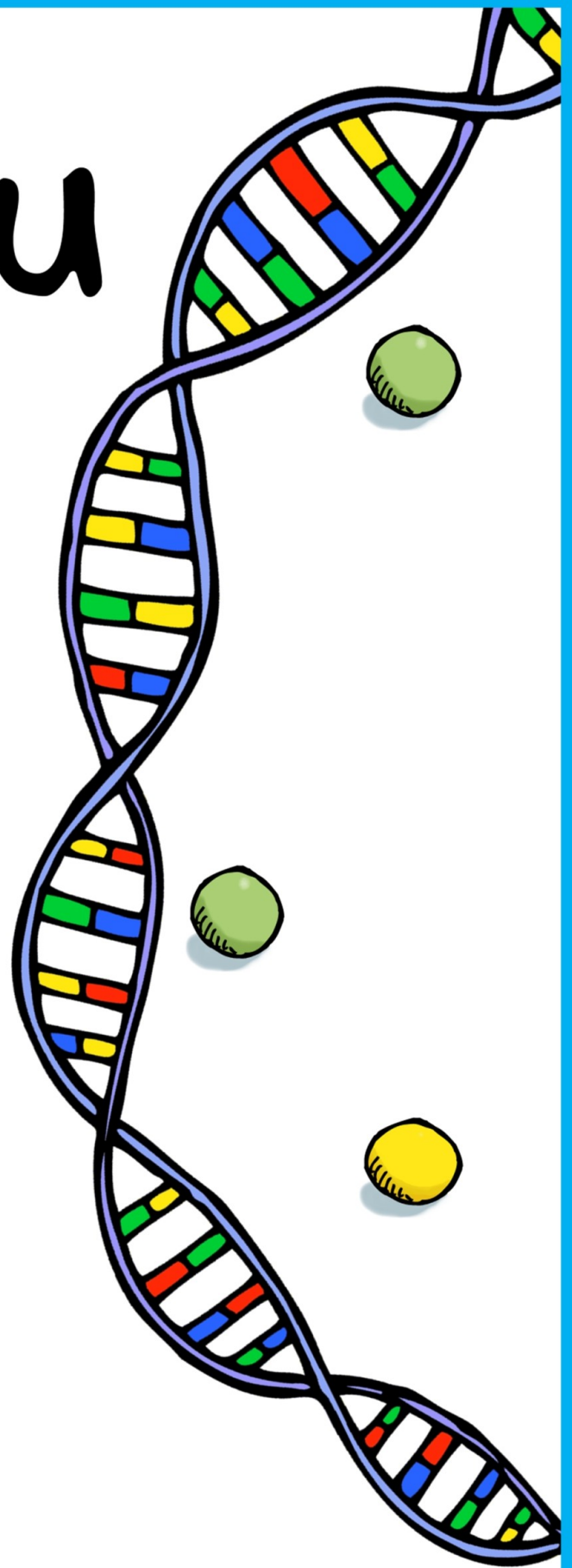
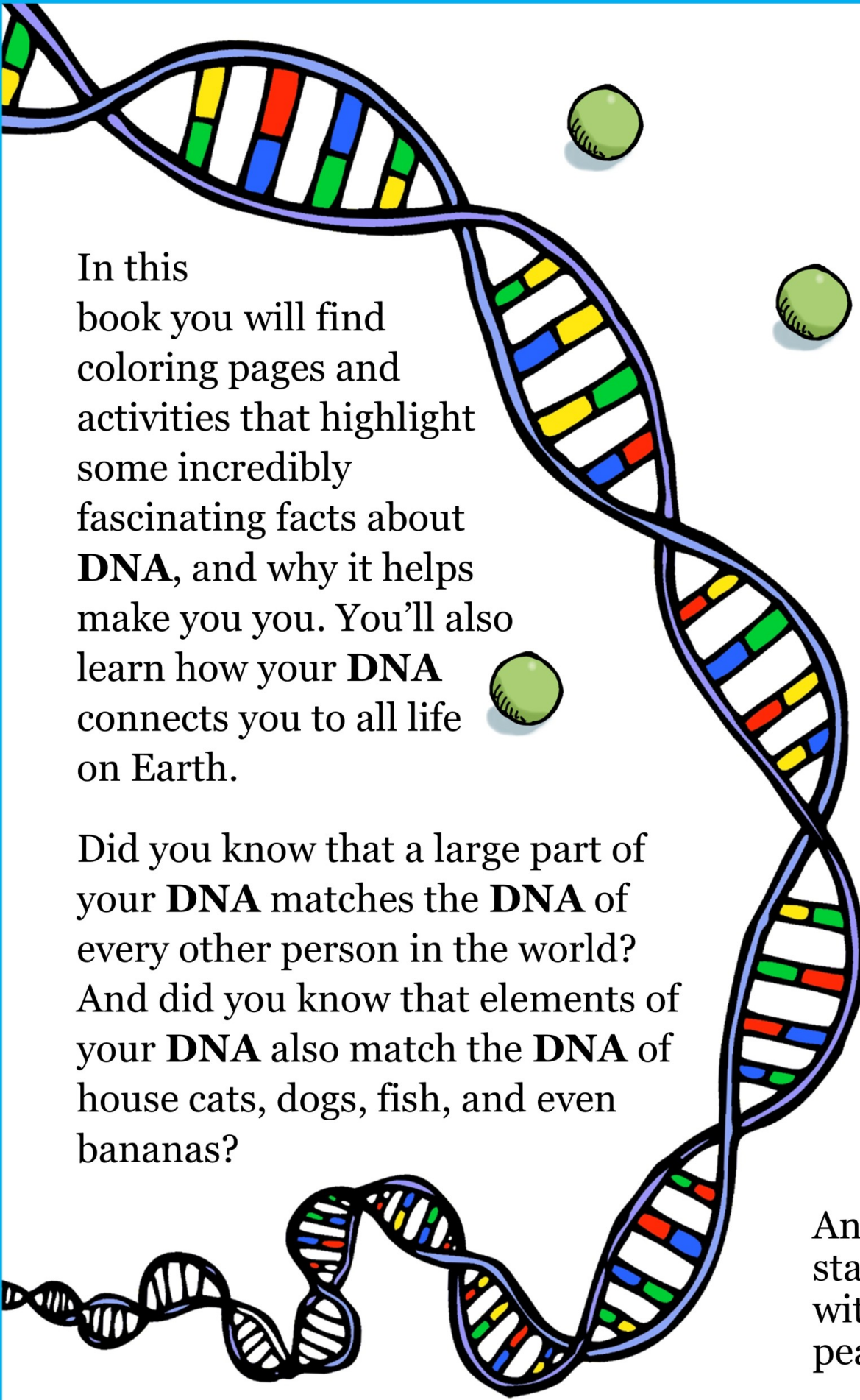


Do you
know
peas
about
DNA?



LEARN AS YOU COLOR
For ages 8 to adult



In this book you will find coloring pages and activities that highlight some incredibly fascinating facts about **DNA**, and why it helps make you you. You'll also learn how your **DNA** connects you to all life on Earth.

Did you know that a large part of your **DNA** matches the **DNA** of every other person in the world? And did you know that elements of your **DNA** also match the **DNA** of house cats, dogs, fish, and even bananas?

And it all started with peas.

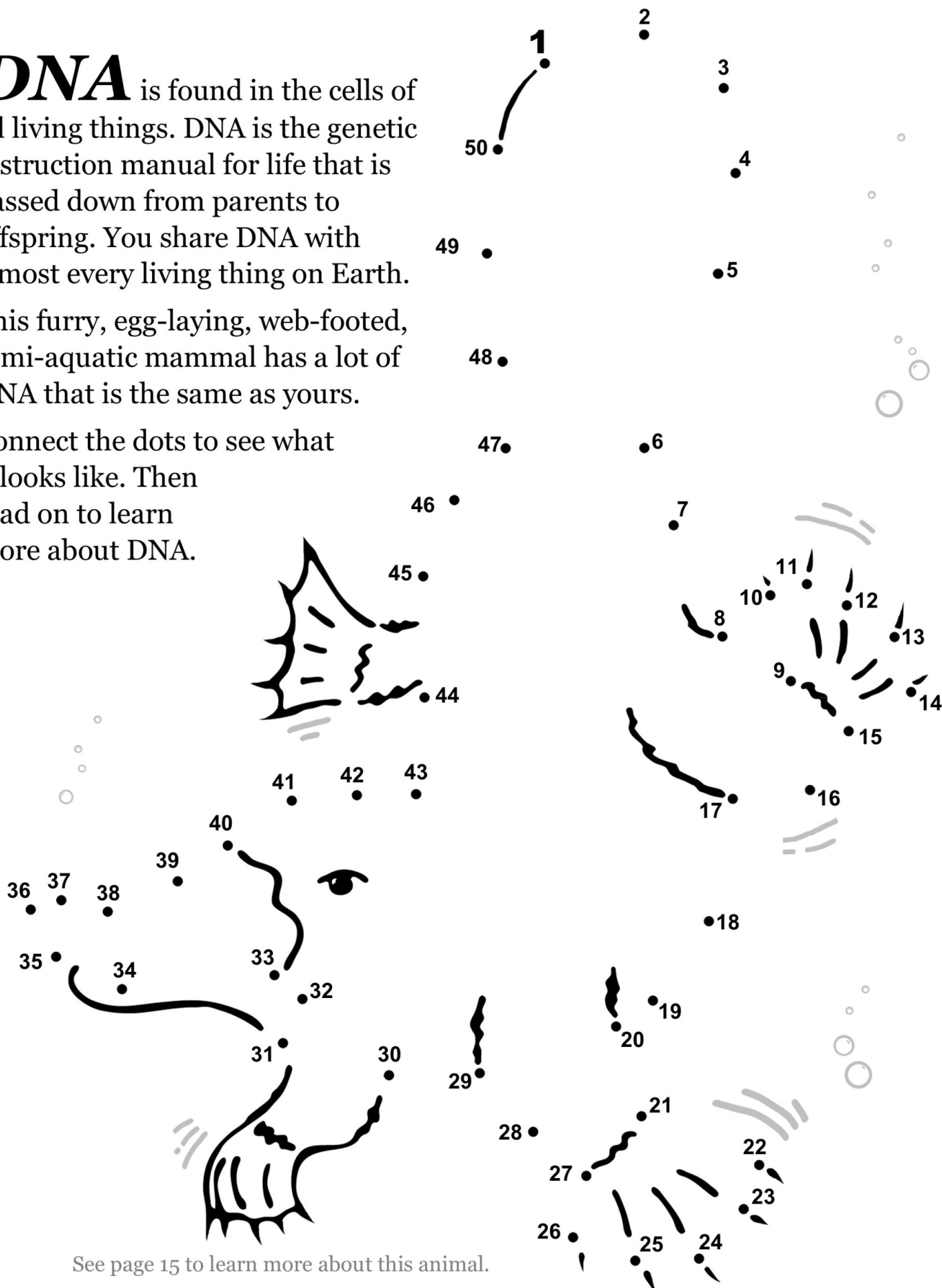


*A thin
thread
connects
all life.*

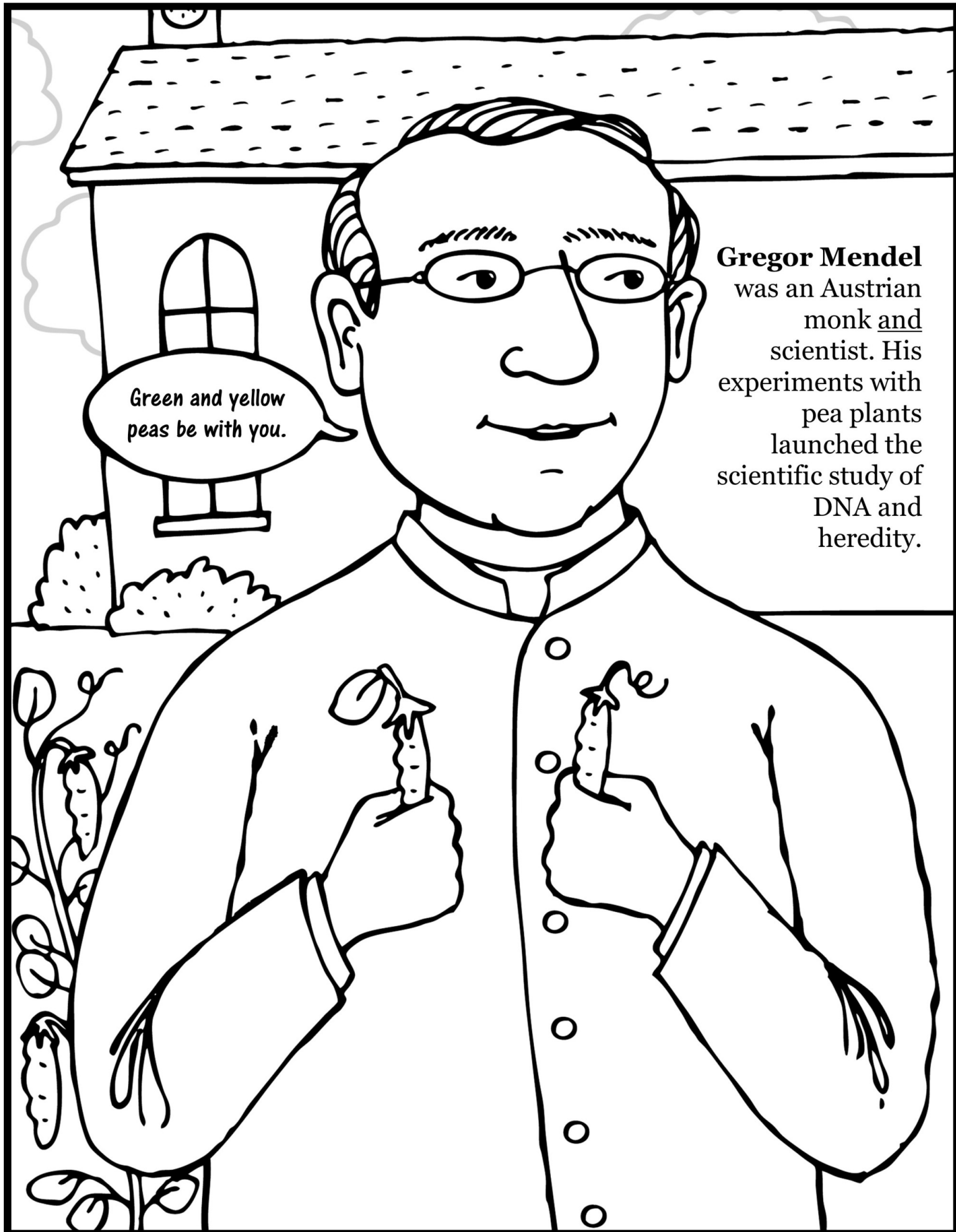
DNA is found in the cells of all living things. DNA is the genetic instruction manual for life that is passed down from parents to offspring. You share DNA with almost every living thing on Earth.

This furry, egg-laying, web-footed, semi-aquatic mammal has a lot of DNA that is the same as yours.

Connect the dots to see what it looks like. Then read on to learn more about DNA.



See page 15 to learn more about this animal.



Gregor Mendel
was an Austrian
monk and
scientist. His
experiments with
pea plants
launched the
scientific study of
DNA and
heredity.

In 1869, **Friedrich Miescher**, a Swiss physician, was examining white blood cells and isolated a substance he called "*nuclei*." Later this substance would be recognized as DNA. This discovery forever change the direction of biological sciences.



You have a lot of DNA in your body, but it is very tiny in size. Until the 1950s, nobody was sure what it actually looked like. That's when British scientist **Rosalind Franklin** figured out a way to see it using X-ray images. Her pioneering work helped to define the structure of DNA and transform the science of genetics.



DNA is short for **deoxyribo**n**ucleic **a**cid.**

DNA



The double helix shape of DNA might be compared to a spiral ladder. Sugar and phosphate molecules make up the rails. And

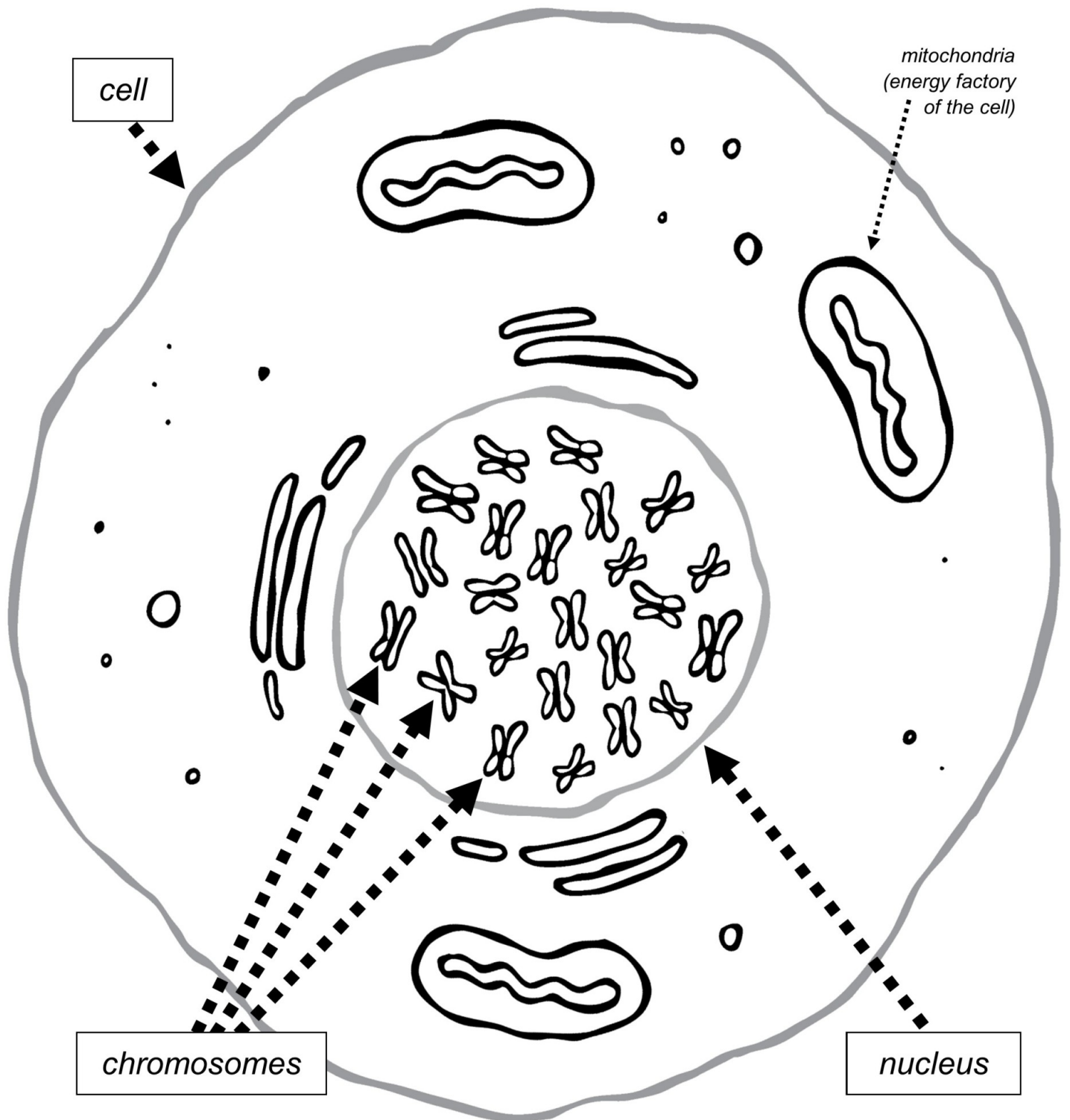
what looks like rungs are actually base pairs of organic molecules called

nucleotides. Your individual genes are made up of DNA segments of these base pairs.

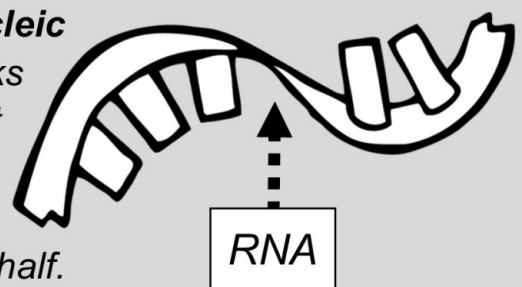
Your DNA is found in your **chromosomes.** Chromosomes are tiny threadlike structures packed tightly with your DNA that are found in the nucleus (the center) of your cells.

Sometimes there may be extra or missing chromosomes, but usually there are 23 pairs of chromosomes in each cell. You inherited a set of 23 from your mother and another set of 23 from your father, giving you a total of 46. In other living things the number of chromosomes varies.

chromosome



Also packed in with your DNA is **RNA**, or **ribonucleic acid**, a small molecule essential for all life. It works with DNA to produce proteins and other important tasks. There are several different types—**mRNA**, **miRNA**, **rRNA**, **ctRNA**, and others—all with different functions. It sort of looks like DNA cut in half.



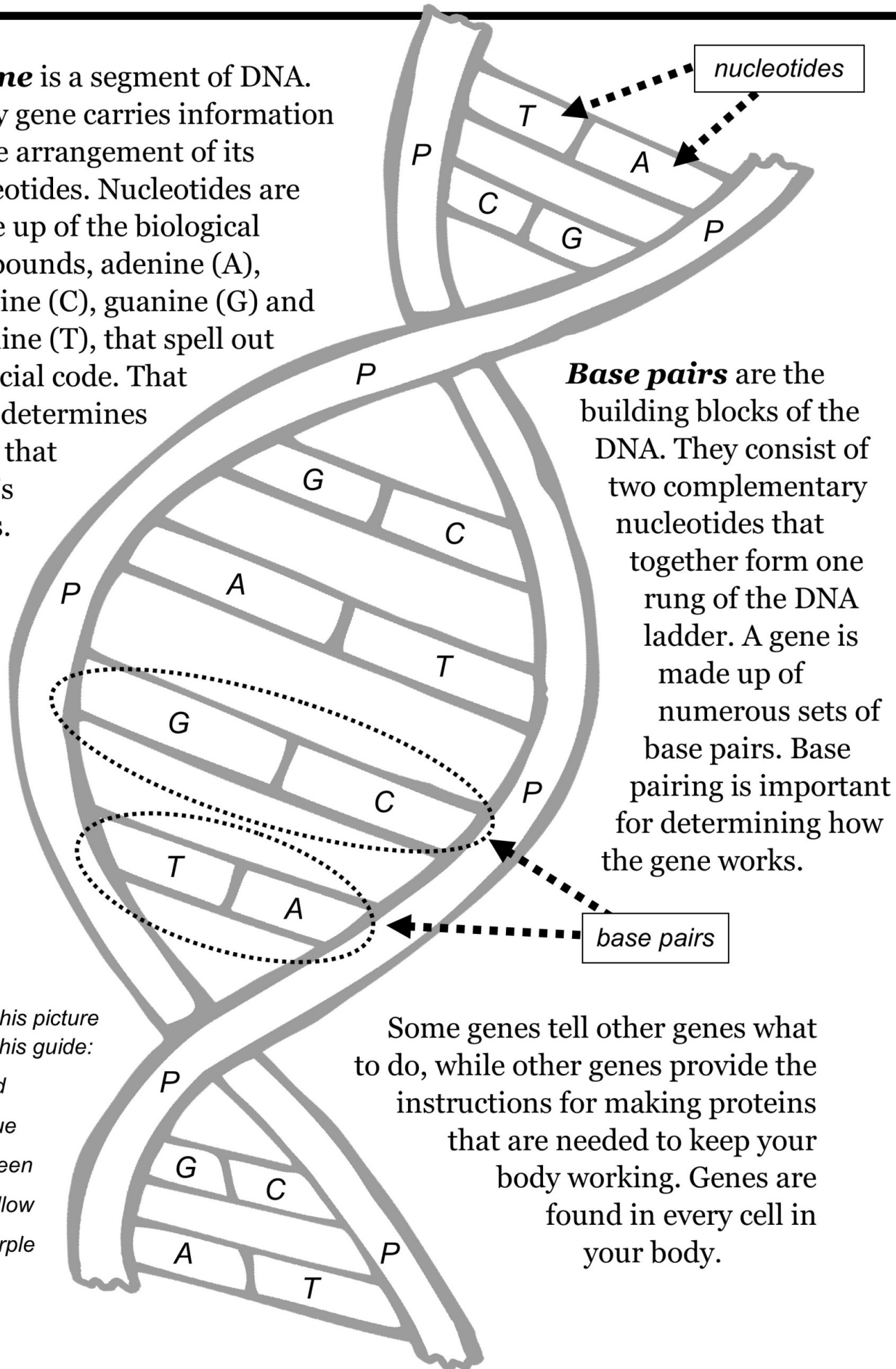
A **gene** is a segment of DNA. Every gene carries information in the arrangement of its nucleotides. Nucleotides are made up of the biological compounds, adenine (A), cytosine (C), guanine (G) and thymine (T), that spell out a special code. That code determines what that gene's job is.

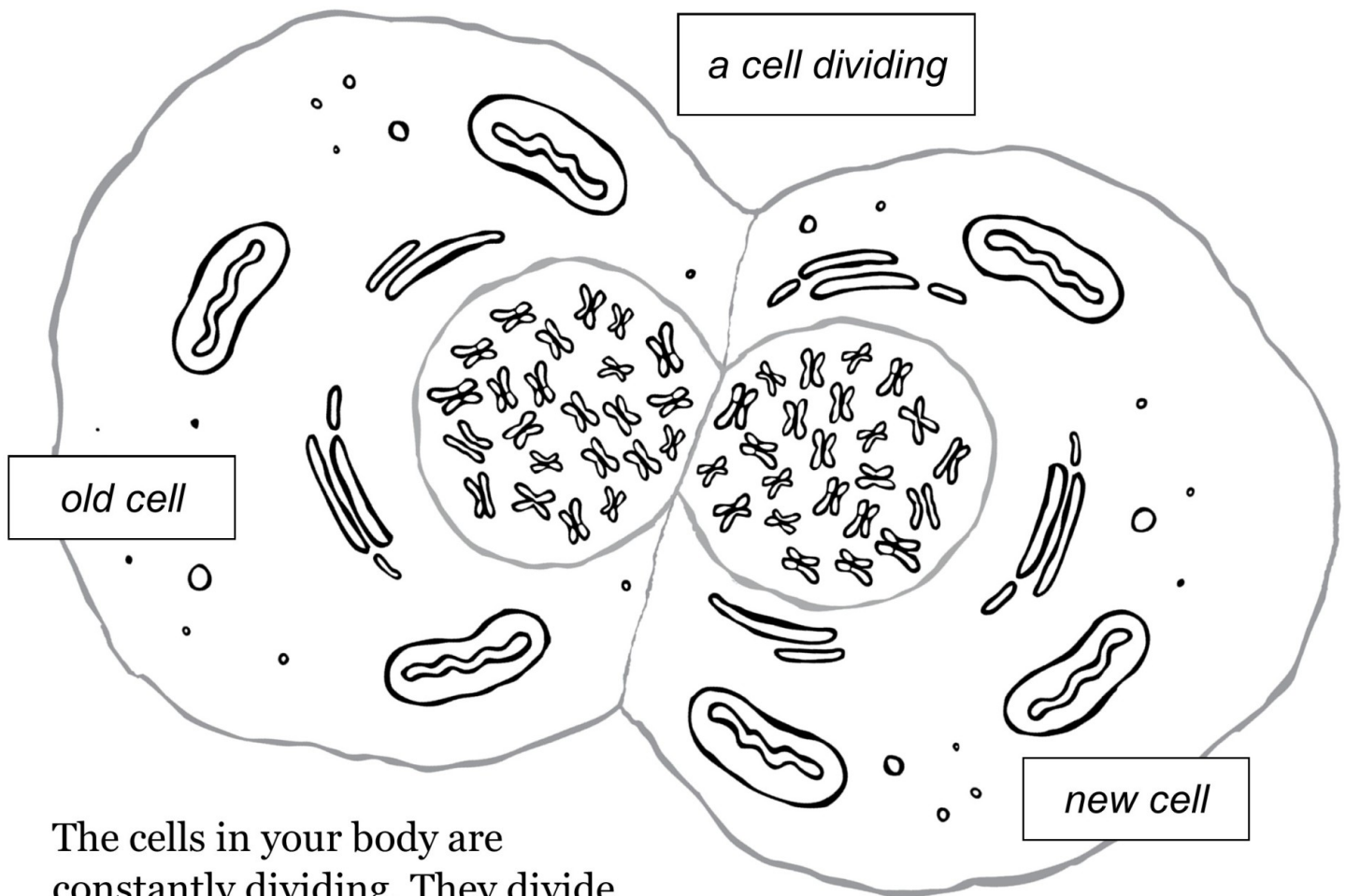
Base pairs are the building blocks of the DNA. They consist of two complementary nucleotides that together form one rung of the DNA ladder. A gene is made up of numerous sets of base pairs. Base pairing is important for determining how the gene works.

Color this picture using this guide:

A = red
C = blue
G = green
T = yellow
P = purple

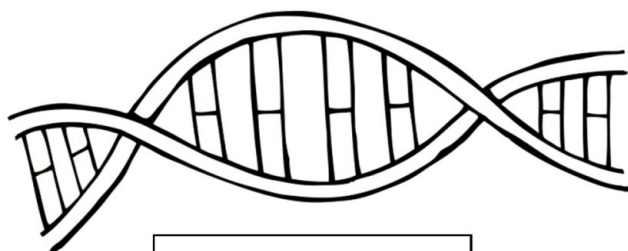
Some genes tell other genes what to do, while other genes provide the instructions for making proteins that are needed to keep your body working. Genes are found in every cell in your body.



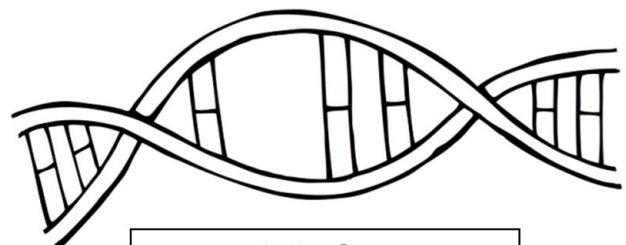


The cells in your body are constantly dividing. They divide to make new cells. This is called **mitosis**, and it happens millions of times per second, all day, every day. This helps you to grow and helps to replace old, damaged, or dead cells as you age. As your cells divide, the DNA in the cell makes an exact copy of itself, so the new cells have the same DNA.

But with all that cell division going on, mistakes do happen occasionally when the DNA is copied. Nucleotides sometimes get deleted or added or otherwise changed. This is called a **mutation**.



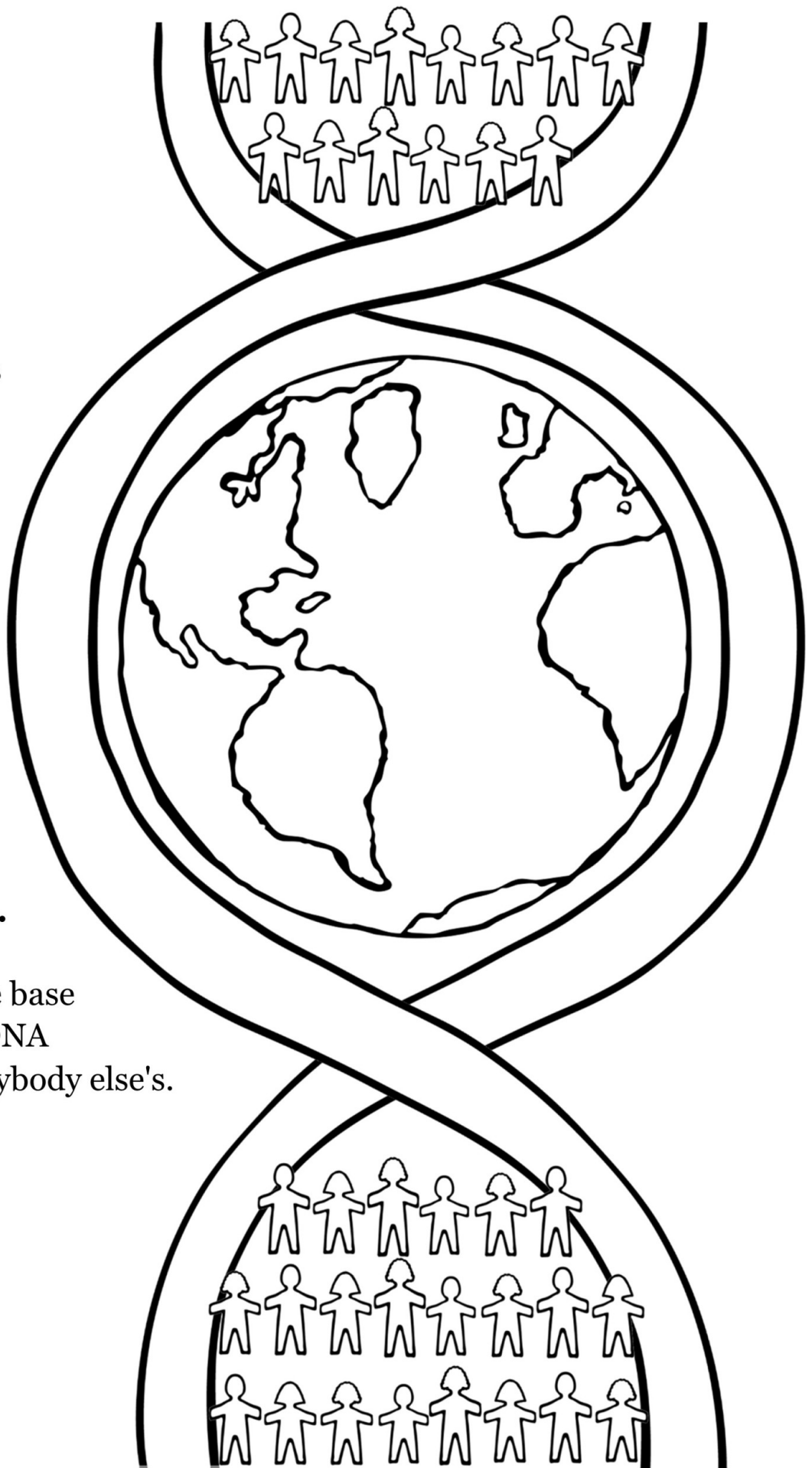
normal gene

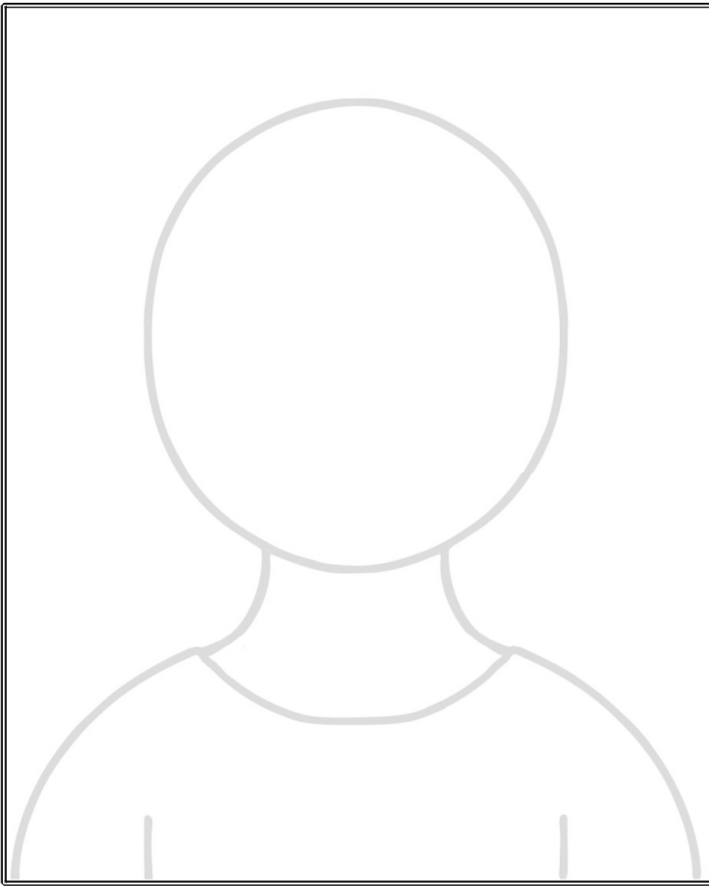


mutated gene

(deleted nucleotides
in this example)

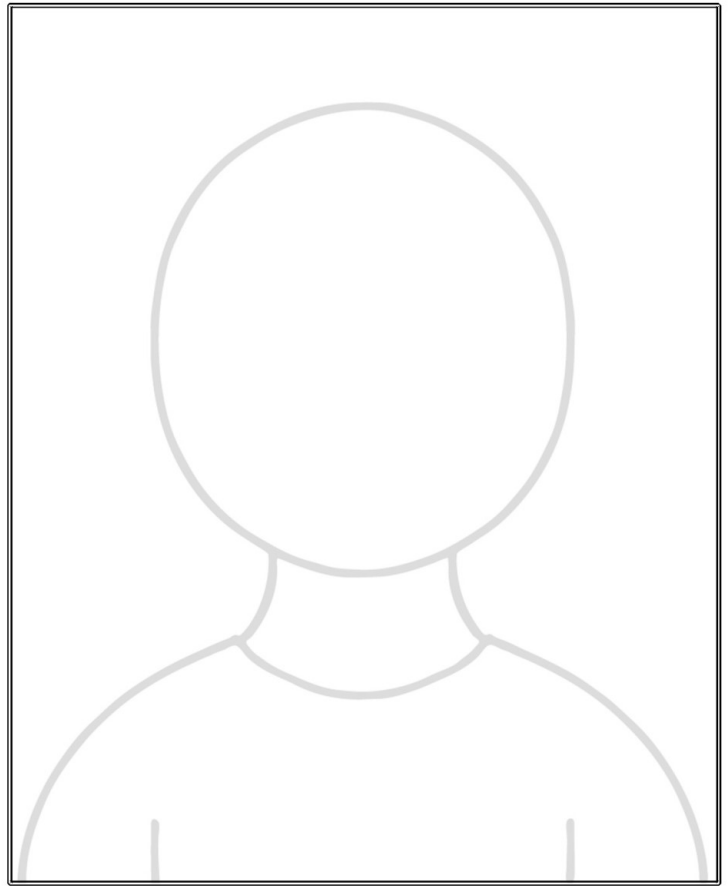
Your DNA contains around 3 billion base pairs of nucleotides. And those nucleotide base pairs are arranged into approximately 20,000 genes. **99% of those base pairs are the same as every other human on Earth.** Only a very small percentage of those base pairs makes your DNA different from everybody else's.



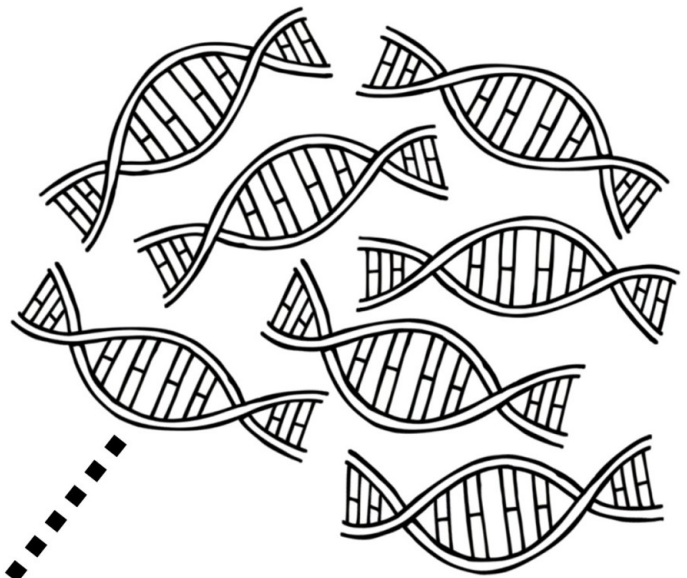
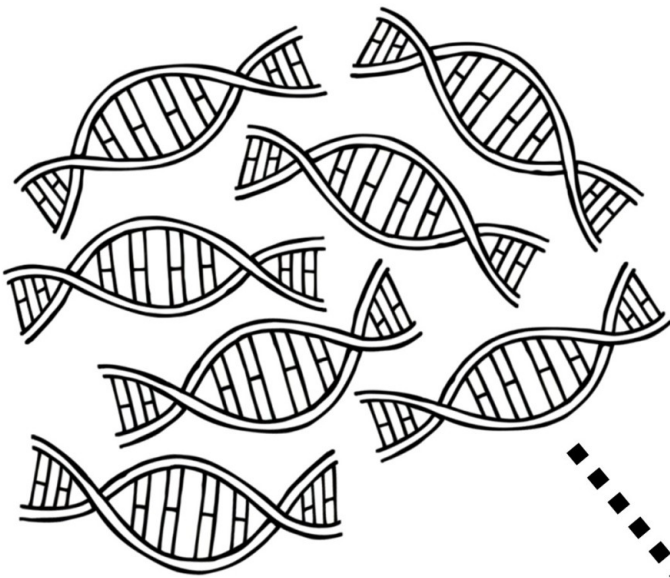


MOM

*Finish the
portraits.*



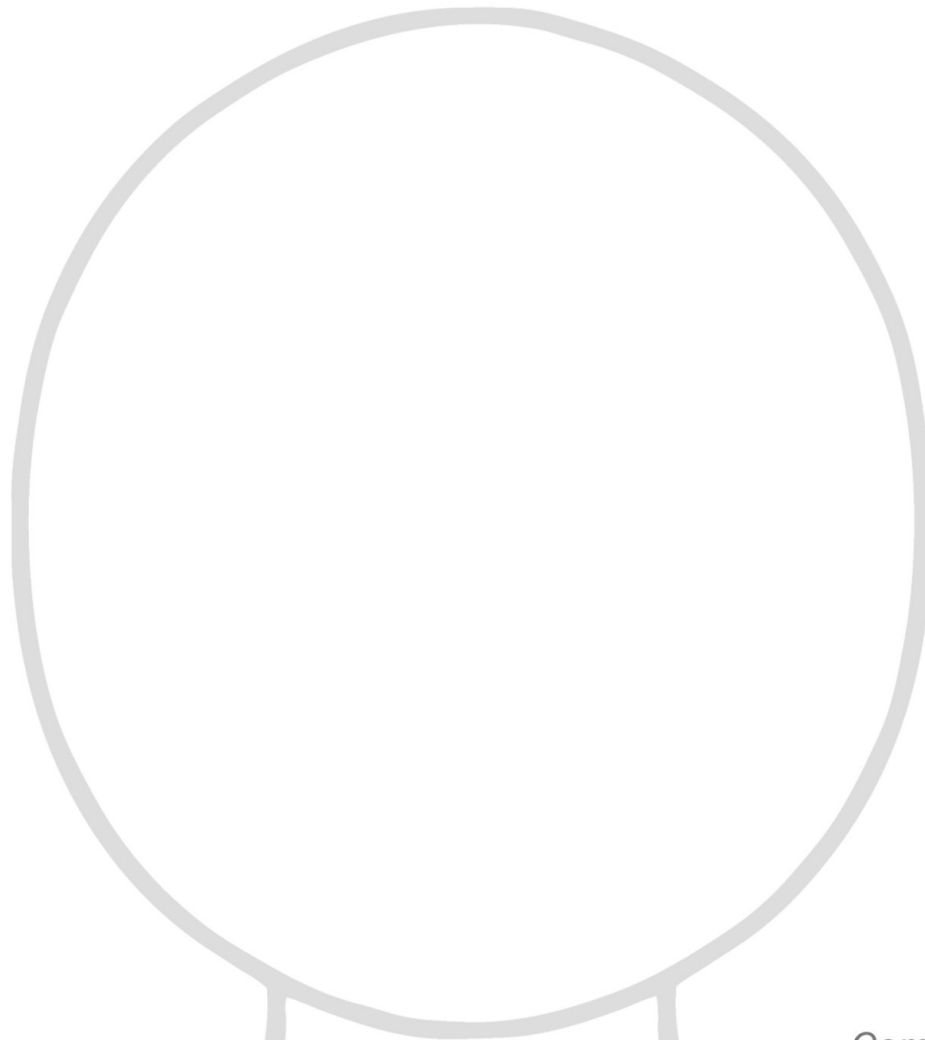
DAD



YOU

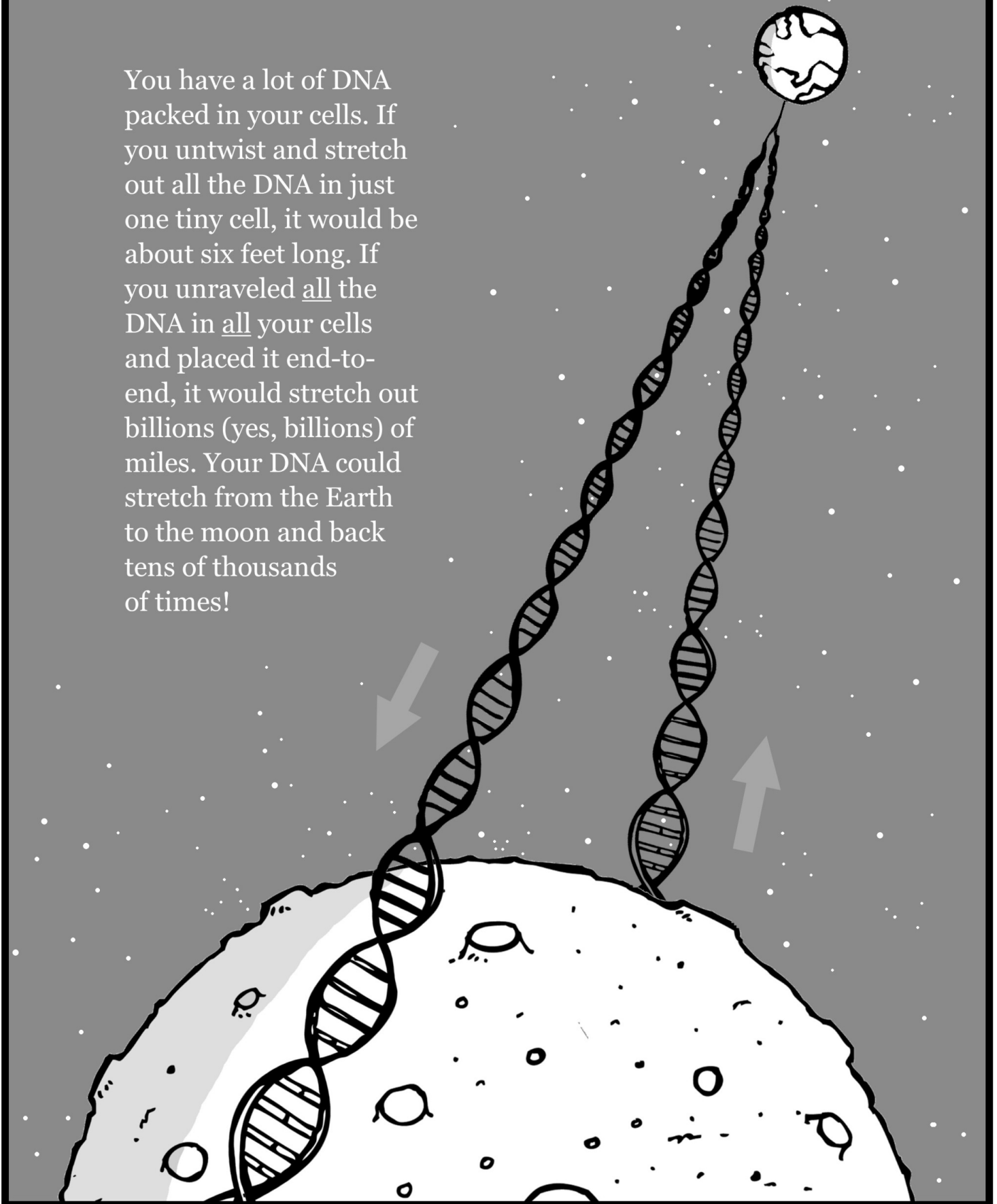
inherited all your genes from your parents. You have two
copies of every gene. You got one copy from your mom and
one copy from your dad.

Genes determine a wide range of traits, such as eye color, hair color, hair texture (curly, wavy, or straight), skin color, freckles, dimples, nose shape, the ability to roll your tongue, and so much more.

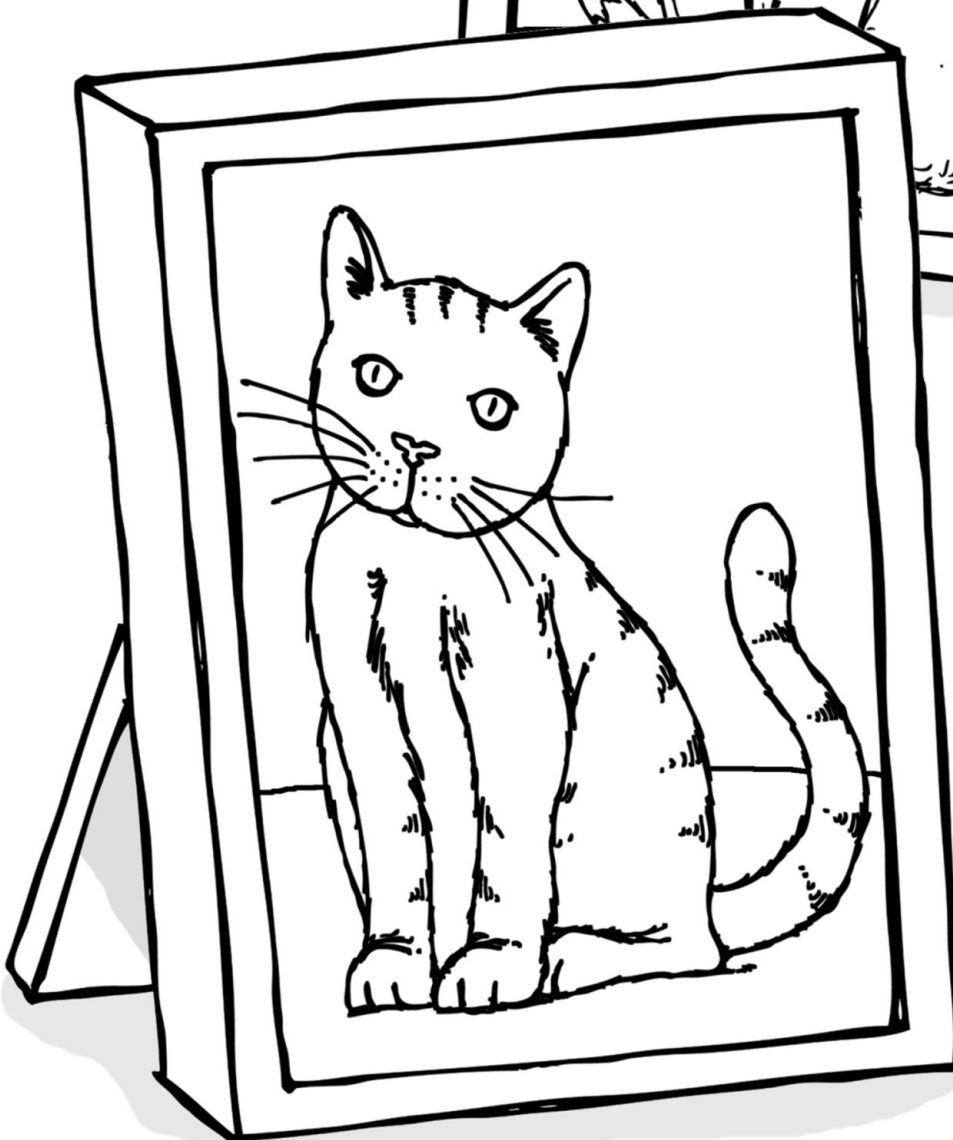


*Complete your
self-portrait.*

You have a lot of DNA packed in your cells. If you untwist and stretch out all the DNA in just one tiny cell, it would be about six feet long. If you unraveled all the DNA in all your cells and placed it end-to-end, it would stretch out billions (yes, billions) of miles. Your DNA could stretch from the Earth to the moon and back tens of thousands of times!

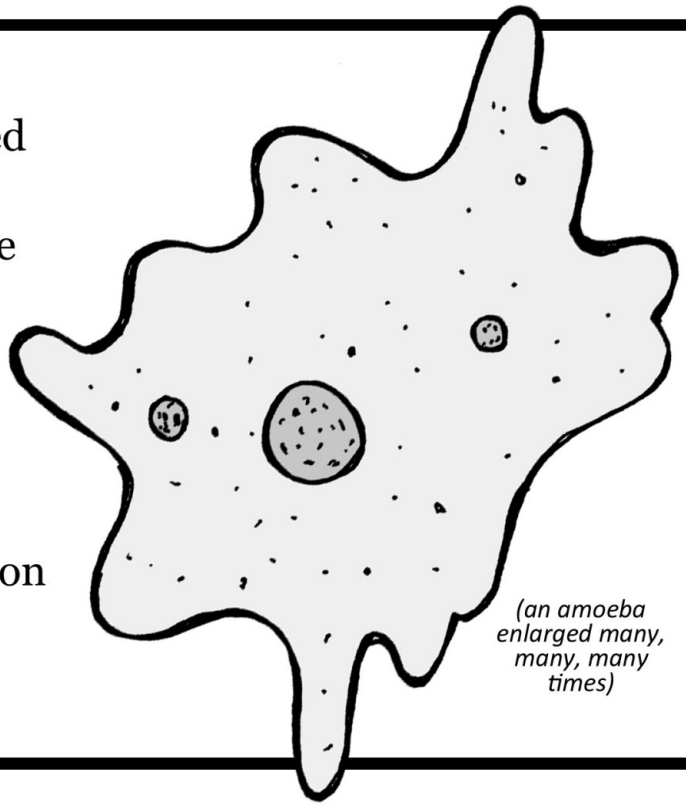


Do you consider
your pets part of
the family? Maybe
that's because
dogs share around
84% of their DNA
base pairs with
their human best
friends.

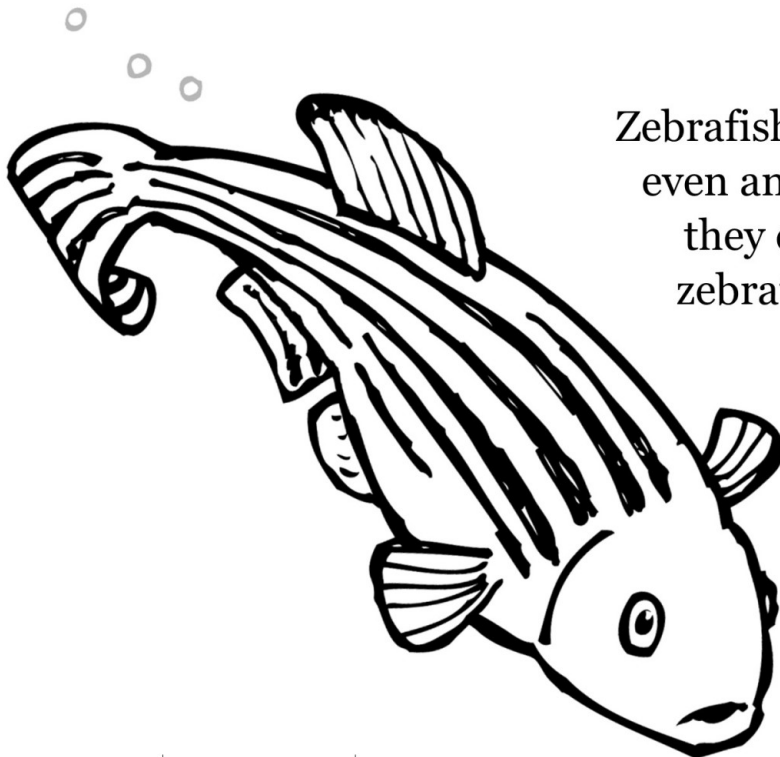


House cats share
even more DNA
with their
human owners.
Around 90% of a
cat's DNA base
pairs match their
human's DNA
base pairs.

Amoebas are a really small one-celled creatures that look like tiny blobs of colorless goo. You need a microscope to see them. Amoebas live in water, moist soil, and a lot of other places. Amoebas may be small, but they have over 200 times more DNA than humans. Scientists are still working on why amoebas have that much DNA.



(an amoeba enlarged many, many, many times)

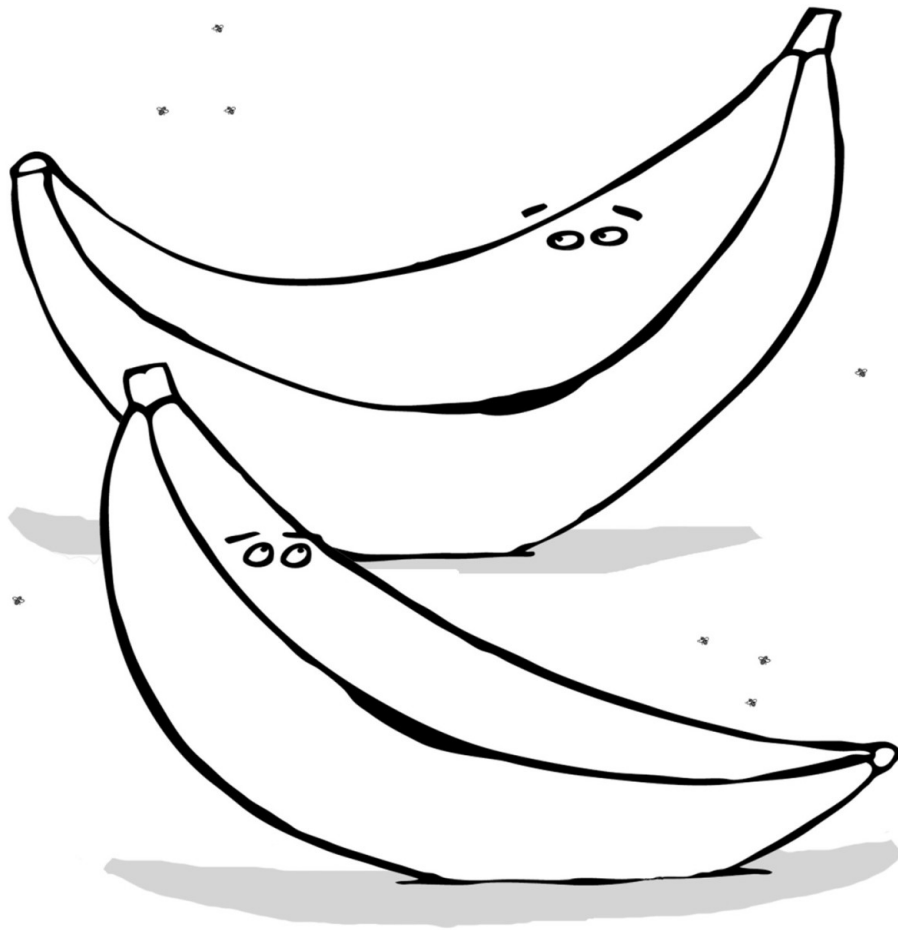


Zebrafish are fascinating. If a fin, a tail, or even an eye gets bitten off by something, they can grow a new one. And because zebrafish share a lot of DNA base pairs with humans, they are one of the most researched animals.

Young zebrafish are excellent subjects for learning more about how DNA repairs itself when it is damaged.

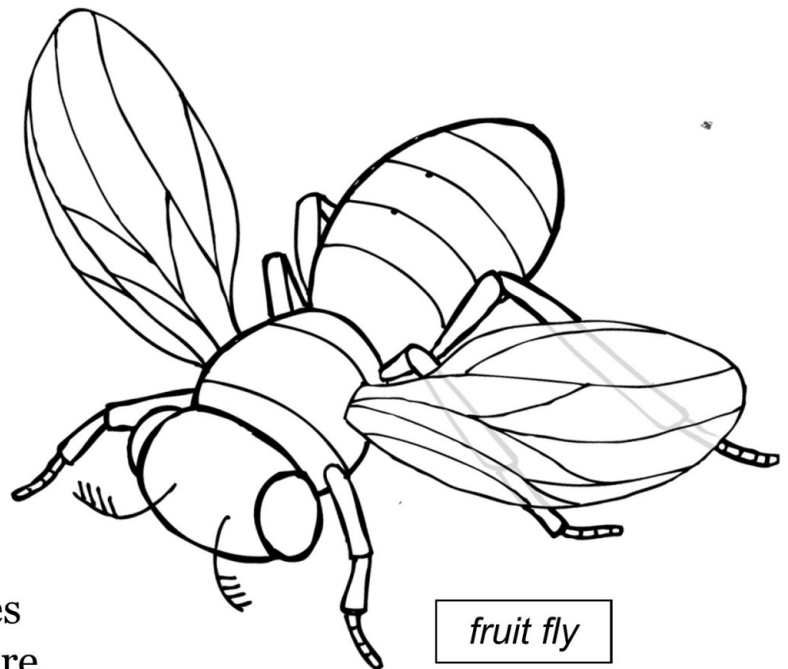
actual size of a zebrafish





Do you like to go bananas sometimes? Well, about 60% of the nucleotide base pairs that you and bananas have are the same.

Fruit flies love bananas too. And fruit flies also share about 60% of nucleotide base pairs with you. Fruit flies are fascinating little creatures and the subject of a lot research by scientists all over the world. These tiny insects make good models for studying human disease because nearly 75% of the genes that cause disease in humans are also found in fruit flies.

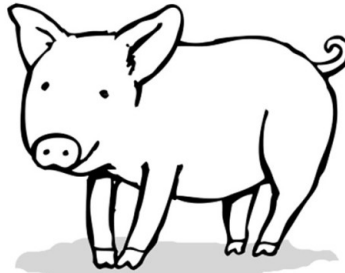


actual size of a fruit fly

How much DNA do these animals share with you? Match the percentage to the animal.



mouse



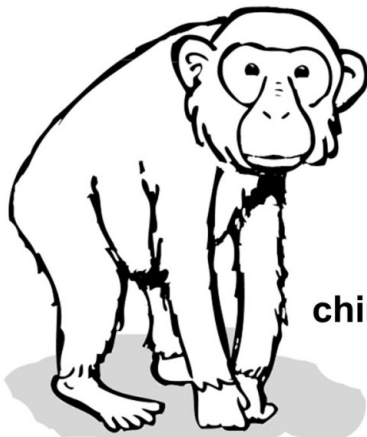
pig



snail



chicken



chimpanzee

85%

98.8%

70%

60%

98%

ANSWERS:

Mouse:85% Pig:98.8% Snail:70% Chicken:60% Chimpanzee:98.8%
And remember that furry, egg-laying, web-footed, semi-aquatic mammal
from the dot-to-dot on page 1? That's a **duck-billed platypus**. Over
80% of its DNA base pairs are identical to yours.

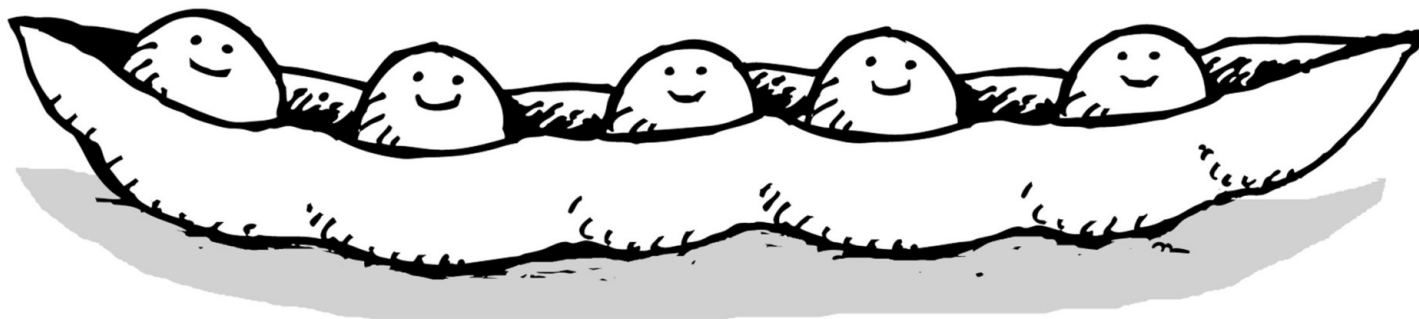
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(Yes, it's been officially registered.)

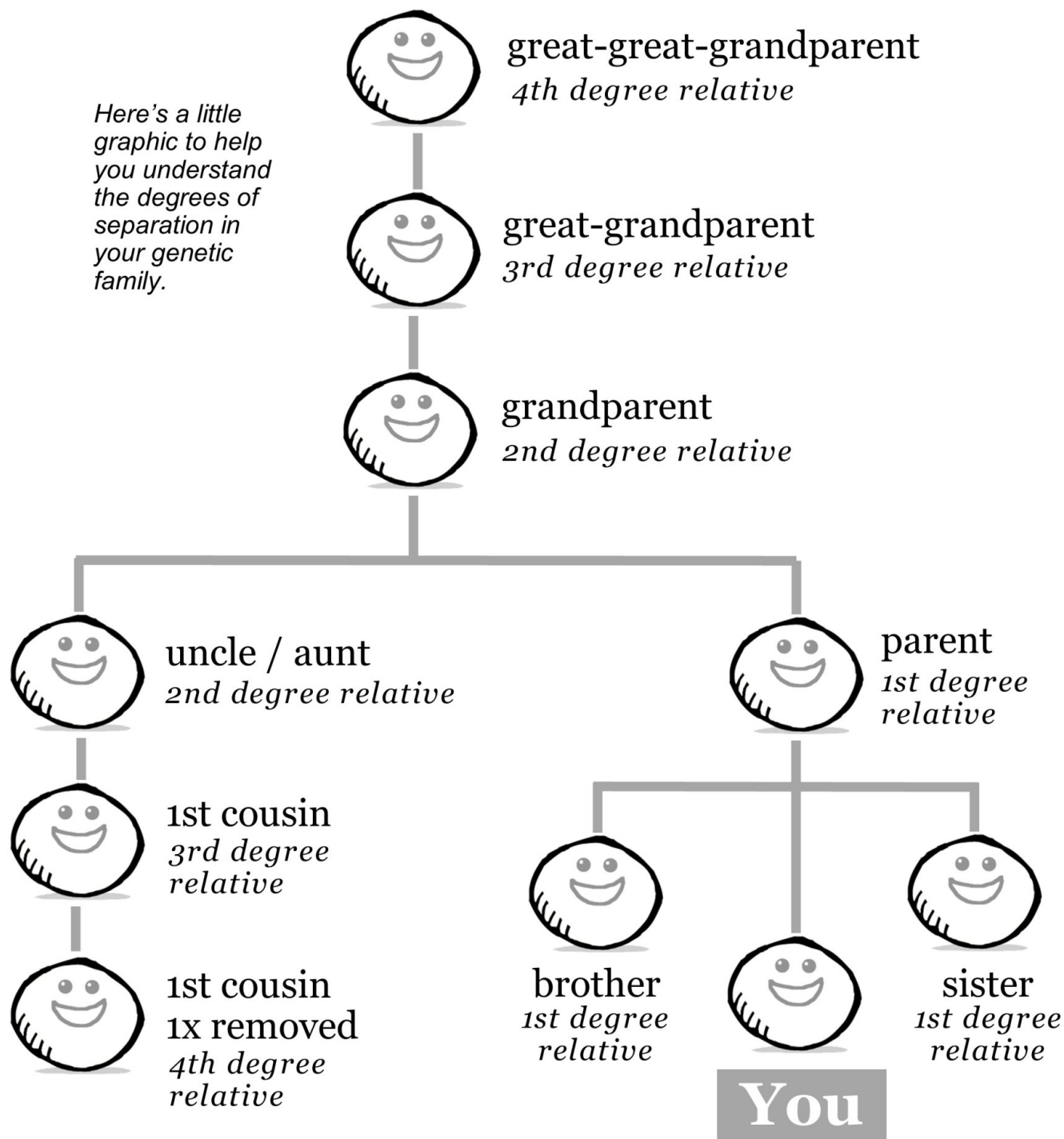
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Go to www.genetionary.org/DNA
for more information.

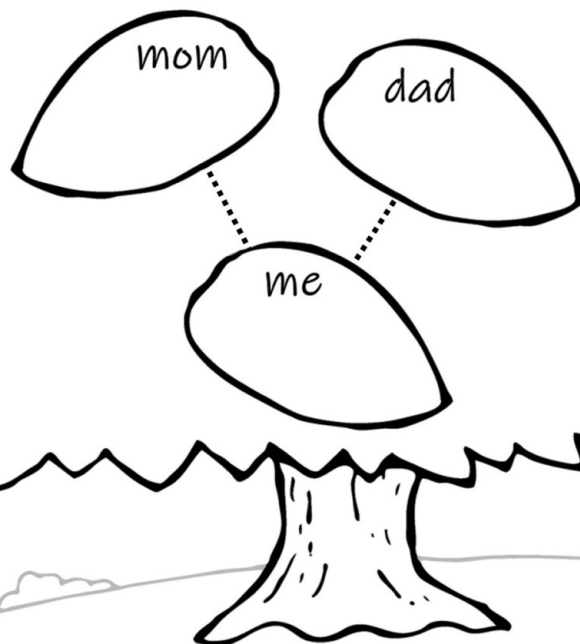
Know Some of the Peas in Your Pod



Here's a little graphic to help you understand the degrees of separation in your genetic family.



MY Family Tree



Grow your family tree by drawing more leaves and filling in the names of family members. See how much of the tree you can fill up. Be sure to add color to your tree.