



whoosh!



Whoooooaa!

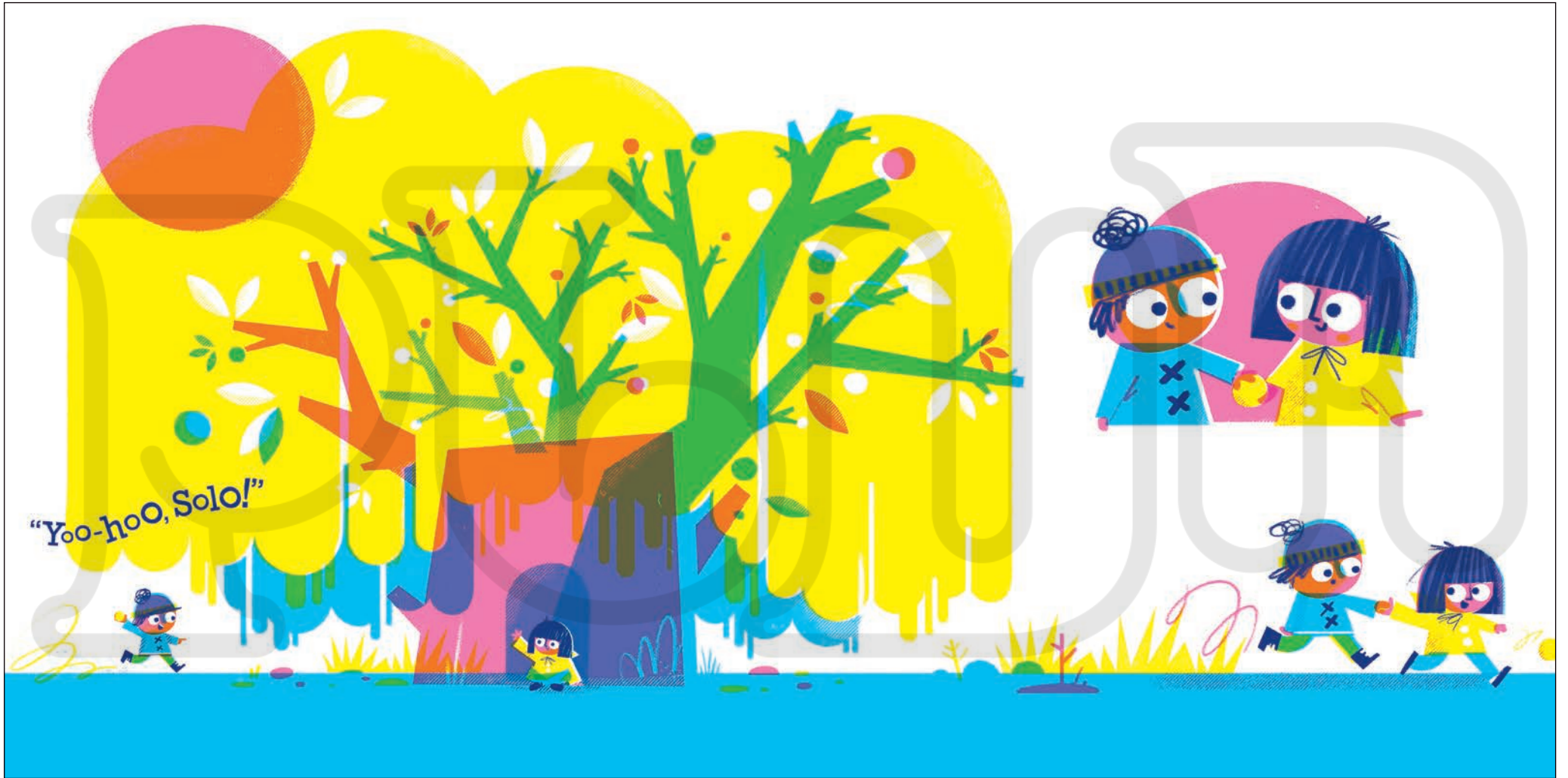
Weeeeeeee!

Wahey!

Whoosh!







"Yoo-hoo, Solo!"

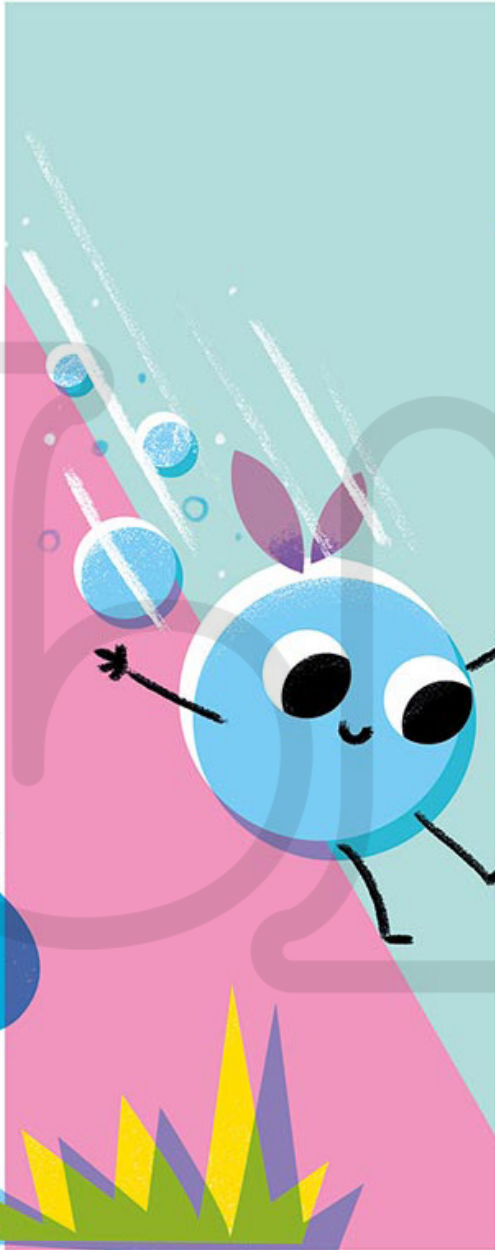
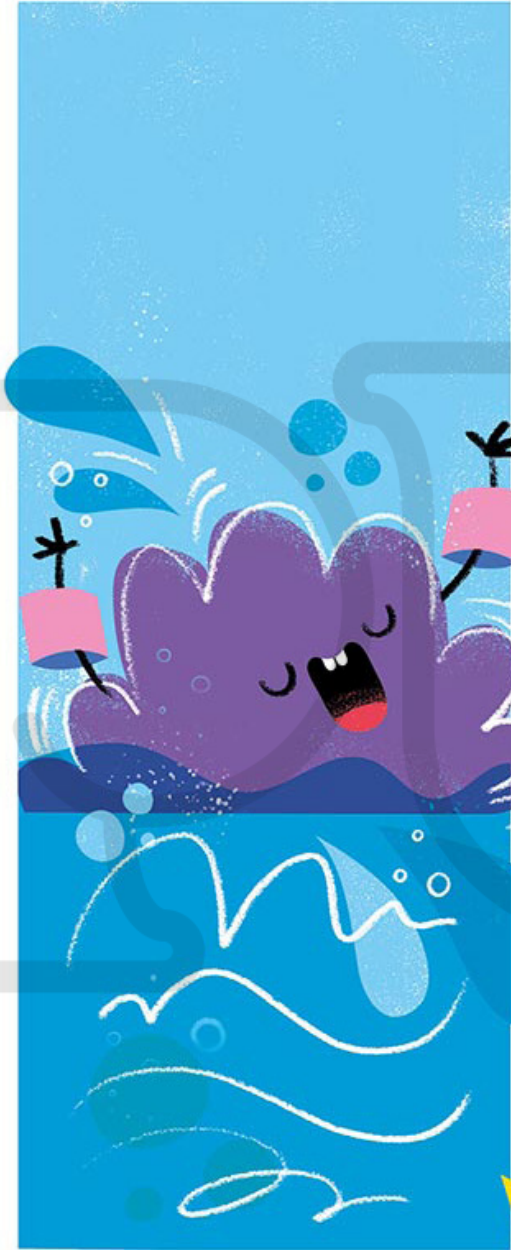
















Hello there, I'm

**CRASH!**



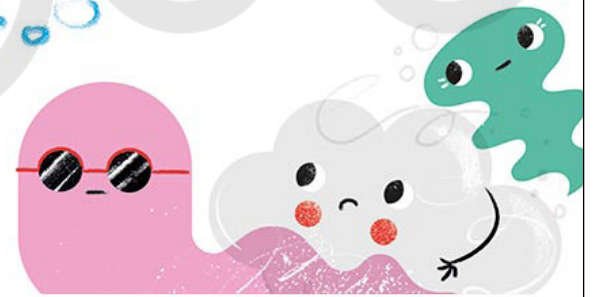
And you can call me

**BANG!**

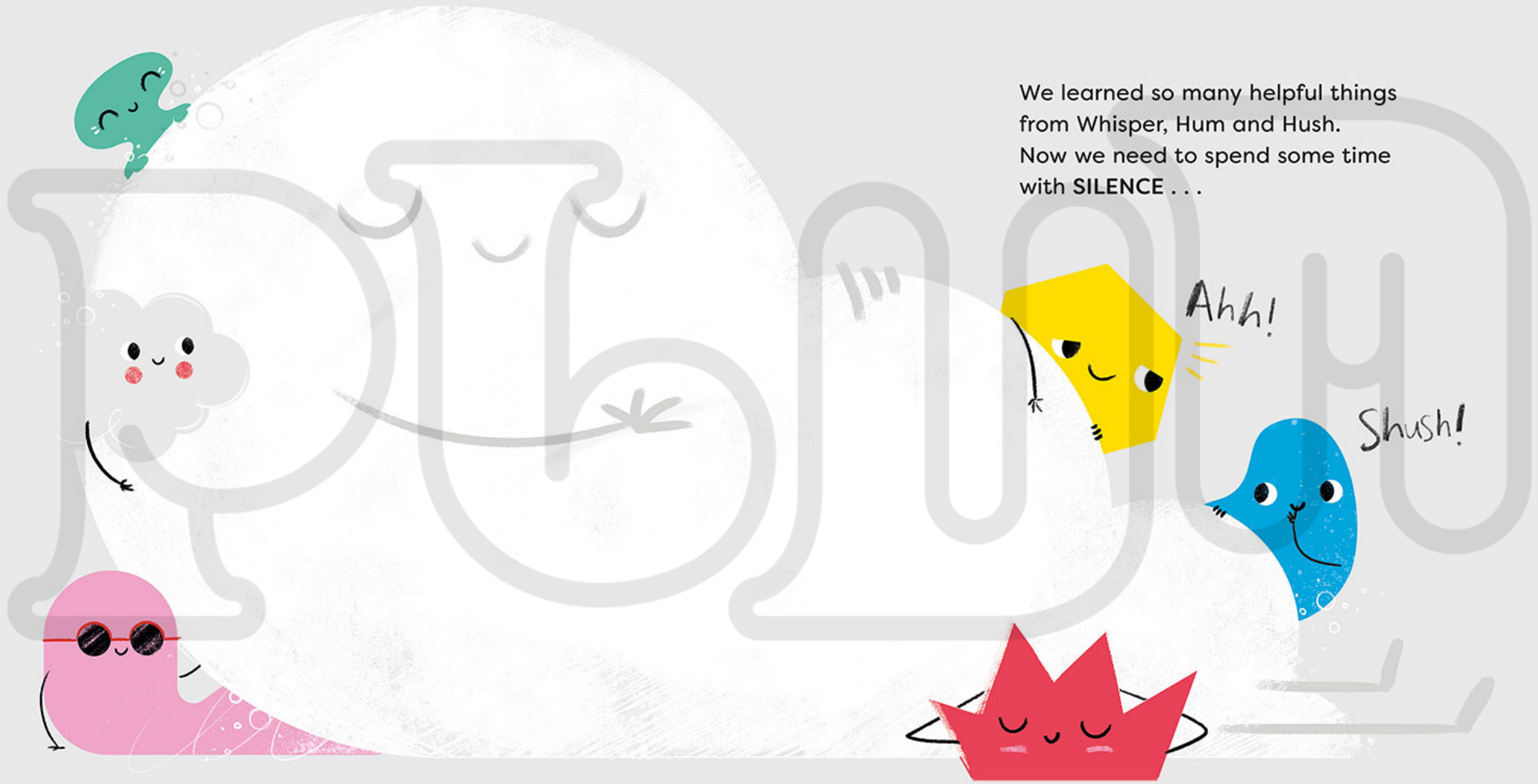
I'm **WALLOP!**

Nice to meet you!

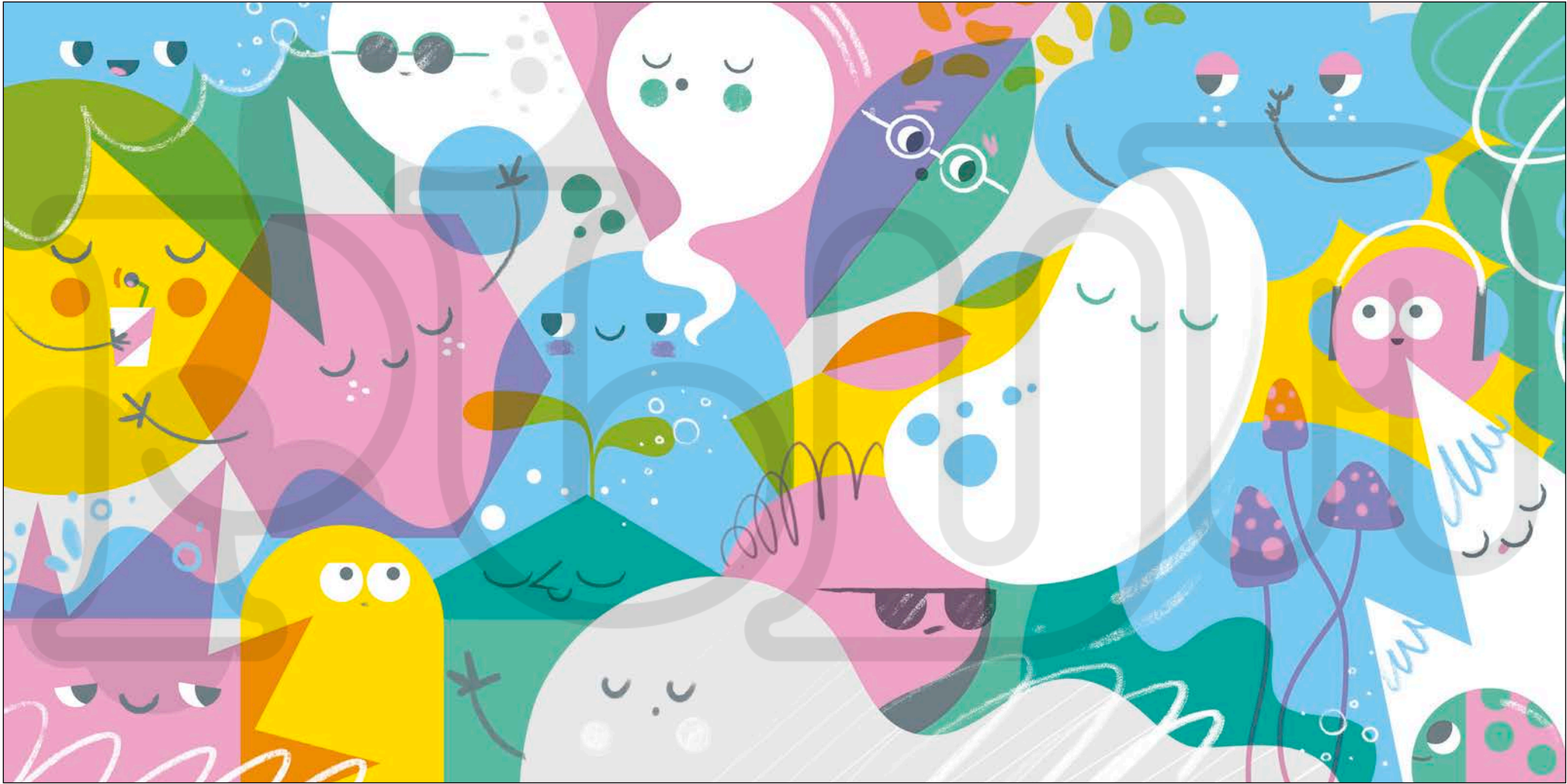
We're a loud and  
noisy gang.



We learned so many helpful things  
from Whisper, Hum and Hush.  
Now we need to spend some time  
with **SILENCE** . . .

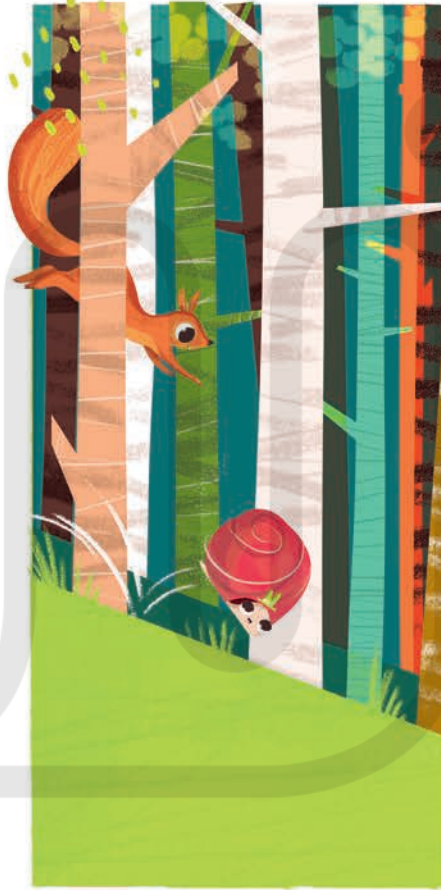


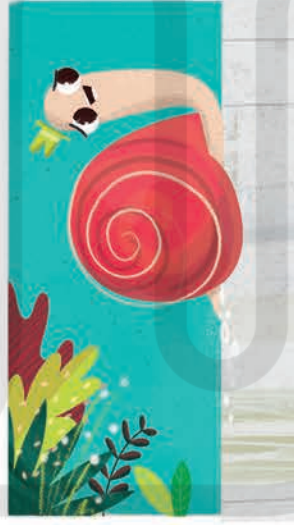


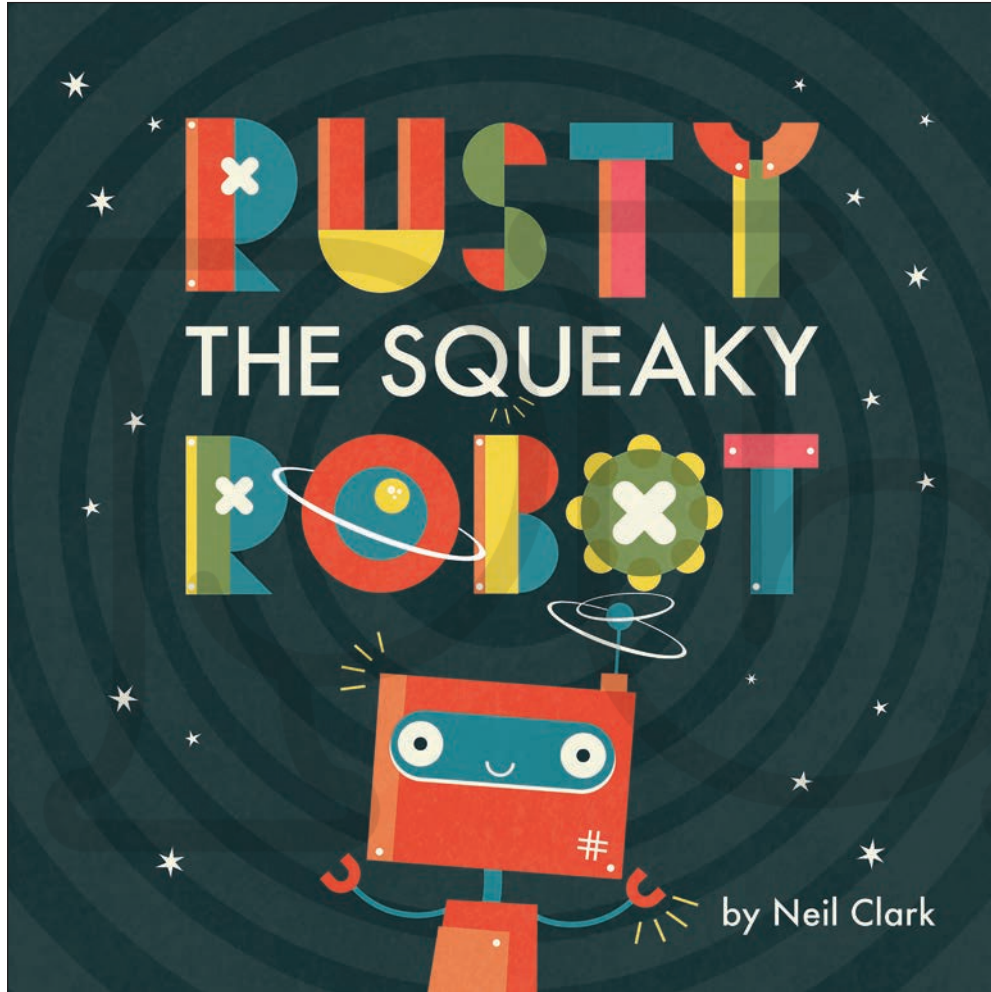












So you want to be a  
**FROG**

Everything  
there is to know  
about frogs!



JANE PORTER Illustrated by NEIL CLARK





# GENES AT WORK

How do your genes make the things your body needs?  
Let's look inside a NERVE CELL to find out...

When you feel pain, your nerve cells make things called **ENDORPHINS** to make you feel better. First, nerve cells alert each other to **GET TO WORK**.

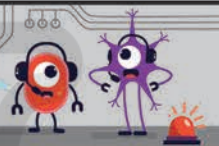
In your brain...

This body **HURTS!**  
We need to make **endorphins** and get them out, **STAT!**



The gene that tells a cell **HOW** to make endorphins is with all your **DNA** in every cell's nucleus.

Roger that, we're locating that gene right now. It's on **chromosome 2...**



DEEP INSIDE THE NUCLEUS OF THIS ONE NERVE CELL...

Inside the cell are things known as **RNA**. They do lots of different jobs. Some of them make copies of genes.

An **RNA** comes to the nucleus, finds the correct gene, and copies it.

The gene copy

Chromosomes

Packaged up and ready to depart!

Next, this RNA heads out through the **ENDOPLASMIC RETICULUM** into the vast **CYTOPLASM**...

The copy is leaving the nucleus now!

ENDOPLASMIC RETICULUM

This is a mitochondrion, delivering energy around the cell.



OUT IN THE **CYTOPLASM**, tiny machines called **RIBOSOMES** are waiting to receive the **RNA** with the copy.

These are **RIBOSOMES**.

GULP

MEANWHILE, other **RNAs** loaded up with **AMINO ACIDS** are flying towards the ribosome...

These bright **BLOBS** are amino acids.

These lines are a **KEY** that matches a bit of the gene copy.

Incoming amino acids!

Empty and departing!

With everything ready inside the ribosome, it's time to start making **ENDORPHINS!**

Open up the flaps to see **HOW**.

When amino acids are joined up in the right order, they make an **ENDORPHIN**.

Assembly COMPLETE!

**MILLIONS** of the same nerve cells are making endorphins **ALL AT ONCE**, to make you feel **BETTER**.



This set of amino acids make an **ENDORPHIN**. Different sets make different things.

# WHERE NEXT?

What else will scientists discover about DNA?

Can genetics help fight the CLIMATE CRISIS?

Will we find out what ALL of our DNA does?

Do you remember the GENE DESERT from page 5?

It's full of genes that DON'T code for making proteins.



Can things with identical DNA turn out differently? HOW?

In my hive, all us worker bees have the same DNA. EXACTLY THE SAME.

Guess what? I have the same DNA as you, too! But I'm different - I'm a QUEEN BEE.

Scientists studying bees have found out how this happens. Nearly all baby bees eat pollen and honey - they grow up into worker bees.

Pollen and honey SWITCH OFF a gene inside worker bees. But I grew up eating royal jelly, my gene STAYED ON and I became a QUEEN.

Can scientists make WHOLE NEW creatures with DNA?

I'm building something in my lab...

Could we change how long we live?

We know aging or GETTING OLD is partly to do with our chromosomes...



# IF WE CAN, DOES IT MEAN WE SHOULD?

What happens if we can choose the DNA of our own babies?

I would like one who is very good at sport and a genius.

I can't afford to pay for this.

If we can change our genes to get rid of genetic disorders, is that OK? What else could we change?

What? So people like us shouldn't exist?

I just want to be able to run really fast. Is that so bad?

Should the police have access to EVERYONE's DNA? Should the government? What about doctors and scientists?

If we had everyone's DNA on a database, we'd easily be able to find out who committed many crimes.

Or make it LOOK like anyone committed a crime.

It would help my research to have access to the entire world's DNA!

But who does that information belong to? Who owns it? Do I have to pay to look at it?

In the future we might need new laws to control what people can do with genetics. Governments around the world are already deciding what these laws might say.

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