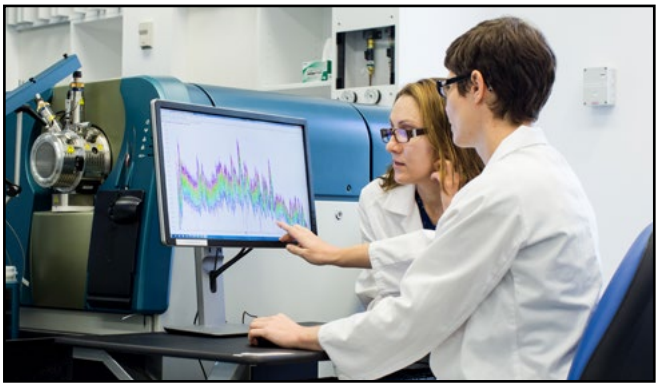
Here's some of the types of scientists at CMRI and what they do:



Biologists are scientists who study living things—this includes the cells that make up our bodies. They search for clues to understand how our bodies work. Some biologists study **infectious disease**, which is when we get sick because of tiny creatures too small for us to see (**viruses** or **bacteria**) that invade our cells.

Chemists understand how the smallest components of things (called atoms and molecules) can be brought together or torn apart to create new things. For example, plants take carbon dioxide (part of the air) and mix it with sunlight and water to make sugar, which we eat! Chemistry is the basis of all life, so it's very important for biologists and chemists to understand these processes.

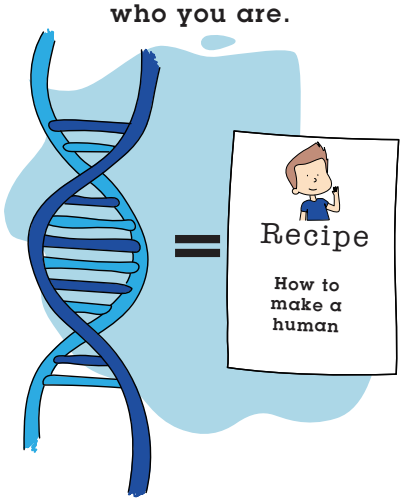
Mathematicians are people who use maths to solve problems. These people can help biologists make sense of the complex changes that occur inside our cells all the time.



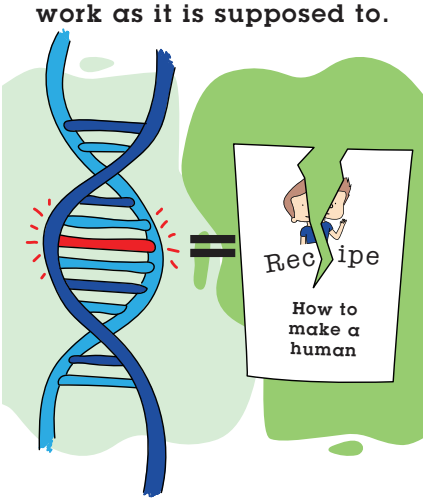
Software Engineers create **computer** programs that make it easier for other people to access and use the information our biologists, chemists, and mathematicians have gathered.

How can scientists fix genetic diseases?

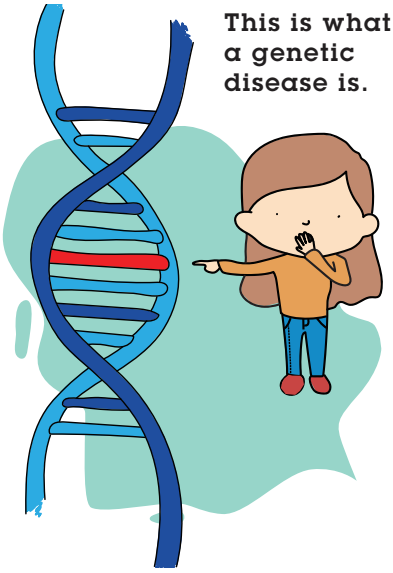
Genes (or DNA) are like a recipe to make you, who you are.



If there's a mistake in the DNA, the recipe doesn't work as it is supposed to.

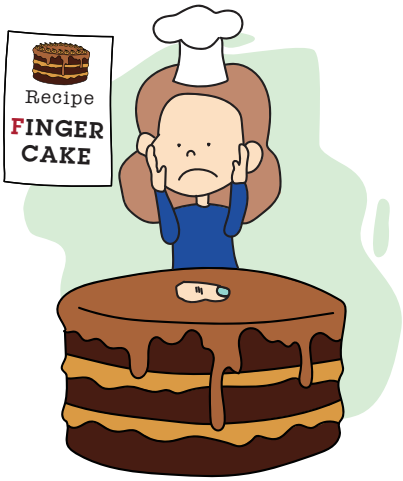


This is what a genetic disease is.

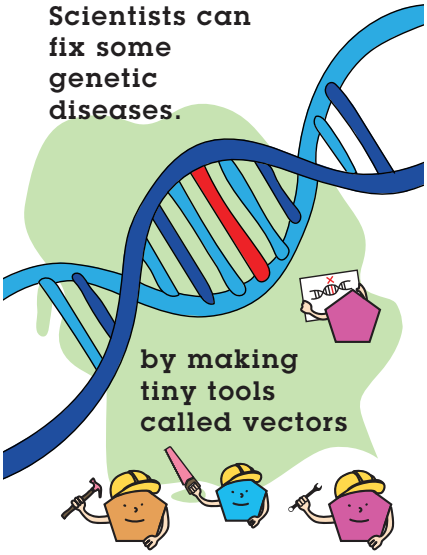


It's like if you want to make a **Ginger cake**

And the recipe says **Finger cake** instead.

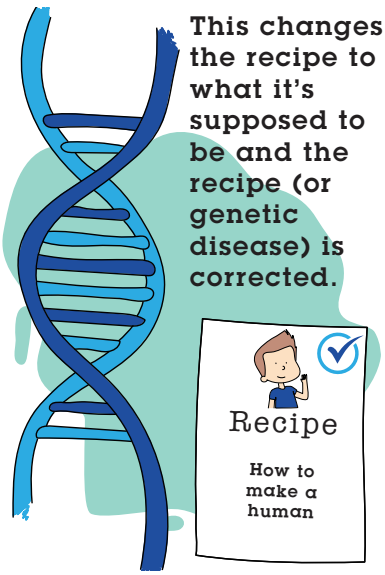


Scientists can fix some genetic diseases.



and replace it with the right letter.

This changes the recipe to what it's supposed to be and the recipe (or genetic disease) is corrected.



VOCABULARY QUIZ

1. Our bodies are made of trillions of building blocks called _____.

2. The instructions that tell cells what they're supposed to do is carried in a chemical called _____.

3. _____ are like words made from the letters in DNA.

4. We all have different_____ like eye colour or hair colour.

5. A _____ is a type of scientist that studies cells and living things.

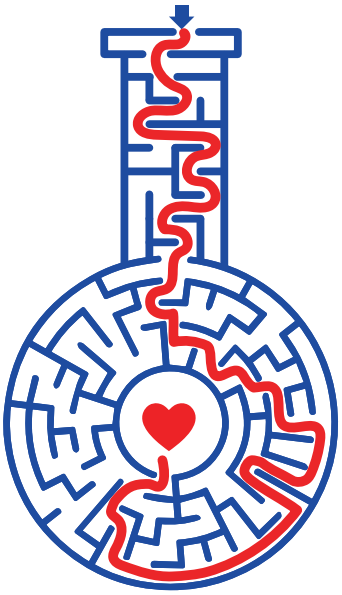
6. When something goes wrong with our DNA, it can cause a _____, and make us feel unwell.

7. You can fix errors in DNA using _____.

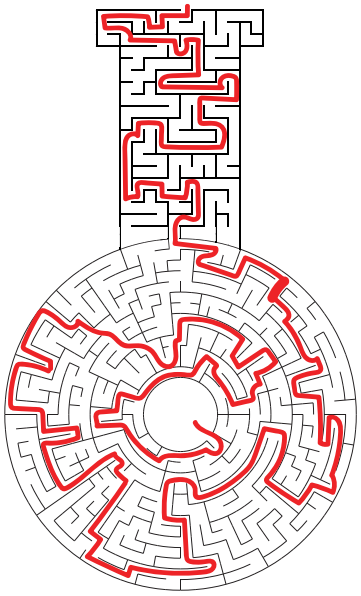
ANSWERS

Answers

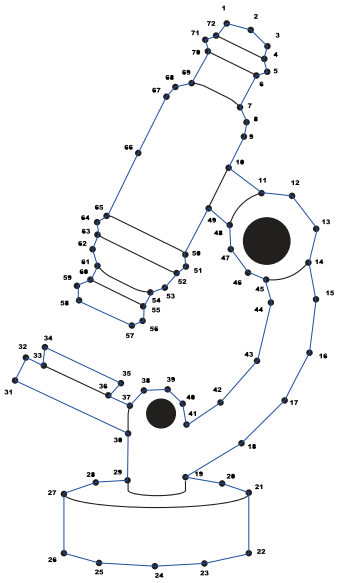
Maze - Level 1



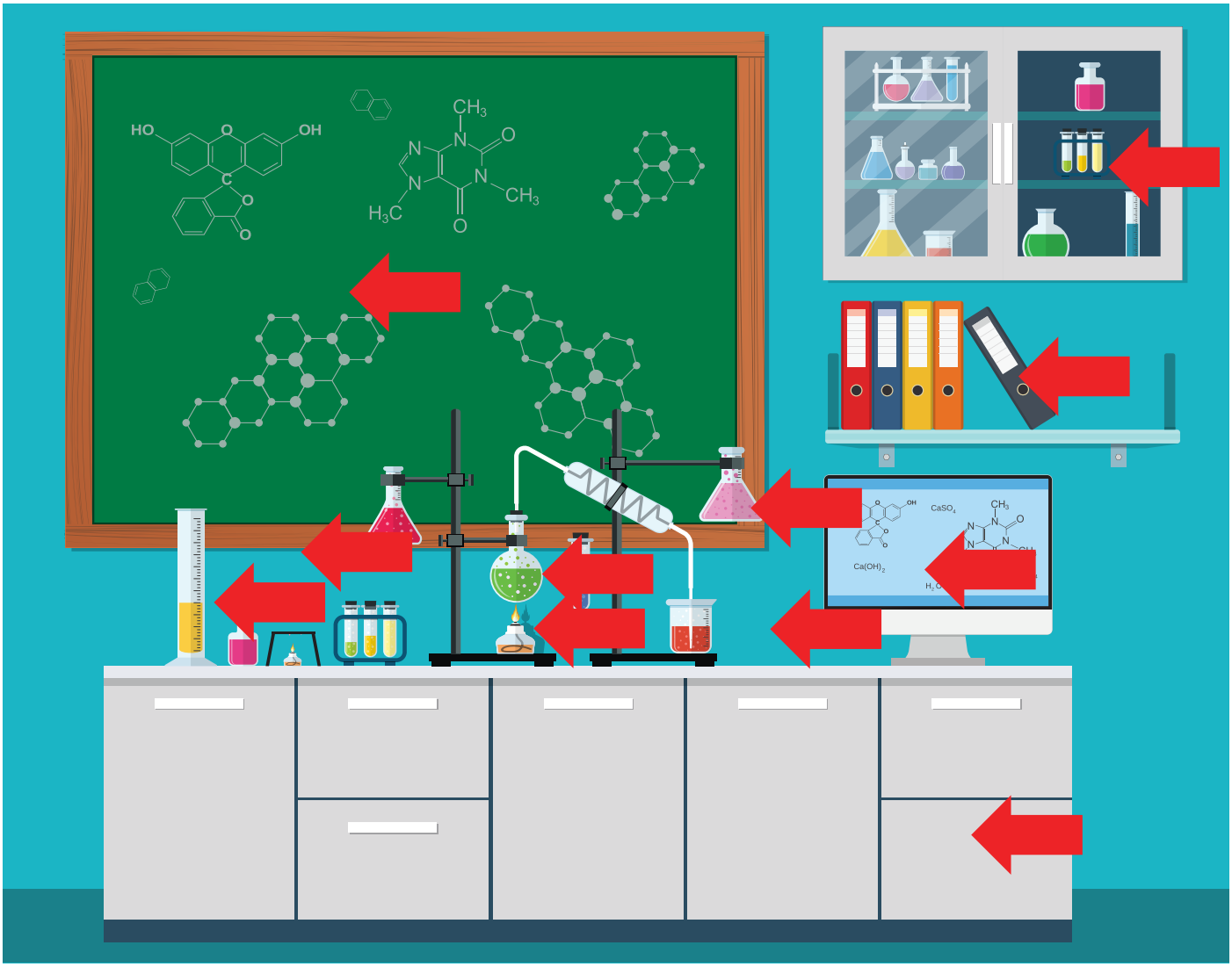
Maze - Level 2



Join the dots



Spot the difference



Colour by numbers

Find a word

N	W	E	R	T	G	I	A	F	J	C	U	R	E	R	U	J	O	M	M
Q	B	O	D	Y	E	O	S	G	L	K	I	Y	D	T	H	K	L	M	I
B	L	T	Y	U	N	P	D	U	L	Z	X	Z	G	X	V	P	N	A	C
I	X	C	N	M	E	L	E	H	V	B	W	Q	F	C	I	C	B	T	R
O	T	P	S	J	T	Z	T	B	V	C	O	M	P	U	T	E	R	H	O
L	K	Y	C	D	I	J	N	H	W	M	S	A	E	R	H	L	R	E	S
O	N	F	I	X	C	Y	U	B	F	R	T	B	E	I	R	L	O	M	C
G	E	N	E	E	D	G	D	F	T	I	R	A	V	R	G	C	G	A	O
I	U	R	N	O	I	N	Y	N	C	X	T	Z	D	E	D	V	A	T	P
S	C	K	T	U	S	I	G	T	A	M	R	W	T	F	C	E	Q	I	E
T	P	I	I	H	E	Y	H	T	E	Z	C	S	Q	M	R	W	U	C	E
A	M	J	S	O	A	J	Y	N	L	D	E	M	X	G	D	E	F	I	I
G	O	P	T	V	S	U	T	S	T	T	Y	F	C	F	N	B	S	A	F
V	K	M	B	U	E	X	P	E	R	I	M	E	N	T	C	V	L	N	X
I	A	H	N	I	I	J	K	A	R	A	Q	W	G	D	H	C	W	P	W
M	L	J	O	K	O	V	N	J	P	I	E	U	M	S	E	S	S	M	K
L	H	Y	P	O	T	H	E	S	I	S	H	V	Z	X	M	Q	X	C	D
S	B	Z	P	S	O	F	T	W	A	R	E	E	N	G	I	N	E	E	R
Y	T	A	L	P	L	K	B	B	K	N	L	A	A	K	S	Q	A	W	Y
Q	H	Q	A	A	Z	P	M	Z	X	S	N	J	O	Q	T	Z	D	U	W

Code cracker

Answer: DNA is an instruction manual written in a code that our body can read.

Secret word: mutate

Vocabulary quiz

Answers: *cells, DNA, Genes, traits, biologist, genetic,* gene therapy

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CHILDREN'S MEDICAL RESEARCH INSTITUTE

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