

CULTURES

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TWO STORIES OF YOUNG
MICROBIOLOGISTS AND DIY
ACTIVITIES INCLUDED!

VOL 2 U M E E I S S U E 3

SPECIAL KIDS EDITION

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Author of
Curey Osa, M.I.
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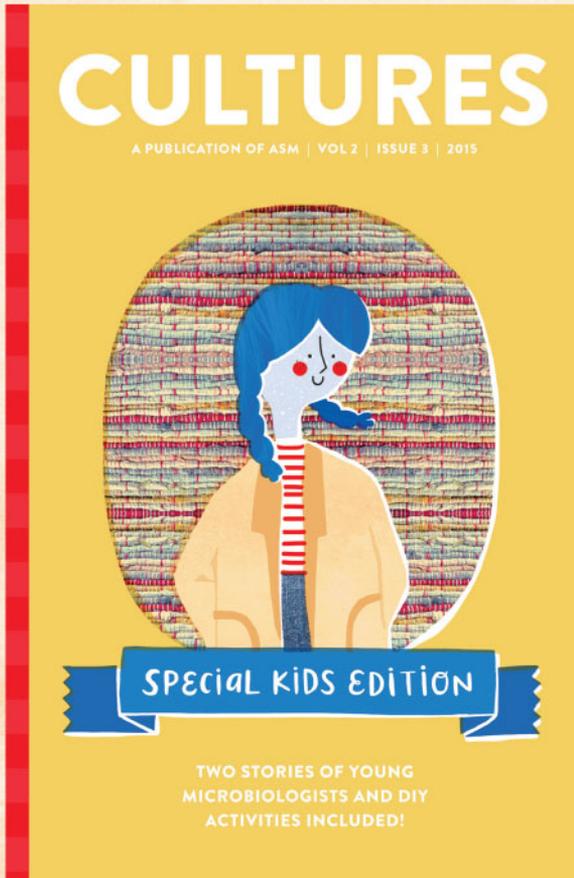
Visit her website at www.terrycjennings.com and her science blog for children at www.kcswildfacts.com

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Scientists Only
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Erin Teagan has a Master of Science degree and worked in biochemistry labs for more than ten years. She is an avid reader and an active member of the Society of Children's Book Writers and Illustrators. Her debut middle grade novel, *The Friendship Experiment*, comes out in fall 2016 with Houghton Mifflin Harcourt. Erin lives in Virginia with her own two little scientists, a ninety pound lap dog and a husband that regularly puts himself in danger with all of his extreme sports.

Visit her website at www.erinteagan.com



Click here to start reading
CUREY OSA, M.I.



Click here to start reading
SCIENTISTS ONLY

CUREY OSA!



Microbe Investigator

BY: TERRY CATASÚS JENNINGS



**Curey Osa is a MICROBE INVESTIGATOR.
Her quest: to find microbes.**

Microbes are organisms that can't be seen with the naked eye. There are millions and millions of species of microbes. They're all different, and they have been around for 3.5 billion years. They have adapted to live everywhere. They are in the air, water, and soil. They live in communities in water pipes, heating vents, and buildings. They live on us and in us.

Curey Osa has found microbes inside ice cores from the Arctic Ocean in the North Pole. In Yellowstone National Park, she found colorful microbes in boiling hot springs. In the ocean, she found microbes growing on vents in the ocean's crust.

She even found microbes in the desert!

As a certified MICROBE INVESTIGATOR with a very special tool kit, Curey looks for microbes. She has notebooks full of pictures and sketches. She has notes on what they do. For instance, she's found that many microbes are made of one cell but they live in colonies that can become huge. Most microbes reproduce by dividing.



Viruses are the most confusing microbes of all. Scientists can't agree on whether viruses are living organisms. They're not even cells. They cannot live on their own. They have to take over living cells in order to survive.



Curey has figured out that some microbes use hairs called **cilia** to move themselves, like a rowboat. Others use **flagella** —little whips that propel the microbes like a motor boat. Some microbes ooze like slime spreading out on a table. Others cannot move at all and have to depend on wind or water or other organisms to carry them around. If a microbe doesn't find an environment it likes, it hibernates. It goes to sleep.





It won't wake up until the environment becomes good enough for it to survive, or until it's carried to an environment that works. Some microbes even build special structures called spores to help them survive. Currey already has a huge list of microbes and what they're good for. She understands that a few of them are bad. Whenever she goes on a microbe quest, she adds to her list. Today she is looking for microbes at Grandma and Grandpa's house.

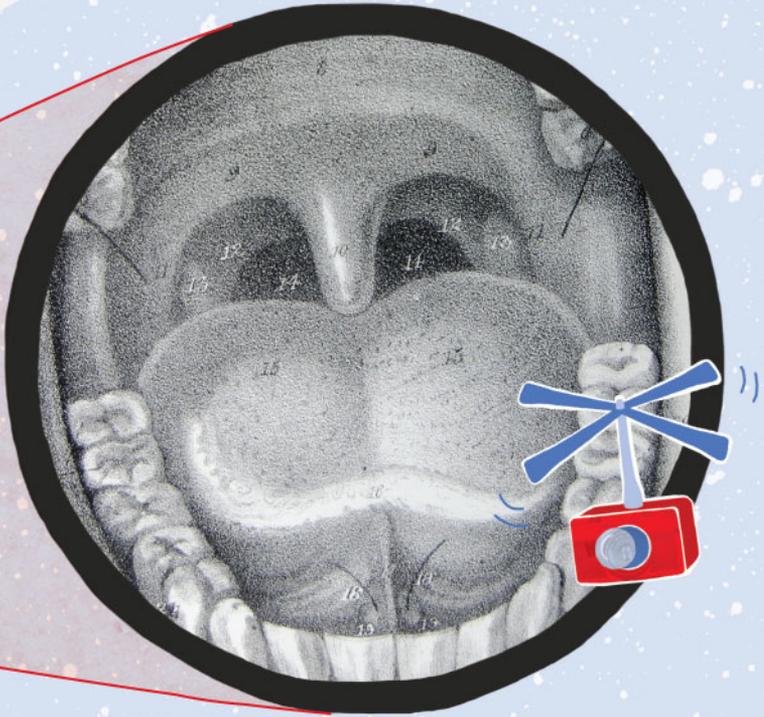


GRANDPA'S MICROBIOME



fig. 1

Microbes love people, and Currey's dying to study a person's microbiome, that is, all the microbes in a person and on a person. Grandpa's agreed.



**Curey Osa will study his microbiome.
While Grandpa takes a nap, she'll
use a pill-sized camera from her
MICROBE INVESTIGATOR
tool kit (MIT) to look at his insides.
She'll see his microbes on a screen.**

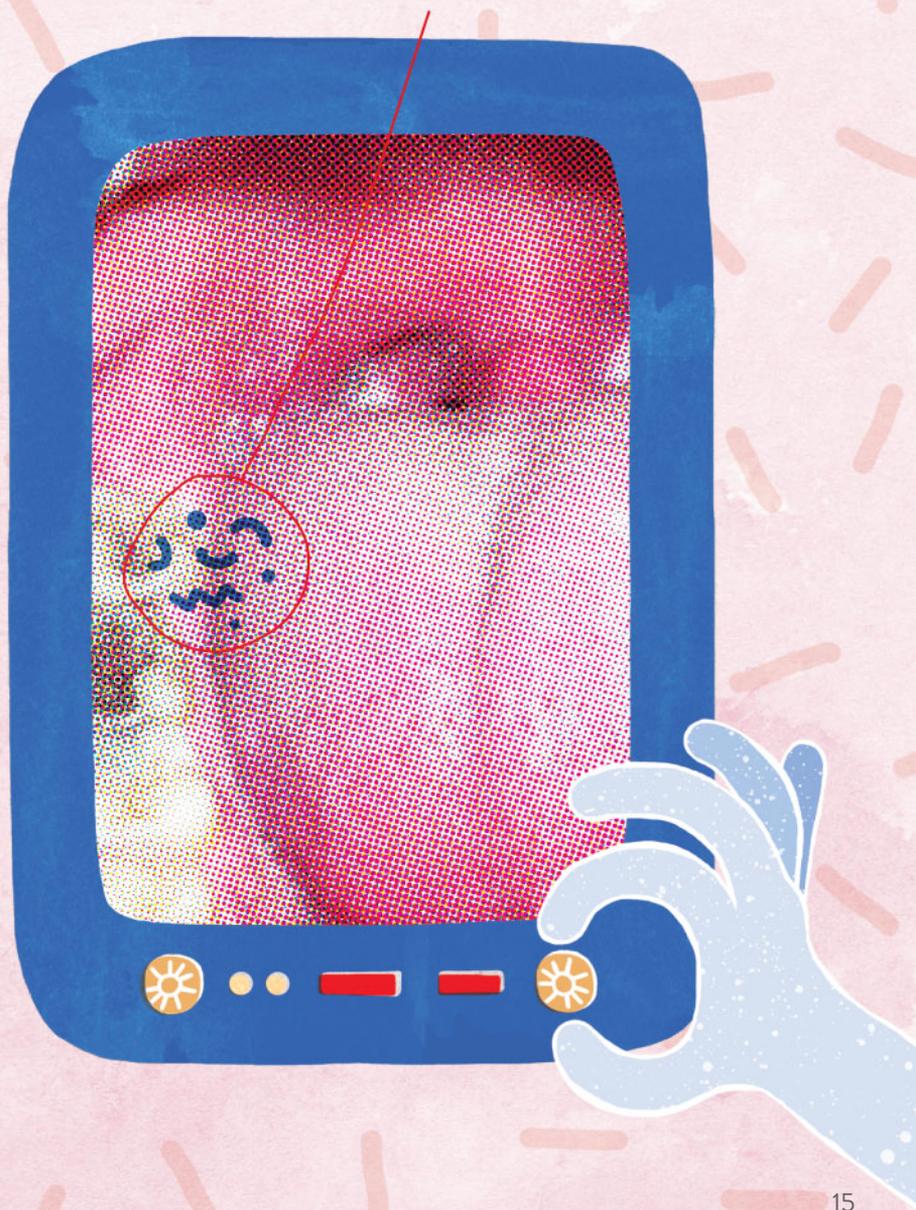
At Grandpa's first snore, Curey drops the camera on his lower lip. In a flash, she grabs the controls. On the second snore, she's in. The camera speeds into his mouth, broadcasting back to Curey's screen.

WOW! Grandpa's mouth is covered in a type of microbe called bacteria. More than 700 different types of bacteria can live in human mouths. Scientists are finding new ones every day. Curey counts 167 types in Grandpa's mouth. And there are thousands of each type. She sees bacteria eating the sugar on Grandpa's teeth.

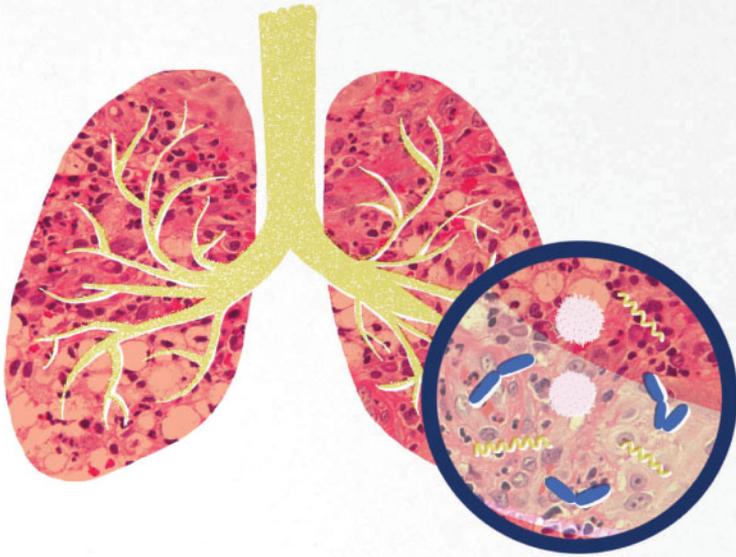
She knows these bacteria.

She knows they cause cavities.

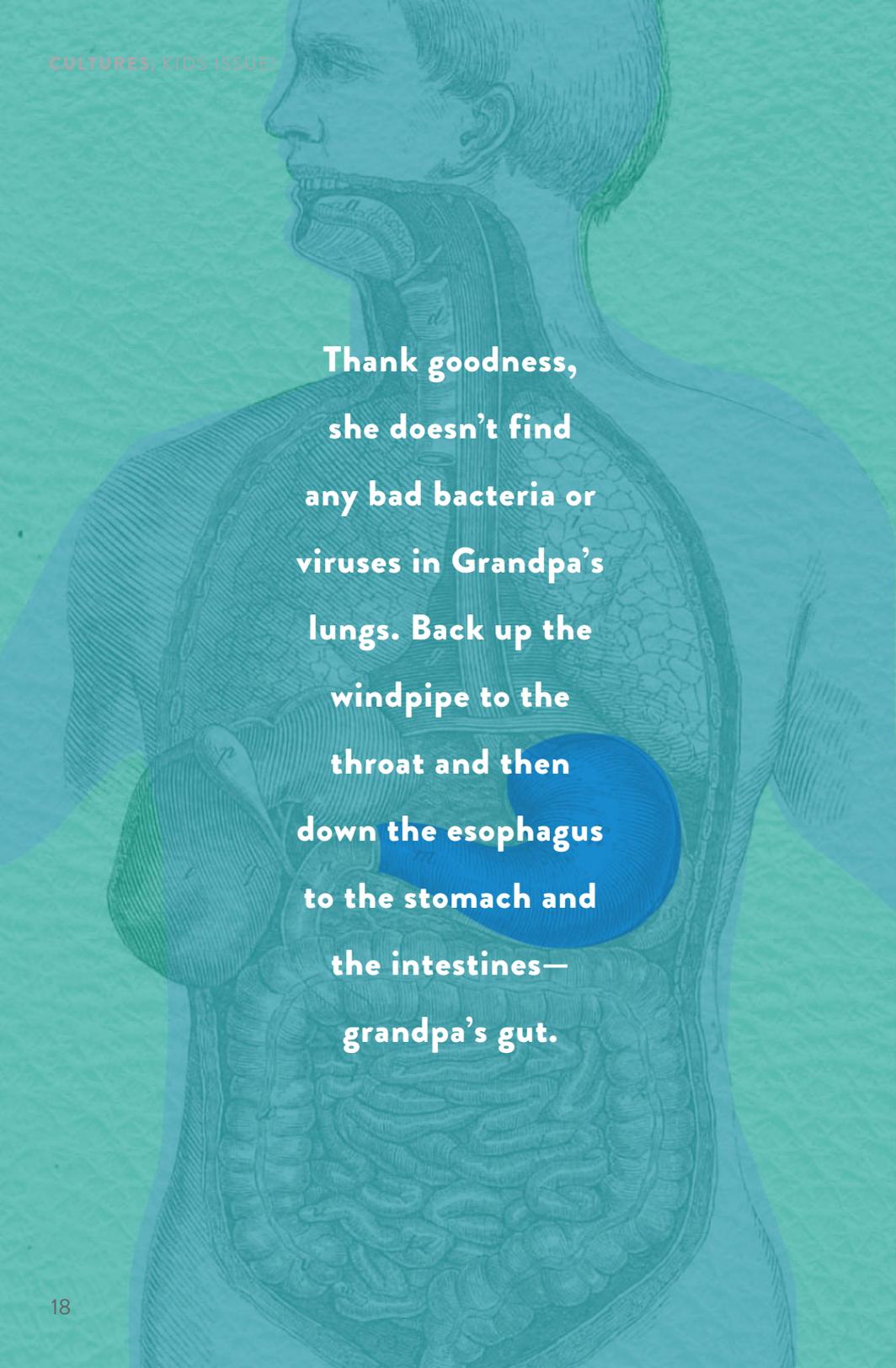
THERE ARE 167 TYPES
OF BACTERIA IN
GRANDPA'S MOUTH



Some bacteria can live without light, heat, or oxygen. In the pockets where teeth join the gums, she finds bacteria that live without oxygen. How cool is that! She's never seen that before. She takes pictures, and makes notes of the number of species. She notes the shapes—rods, spheres, and spirals—and the colors. She even sees a bacterium that looks like it has bunny ears— **Bifidobacterium**. It's one of her favorites. Bifidobacterium helps the good bacteria in the gut to be even better, and it's found in some yogurt. Grandpa must have had yogurt for lunch.



From the mouth, she guides the camera down the windpipe, down into his lungs. She's on the lookout. The lungs don't have any good bacteria to protect them and so they are a really good place to find bad bacteria—like the bacteria that cause pneumonia. You can also find viruses, the microbes that give us colds, flu, and a different type of pneumonia.



**Thank goodness,
she doesn't find
any bad bacteria or
viruses in Grandpa's
lungs. Back up the
windpipe to the
throat and then
down the esophagus
to the stomach and
the intestines—
grandpa's gut.**



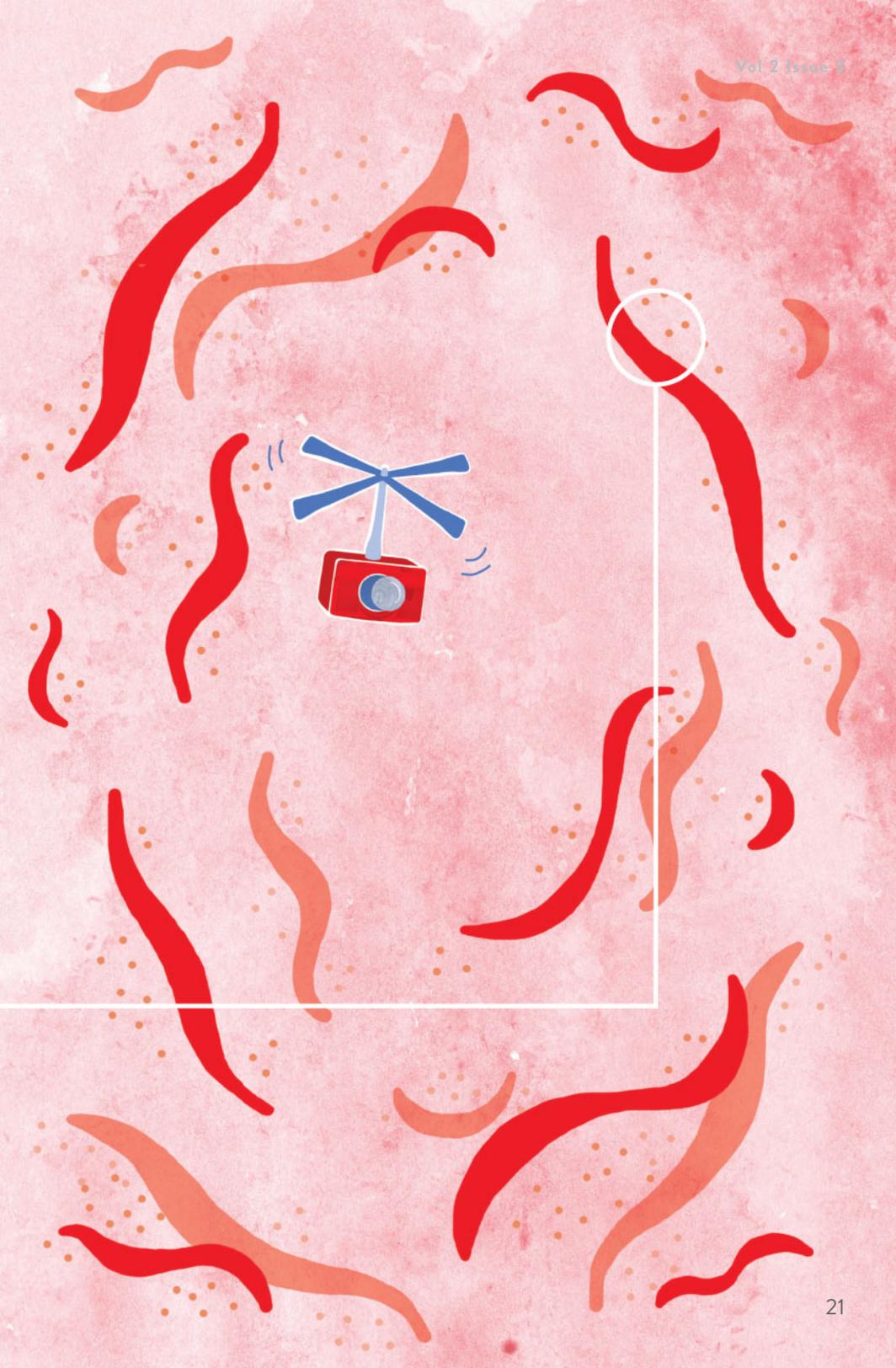
Uh, oh. The deli meat
Grandpa had for lunch
is covered in bad
bacteria! The good
bacteria in his gut don't
allow the bad bacteria
any place to live, grow,
and reproduce. Thank
goodness for the good
bacteria! He could have
gotten food poisoning.

Now that the scare is over, she sees at least 1000 different types of microbes. Most of them are bacteria. They're in the stomach and attached to the walls of the intestines. Bacteria cling to every bend and curl, doing their job. They're so thick she can barely see the walls.



COOL FACT:

A BABY'S MICROBIOME IS FORMED BETWEEN BIRTH AND AGE TWO. AFTER THAT IT WILL CHANGE, BUT NOT VERY MUCH.





Bacteria's most important job in the gut is to break down food our bodies can't break down. They help pull out the nutrients from the food Grandpa ate. They change it to a form his body can use. They mush up the parts of food the body can't use, like fiber, and get it ready for its trip out of the body—as poop. When bacteria do their job in helping digest food, sometimes gases form. The gases can be smelly. If they build up, they can explode out with a loud noise.

Inside the gut, bacteria do other jobs. They keep out bad bacteria, like the bacteria on the rotting deli meat.





They make vitamins, like B12 and K.

There are so many bacteria—so many different types! And they multiply quickly. Curey's

eyes get blurry,

her fingers

numb. After

recording the

microbiome in

Grandpa's gut,

she doesn't have the energy to check

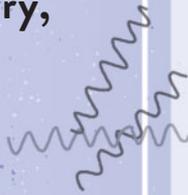
out the microbes on his skin. She takes

the camera out of grandpa, sits back

and takes a little snooze. She's checked

out what's in him. Later she'll check

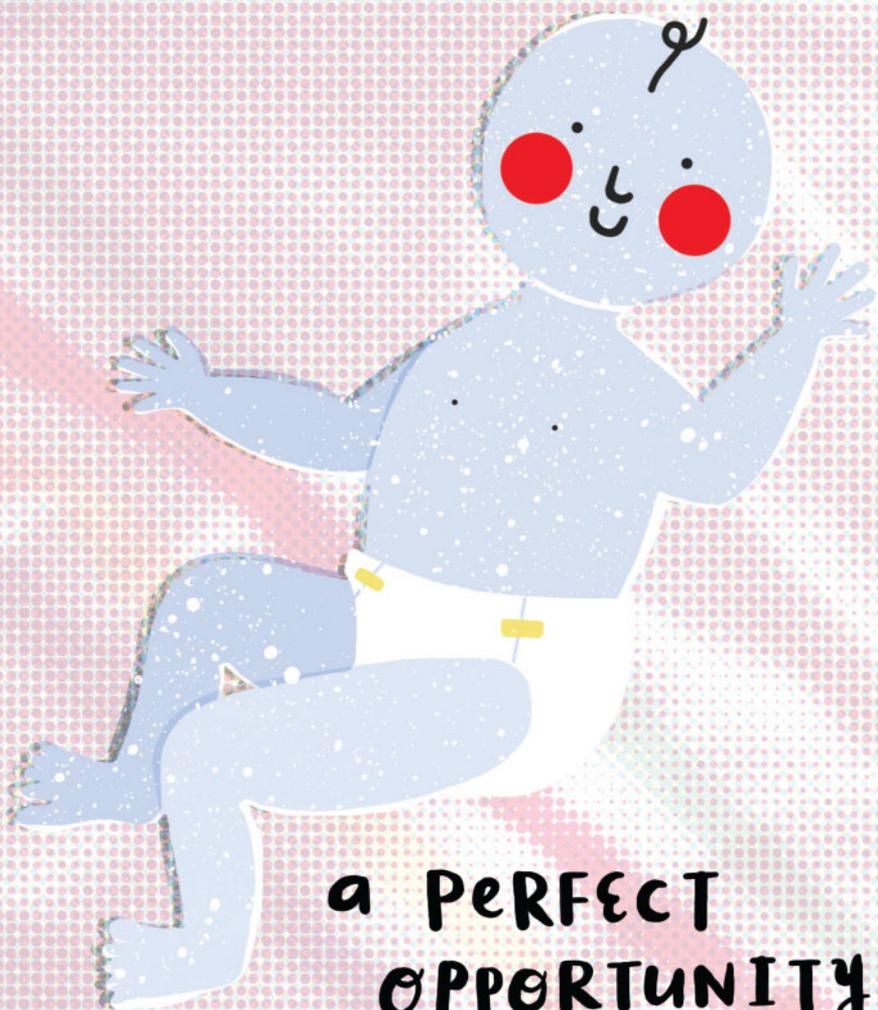
out what's on him. On his skin.



COOL FACT:

ONE BACTERIUM CAN GROW TO MORE THAN TWO MILLION BACTERIA BETWEEN BREAKFAST AND DINNER.





**a PERFECT
OPPORTUNITY**

“Can you take care of the baby?”

Mama’s voice sneaks into Curey Osa’s snoozing brain. Gaby’s just woken up and he’s crying.

Yes! She’s tired, but this fits right into her plans. She can check out her baby brother’s skin, instead of bothering Grandpa. Gaby’s microbiome is much smaller. And all he’s wearing is a diaper.

“We’ll play in a second,” Curey tells Gaby. She hands him a toy.

With her super powerful Electron Magnifying Glass (EMG), she quickly takes a look. He’s covered with microbes!

Gaby got his first microbes coming out of Mama's birth canal. Then he got more microbes when anyone touched him.



Some of the microbes on Gaby's skin had come from Curey! Some might have come from Buster, their dog. They could have landed on him from dust in the air. She tickles his feet to look at his toes. The skin between the toes is red and peeling. Curey takes a look with her EMG. Then she checks a chart in her MIT.



MICROBES:

GOOD

vs.

BAD

BACTERIA helps us digest food and makes vitamins that are important for our health!

BACTERIA can also give us diseases and can make food and water unsafe to drink. *E. coli* is an example of a bacteria that can make food and water unsafe to ingest.

Scientists have figured out how to use **VIRUS** microbes to make vaccines. Vaccines prevent us from getting diseases like polio, measles, and the flu.

Some **VIRUSES** can be bad. Have you ever had the chickenpox? That's caused from a microbe known as human herpesvirus 3. Colds, the flu, AIDS, and Ebola are all caused by viruses.

FUNGI decompose dead or dying things. Some, like mushrooms, are good to eat! And many give color and flavor to cheese. (Have you ever eaten blue cheese? The blue you see in that cheese is actually a fungus!)

FUNGI can give us ringworm or athlete's foot. Some plant fungi cause trees or plants to die. Mildew and mold can be dangerous to our health and is often found in damp, dark places, like basements.

PROTOZOA have been on earth for a very, very long time. They help termites digest wood in their stomachs.

PROTOZOA can also give us diseases like sleeping sickness, malaria, and giardiasis.

ARCHAEA can survive in hot and cold environments and are useful for mining iron and copper.

ARCHAEA can damage oil wells by feeding on important sulfur.

The chart in her MIT says her brother has a fungus in between his tiny toes, even though he's a baby. It's called athlete's foot fungus. She shoots lots of pictures. Later she'll translate them into notes.

Now, a disgusting smell reaches her nostrils. A dirty diaper. Score! She changes her brother and fills a page in her notebook with the microbes she finds in the diaper. Some of them are the same she found in Grandpa's gut, but some of them are different.

But wait. Gaby feels warm. She tickles him again. He doesn't giggle. She looks in his ears—microbes. In his nose—microbes. But they all seem to be good microbes.

“Say, ‘AAHH’, Gaby,”

she asks her brother.

Aha! The tonsils on the back of his throat are bigger than she expects for a baby. They’re covered with white patches. She’s very familiar with this bacterium. It’s called **Streptococcus**. It’s what gives you strep throat. Poor Gaby.

“Mama, Gaby has strep and athlete’s foot.”

Mama comes running. Curey knows her microbes. As Mama picks up the baby, he lets a long, loud toot.

“At least his gut microbes are working,” Curey says.



COOL FACT:



DIFFERENT PEOPLE
HAVE DIFFERENT
TYPES OF BACTERIA IN
THEM. FOR INSTANCE,
JAPANESE HAVE
BACTERIA TO HELP
THEM DIGEST SEAWEED.

IN GRANDMA'S KITCHEN

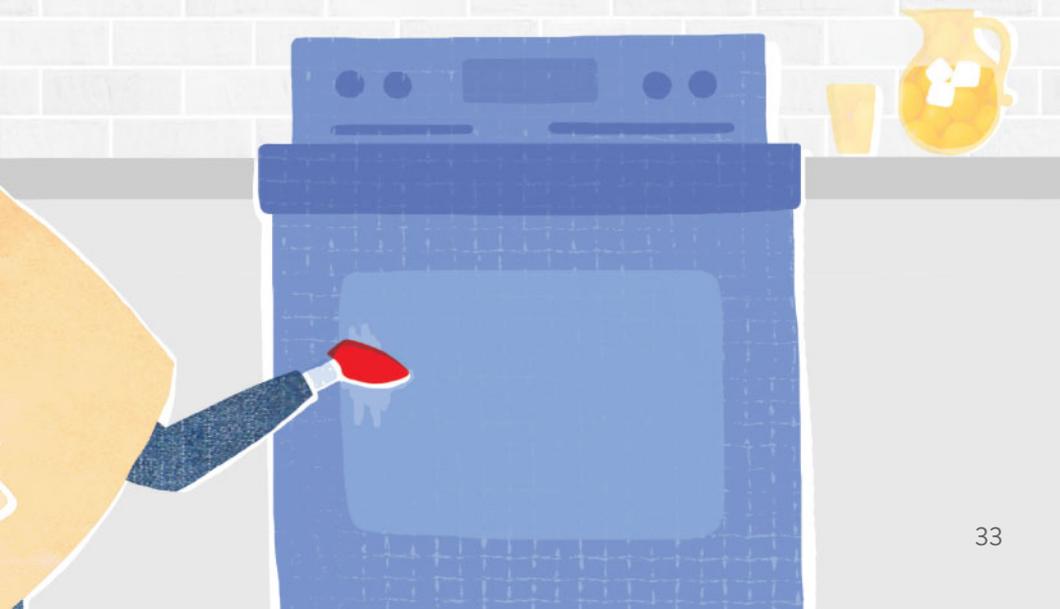
“May I have some lemonade?”

Curey asks her Grandma.

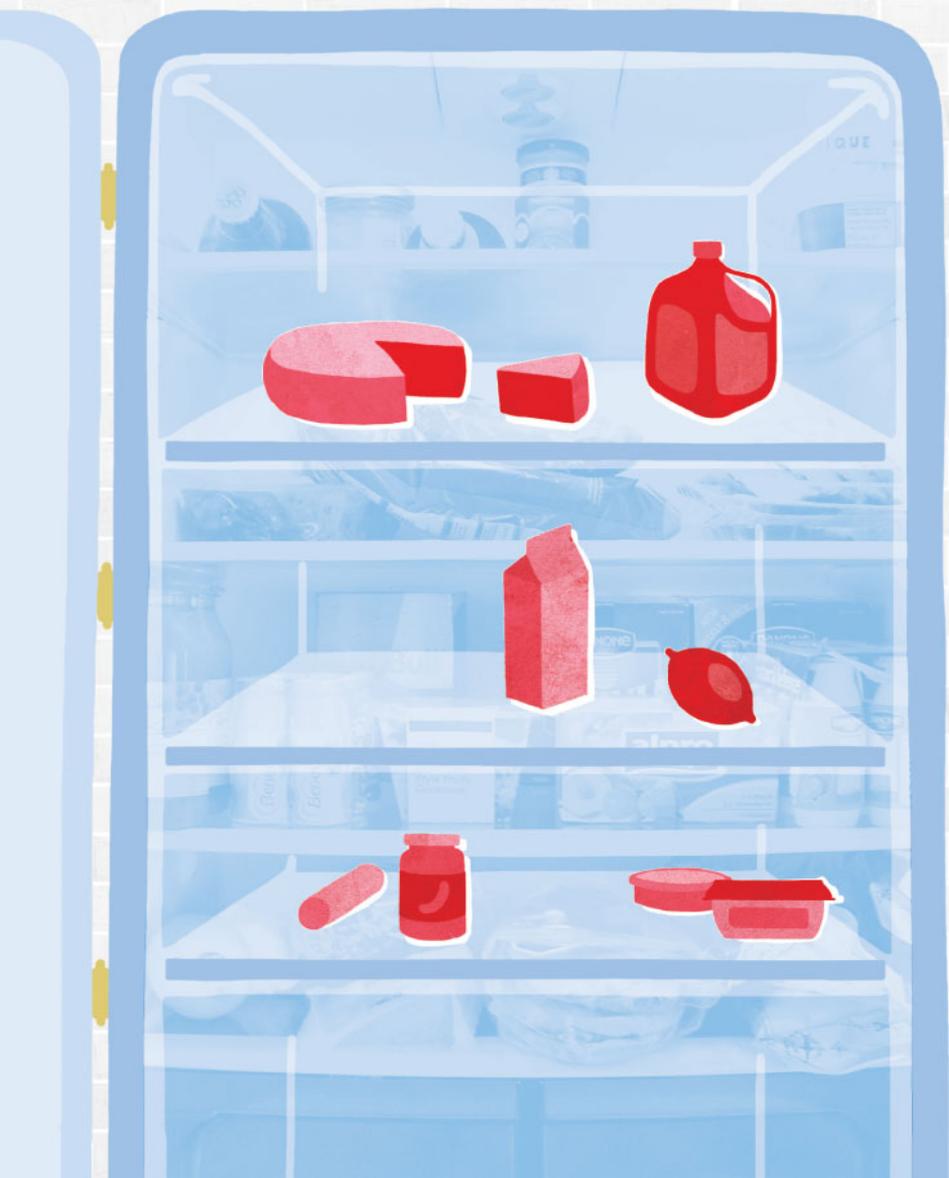


“Sure,” Grandma says. She’s kneading bread. Turning and twisting it before she lets it rise again. “Want a peek?”

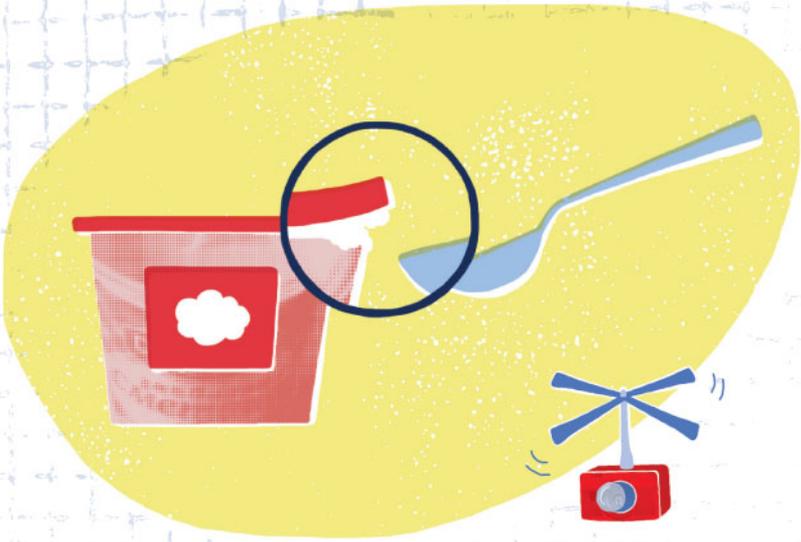
Curey doesn’t need another invitation. Under her EMG, the yeast fungi are hard at work producing a gas to make the bread rise. They also ferment the sugars in the dough to give the bread flavor.



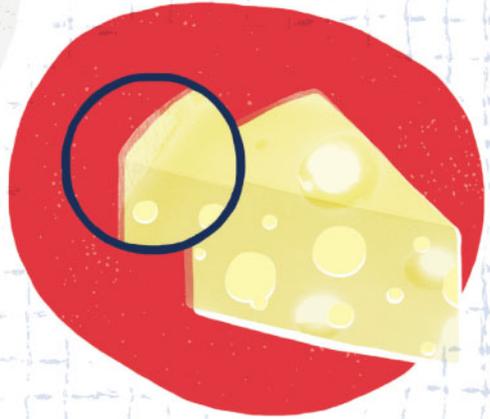
Now that she's in the kitchen, she can't resist the urge to look at everything.



She takes out and opens every jar, baggie, and box Grandma keeps in the fridge. Grandma loves cheese. Currey Osa finds bacteria in Grandma's cheeses. Cheese is made from milk. Lactic acid bacteria are the microbes used to ferment or break down the milk. They cause it to separate into curds (solids) and whey (liquids). The liquid is removed and the cheese hardens. Different bacteria and what the cows or goats eat give some cheeses their colors and flavors. Bacteria or fungi harden a rind around others.



Blue cheeses are stinky, but they're Currey's favorites. Cheesemakers shoot mold fungi into cheeses like Roquefort, Gorgonzola, and blue cheese to give them a special flavor and blue and greenish colored veins. Is the mold still alive in the cheeses in Grandma's fridge? Currey looks with her EMG.



Some of the molds were still hard at work. One piece of cheese had a different type of bacteria. It was going bad.

Sour cream and sauerkraut? Full of bacteria. Pickles? The same. Is there a pattern? Lactic acid bacteria soured the milk to make it cheese. Soured cabbage made sauerkraut, and soured cream ...

Yep. There was a pattern. Bacteria are good at turning things sour. It's called **fermentation**. It's what gives some foods their taste and texture.

Curey opens the deli meat Grandpa ate. It smells bad. It looks slimy.



The expiration date on the package was two weeks ago. She shows it to Grandma and they throw it in the trash. But the bananas and apples on the counter are safe to eat, even though they have brown spots. No bad bacteria in those!

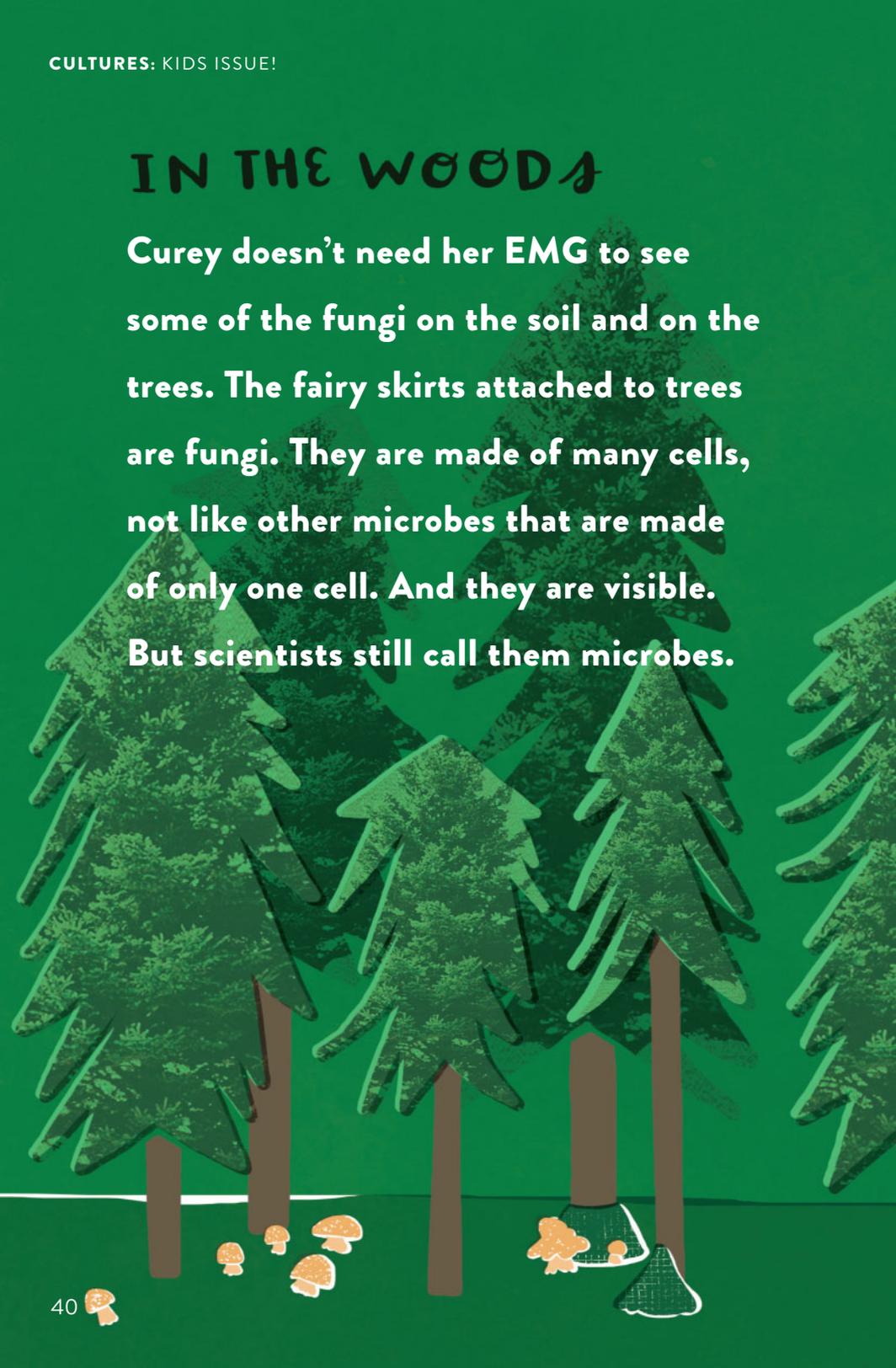


WHEN MICROBES BREAK DOWN A SUBSTANCE, SOMETIMES THEY MAKE BUBBLES AND GIVE OFF HEAT. THIS IS CALLED FERMENTATION. FERMENTATION IS WHAT MAKES YOGURT, BREAD, CHEESES, BEER, AND WINE.



IN THE WOODS

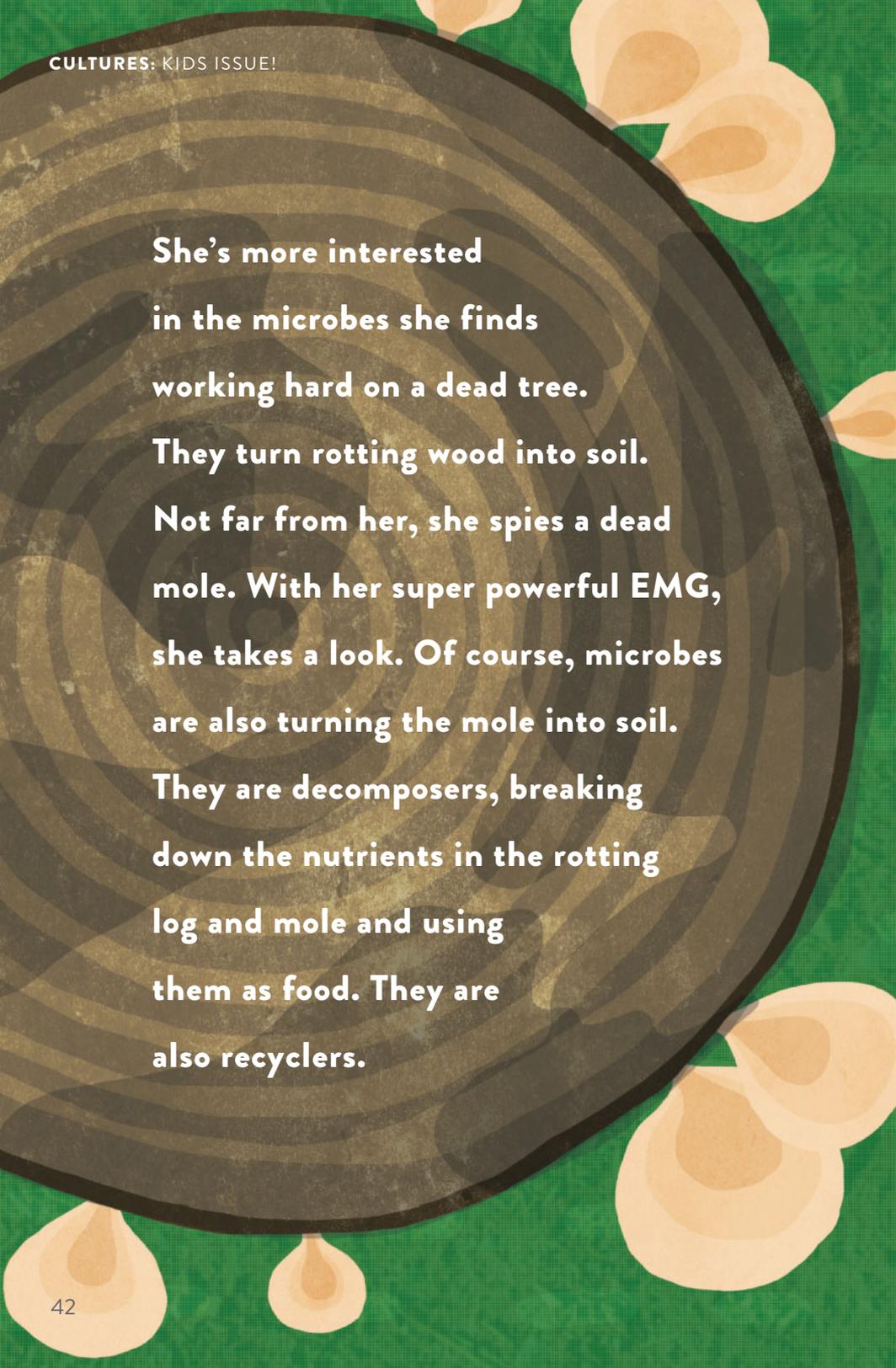
Curey doesn't need her EMG to see some of the fungi on the soil and on the trees. The fairy skirts attached to trees are fungi. They are made of many cells, not like other microbes that are made of only one cell. And they are visible. But scientists still call them microbes.



Mushrooms are the fruit of **fungi.**

Even though she's hungry, Curey never eats a mushroom from the wild unless her parents or a mushroom expert tells her it's okay. Some of them can be deadly, even the beautiful ones.





**She's more interested
in the microbes she finds
working hard on a dead tree.
They turn rotting wood into soil.
Not far from her, she spies a dead
mole. With her super powerful EMG,
she takes a look. Of course, microbes
are also turning the mole into soil.
They are decomposers, breaking
down the nutrients in the rotting
log and mole and using
them as food. They are
also recyclers.**

They release the nutrients into the soil to be used by other living organisms. She makes a note to come back in two weeks to see what's happened to the mole. She takes pictures. She knows without microbes the food web would not work.

COOL FACT:

THE LARGEST KNOWN ORGANISM ON EARTH IS A MUSHROOM! IT IS 3.5 MILES WIDE, LIVES MOSTLY UNDERGROUND IN THE STATE OF OREGON, AND IS THOUGHT TO BE 2,400 YEARS OLD.



ON THE POND

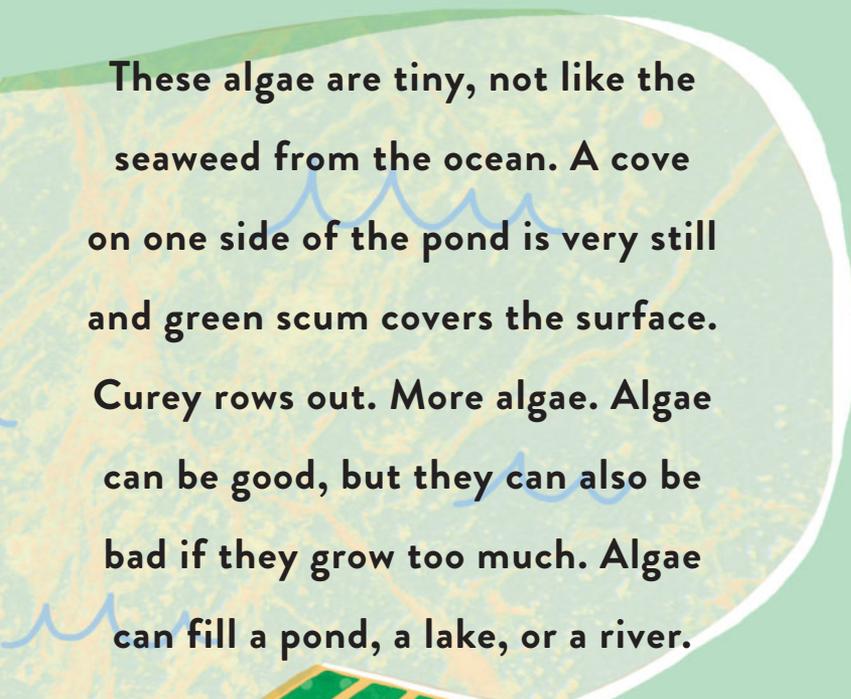
Ooops!

Curey slips getting into Grandpa's boat. The step on the dock is covered with slimy, green stuff. Thank goodness she plops right on the seat.

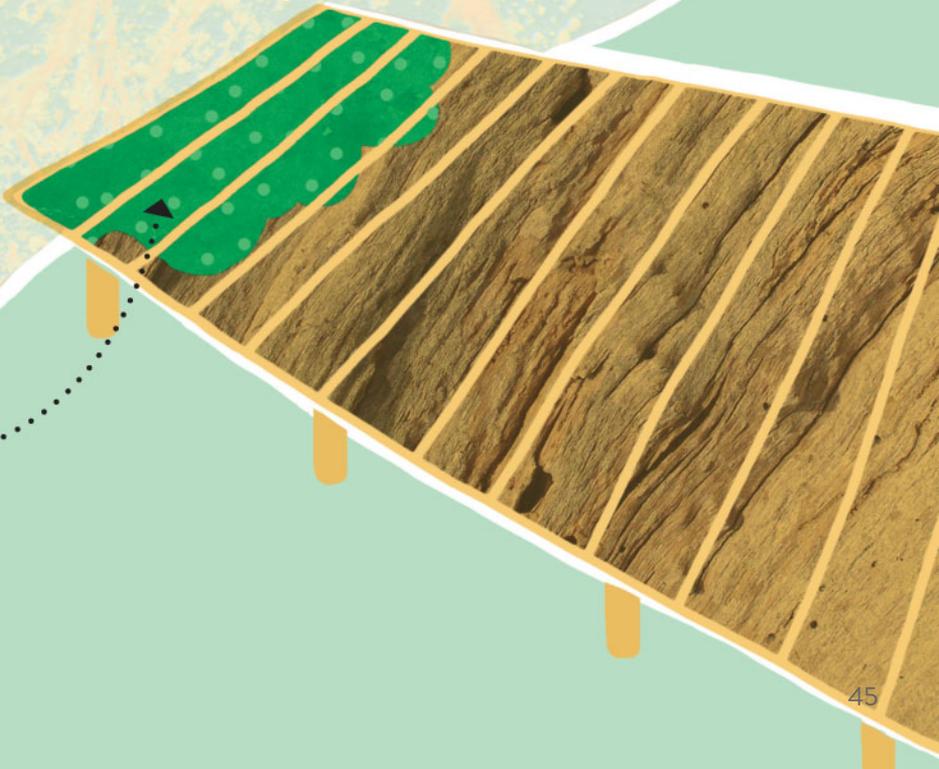
Her tool kit isn't damaged!

First, she looks at the step:

ALGAE!



These algae are tiny, not like the seaweed from the ocean. A cove on one side of the pond is very still and green scum covers the surface. Curey rows out. More algae. Algae can be good, but they can also be bad if they grow too much. Algae can fill a pond, a lake, or a river.



As other organisms munch on the algae, they multiply and hog the oxygen from the other living things in the pond. At the same time, too much algae floating on top of the water can block the sunlight from shining below the surface. Without oxygen or sunlight, whatever else lives in the water will die. Curey makes a note to tell Grandpa.

Wearing gloves, she takes a glass full of pond water. *Escherichia coli*? She's seen this microbe before—a bacterium. She checks her MIT. Yep. This is a type of *E. coli* that lives inside a cow's guts. She saw *E. coli* inside Grandpa's gut and in Gaby's diaper, but this bacterium is different. How did it get in the water? A look around solves the mystery. Not far

from the pond, five cows lie in the shade of a tree. They either pooped in the pond while they were cooling their udders, or their poop was washed into the pond by rain. That's how the *E. coli* got into the pond. **NOT GOOD.** *E. coli* from cows' guts is harmful to humans.

Curey sees many other microbes in the water. Wait! Is that *Giardia*? She checks her book. She'd better be extra careful handling the sample. *Giardia* can infect humans and make them sick if swallowed. Carefully she drains her cup back into the water without splashing. She cleans all her instruments with antibacterial tissues and takes off her gloves and stows them in a trash bag. She rows back to shore to talk to Grandpa.

Curey and Grandpa have a long talk about what she found in the pond, and about eating bad deli meat. The pediatrician sent Gaby an antibiotic to fight the strep throat. He'll be feeling better in the morning. She can smell the bread Grandma was kneading, now baking in the oven. After a day of working with microbes, she slips into a warm, soapy tub for a good scrub.

It has been a wonderful day for
Curey Osa, M.I.



**COOL
FACT:**

SCIENTISTS ARE
FINDING NEW
MICROBES ALL
THE TIME!



SCIENTISTS ONLY

BY: ERLN TEAGAN

Aunt Kara comes today. She’s a *real* scientist who works in a lab and uses words like “hypothesis**” and “**genome**” and “**Eppendorf tube**”. I’m going to be a scientist when I grow up just like her.**

Everything has to be perfect when she comes, so I sneak past my little brother James eating his waffle in the kitchen and tip-toe to the little room under the basement stairs. It’s a room Dad built particularly for me. My own laboratory because I’m already a scientist with all of my experiments and ideas.

.....

Aunt Kara told me what these words mean:

HYPOTHESIS: *an idea you can test with experiments*

GENOME: *all the material that makes up a person*

EPPENDORF TUBE: *special tube with a hinged lid*

Last year I would have won the second grade science fair except my fruit flies decided to escape the night before the big day.



Lab coat. Check! **Goggles.** Check!
Dr. Octopoda, my trusted stuffed octopus and lab assistant. Check! I adjust the sign on the door that says **‘SCIENTISTS ONLY’** and walk inside.

Aunt Kara told me all good scientists wear a
LAB COAT and GOGGLES to be safe in the lab!

.....

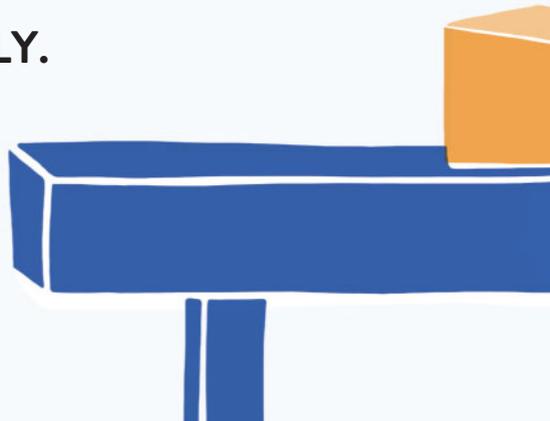
Lab coat

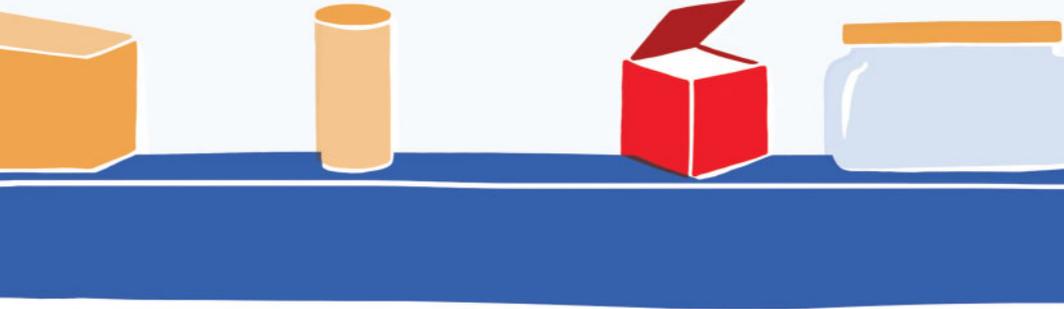
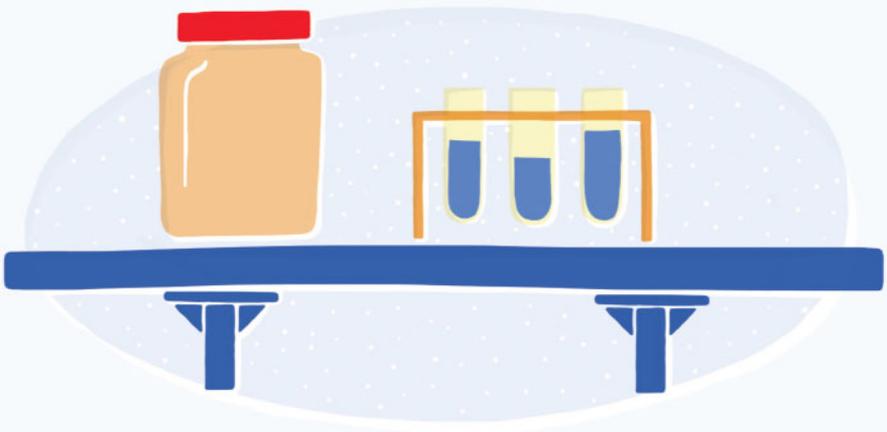
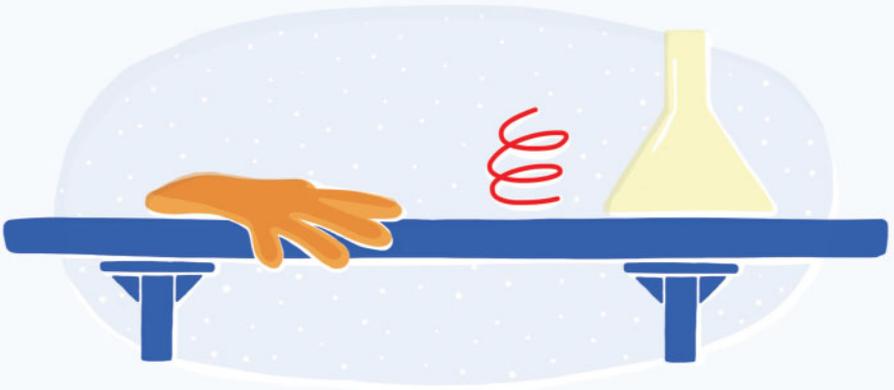
Goggles

Dr.
Octopoda

Last night Dr. Octopoda and I super-extra cleaned up the lab. All of my experiments are lined up on my lab bench next to my shelf of cool science stuff that mostly Aunt Kara gave to me. Big and little funnels, lab gloves for handling delicate materials, a beaker, glassware with twisty necks, and also an old rusted-up scale to weigh things. One time James sat on it when I wasn't looking and nearly broke it.

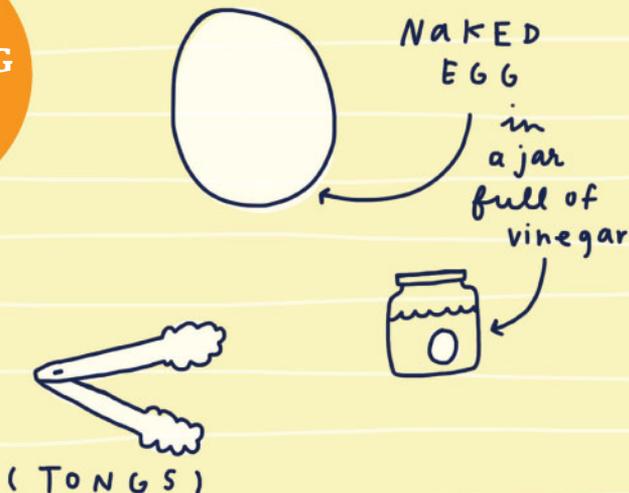
This is why the lab is for
SCIENTISTS ONLY.





I put Dr. Octopoda in his spot in the corner, open my lab notebook, and check on my experiments. My naked egg still sits in a jar of vinegar. I plug my nose and lift the egg with my tongs, careful not to squeeze too hard. Most of the eggshell

TRY MAYA'S
NAKED EGG
EXPERIMENT
ON PAGE 42!



is gone by now, and I write this in my notebook under the word 'Observations.' Last night most of the shell was still there, but now, if I touch the egg, the shell comes off white and powdery on my finger. Aunt Kara is going to love this.

OBSERVATIONS

Day 1

Shell is starting to get soft

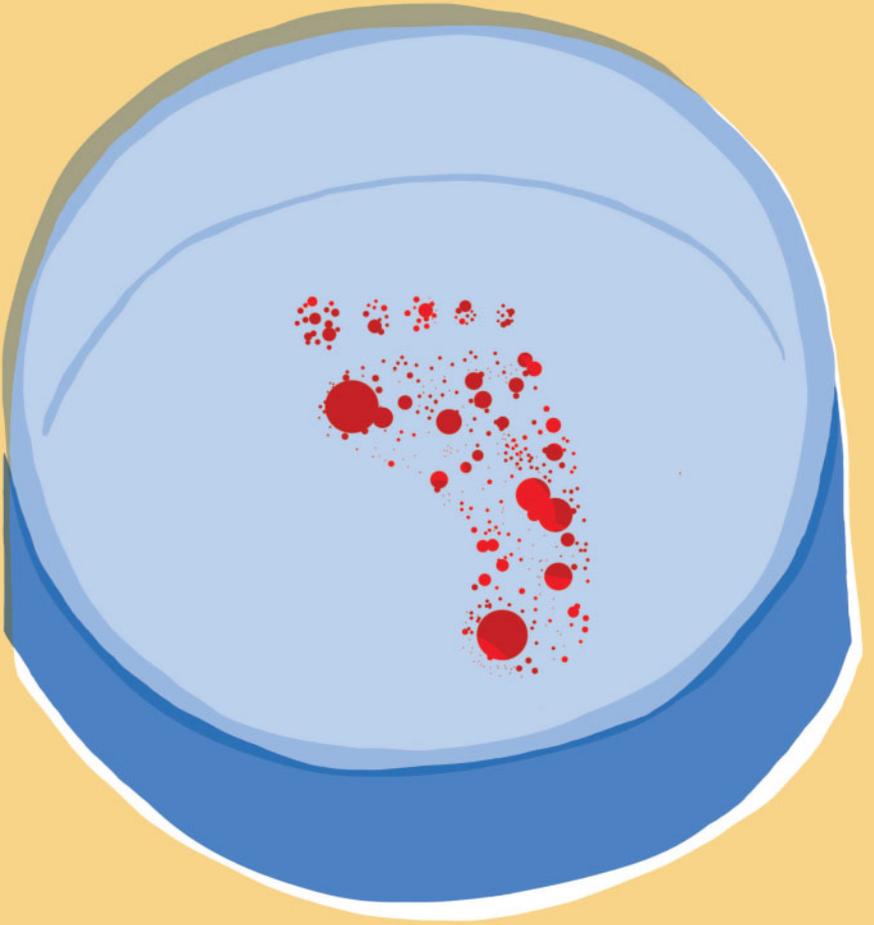
Day 2

Shell is almost gone! Shell turns to powder when touched.

Day 3

I move on to my next project –
THE FUNKY FOOT EXPERIMENT.

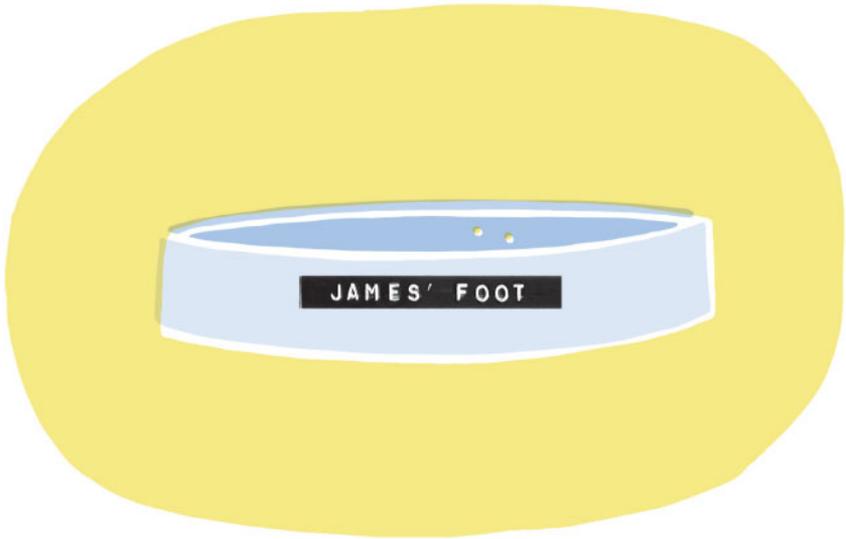
A few days ago, with triple-layered gloves, I pressed one of James' toes onto a **petri dish** because his feet stink worse than a rotten bologna sandwich in the middle of a trash heap. Whatever germs were on his feet would grow big and huge on the petri dish and I'd have proof once and for all that James needs a bath. It's a dangerous and disgusting experiment, but there are no wimps in science.



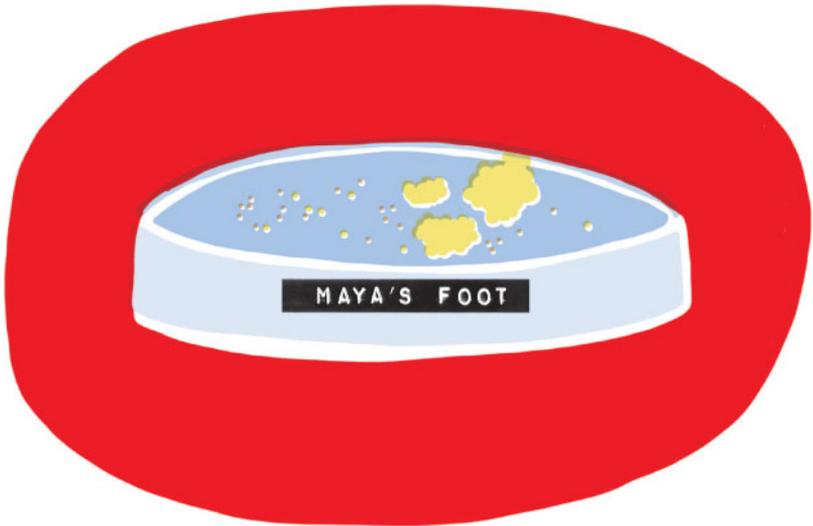
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Aunt Kara taught me about the petri dish:

It is named after a famous scientist: Julius Richard Petri! It is a round plastic plate that biologists use to “culture” or “grow” cells!



Secretly I pushed my own toes onto a second petri dish so I could compare a properly washed and sanitized foot to James' funky foot. I lean in close to the petri dishes. My dish is bursting with yellow and white dots with one giant fuzzed blob growing out of control while James' petri dish is barely even spotted



with anything. I grab Dr. Octopoda for a second opinion. How can this be? I take a bath every single day! Aunt Kara says that sometimes she has more questions than conclusions after an experiment. Dr. Octopoda thinks I mislabeled the petri dishes. He is usually right about these things.

There is a knock on my laboratory door. I toss Dr. Octopoda into his spot and add three drops of blue food coloring into a yellow bubbling concoction. It is my last experiment not counting the crystals I've been growing for a week that are tucked safely in a corner on a tray under a 'DO NOT TOUCH UNDER THE LAW' sign by my desk. They are a gift for Aunt Kara because, besides science and Eppendorf tubes and animal brains, she likes jewels best of all.



When I open the door, I am not happy to see James and his friend with no front teeth, Adam.

“The laboratory is closed!”

I say, blocking the door.

“Maya, we’re allowed in here too!”

James says.

“SCIENTISTS ONLY!”

I say. Adam peers over my shoulder,

“But, my sister loves science.”





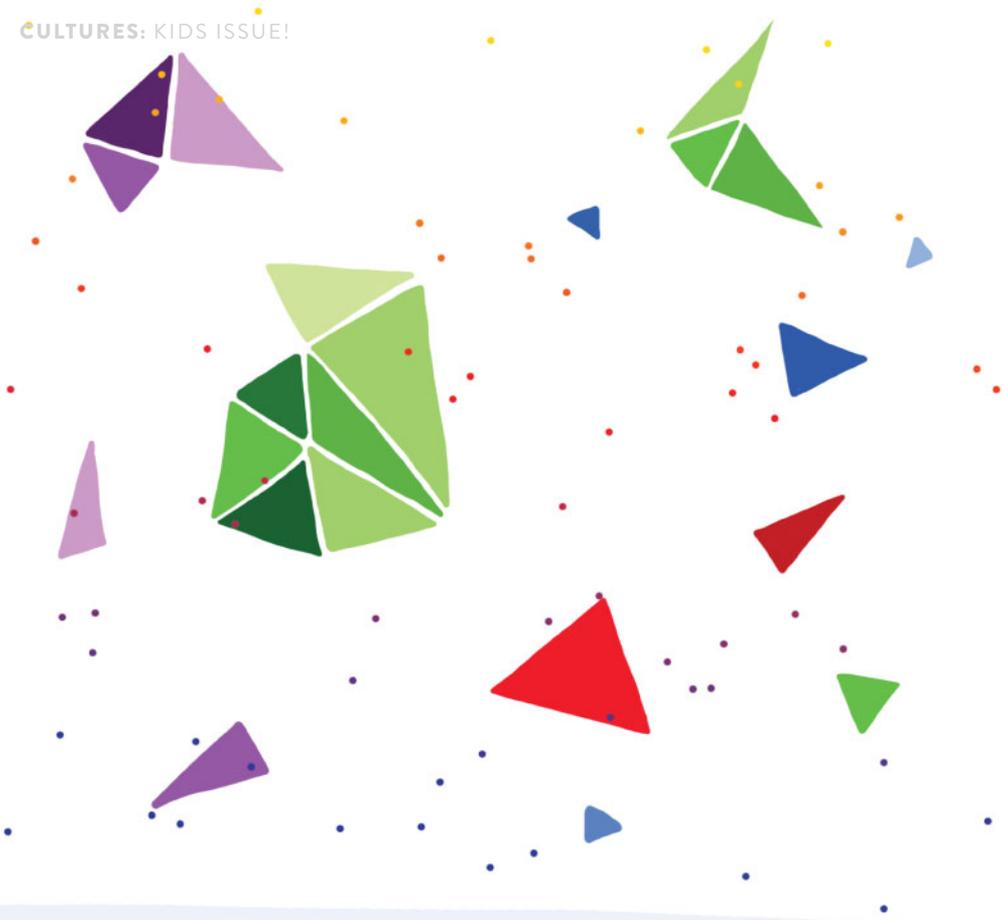
I perk up. Adam's sister Alison is in the third grade, too, and has a giant collection of moon rocks that came actually from the moon. I have wanted to be her friend since kindergarten.

“What is that?” Adam says, pointing at the bubbly liquid which is now green.

I snap on a new pair of lab gloves and carefully lift the beaker. It's just colored fizzy water but I say, “ H_2O .”

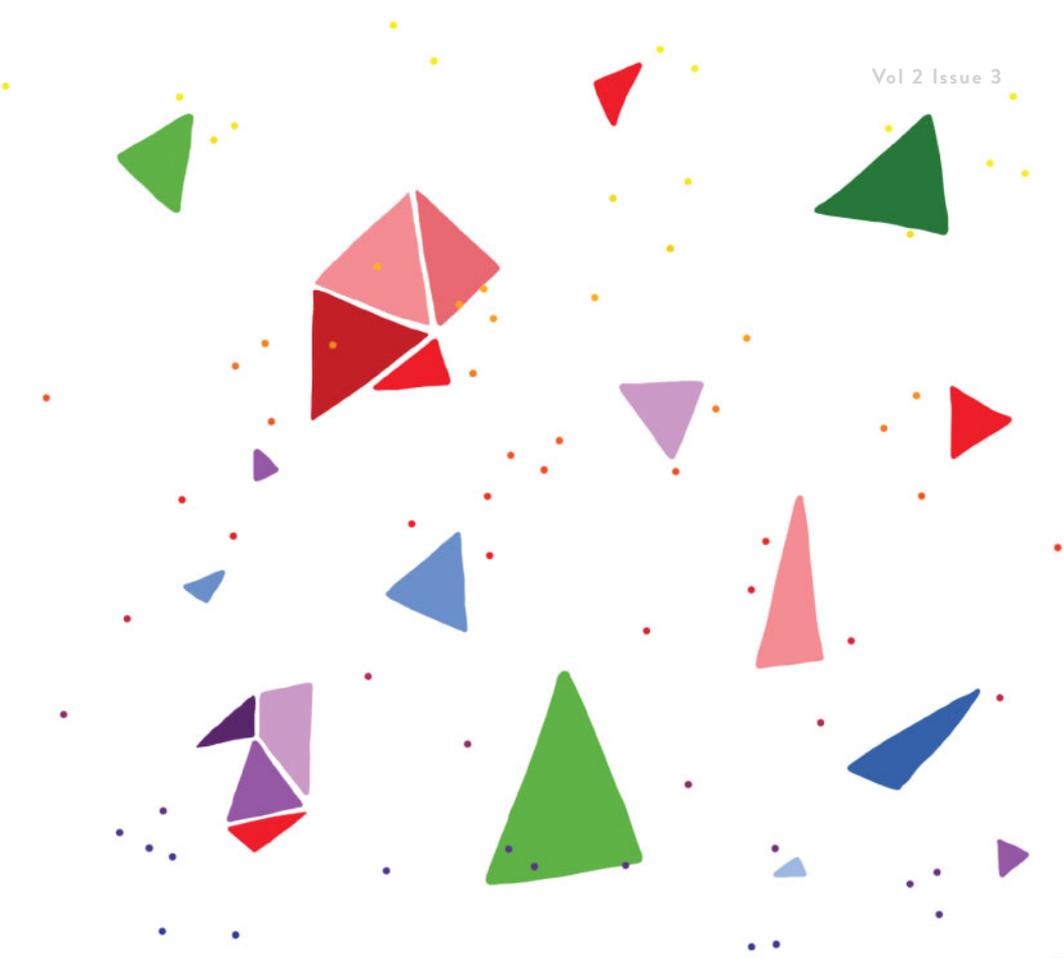


H_2O is what scientists call water, because it is made out of two hydrogens and one oxygen atom!



Adam is impressed. I let him step three feet into my laboratory for a closer look.

There is a crash by my desk and when I turn around, slow-motion scared, I see James holding what used to be my tray of crystals for Aunt Kara. The crystals



are shattered across the floor. Green,
pink, purple. Broken. Pulverized. I can't
even breathe I'm so fire-breathing mad.

“Sorry, Maya.” James steps past
me, slipping and sliding on the
smithereens of my crystal creations.

He grabs Adam and dashes out of the lab.

Dr. Octopoda and I stare at the disaster for a long time. We're so devastated we don't even hear Aunt Kara come in, but I can smell her perfume and hear the jingle of her bracelets.

"Maya! What happened?" she says.

I can't turn around because I want to cry and scientists probably never do something like that.



“Did you make these?” She plucks a shimmery shard of crystal from the floor. “They’re beautiful.”

I wipe my face with Dr. Octopoda.

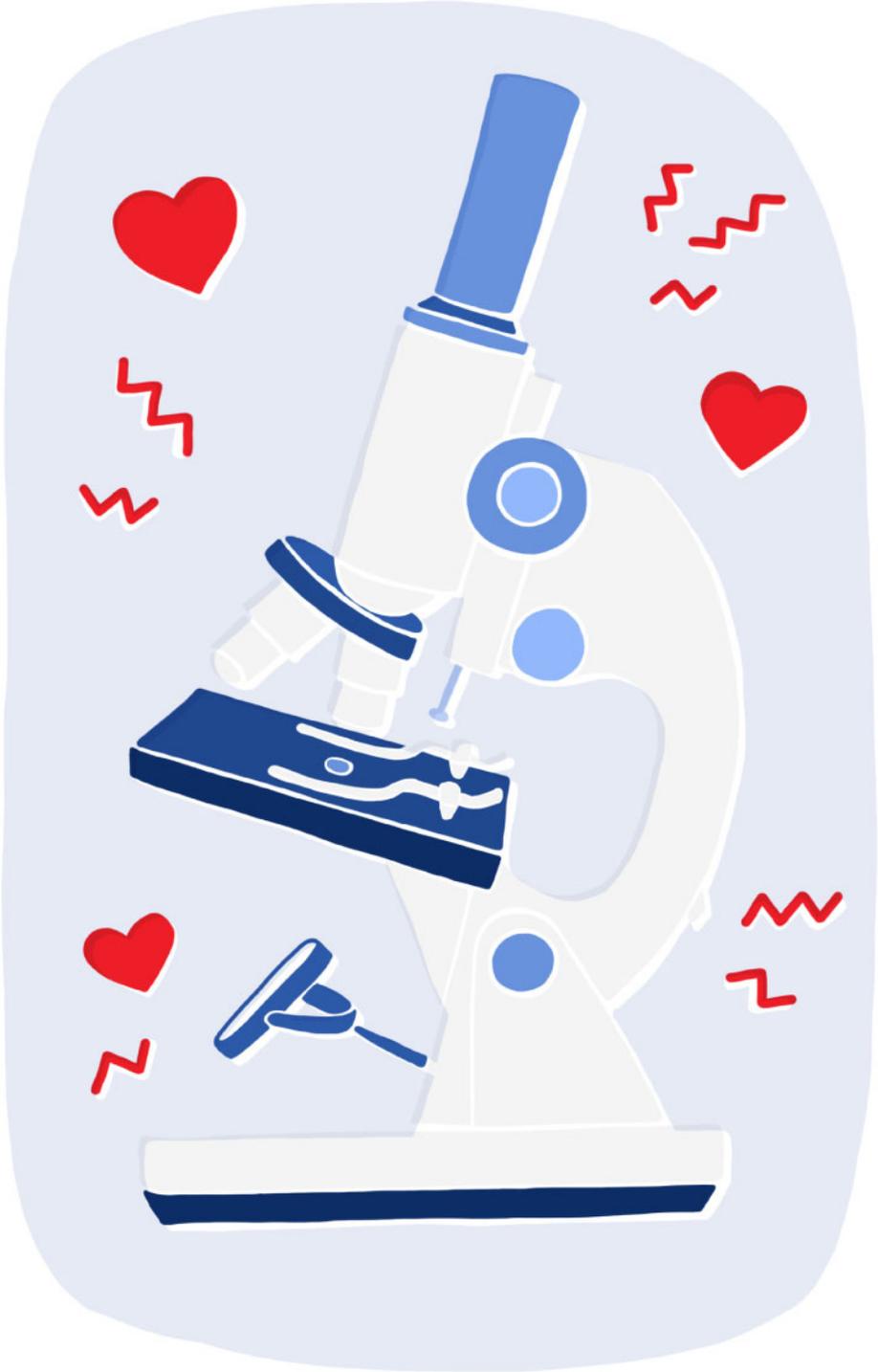
“I made them for you but...”

“I have something that might cheer you up.” Aunt Kara pokes me in the shoulder and hands me a box.

With Aunt Kara you never know what it might be. A lava rock or a weird vegetable she grew in her garden, or even a tarantula, already dead of course and in a glass box like a museum. But, this time it’s none of those things. It’s something I’ve wanted for almost my whole life. A **microscope**.



MICROSCOPE: *a tool for viewing very small objects*



“We got a new one at the lab and I thought you’d want my old one.”

“To borrow?” Dr. Octopoda and I can’t believe it. “Like, for a little while?”

Aunt Kara laughs. “For you to keep.”

She pulls it out and it’s white with some dings and scratches, and it’s probably the most beautiful thing I’ve ever seen.

She puts it on my desk and plugs it in. I look around for the perfect place to hide this new microscope so James can’t sit on it or crash it to smithereens on my floor. There is no such place. I will have to carry it with me everywhere.

“Hand me those **slides**.” Aunt Kara points toward the box.

I give her a plastic container with a bunch of thin rectangles of glass. She places the shard of broken crystal onto the slide and pushes it under the microscope lens. Aunt Kara takes a few seconds, adjusting the dials on the microscope, and then she backs up. “Take a look.”

The tiny piece of crystal looks like a giant ice cube with a ragged edge from where it was broken.



.....

SLIDES: Aunt Kara uses glass slides to sandwich Maya’s sample so she doesn’t get the microscope dirty.

“Try this one.” Aunt Kara swaps the slide out for another one.

When I look at the new slide I see all sorts of colors and shapes. “Wow,” I say, but I wish I could say just the right word to describe what I see. Amazing? Mind-boggling?

I show Dr. Octopoda and he is so excited he has nothing to say at all.

“Science is full of surprises.” Aunt Kara stands up and stretches.

“Sometimes when you think you’ve failed,” she looks at the crystals smashed on the floor, “you make an even more exciting discovery.”



Science
is full
of
surprises





I take out my lab notebook and write down all of my observations before I forget them.

“Did you make your own petri dish?”
She lifts up my funky foot plate.

“Dad helped me make the gel so the germs would grow. I wanted to prove to Mom and Dad that James needs a bath.”

“A strong hypothesis.” Aunt Kara laughs. “And, what is your conclusion?”

My face reddens because she can see ‘Maya’s Clean Foot’ labeled right on the bursting with nastiness plate.

“I still have more questions than answers at this point.”

There's a quiet knock on my door and I think it must be mom checking in on us, but I'm surprised to see James standing there with Adam and Alison.

“Alison came to pick up her brother and I told her about your laboratory.” James is staring at the floor. “Don't worry, I know, scientists *only*. I'll stay here.”

I look at Aunt Kara. She nods toward James like I should let him in. I button my lab coat up tight and cross my arms. Anyway, I only have one extra kid-sized lab coat. I hand it to Alison.

“Is this a naked egg?” she says.

“I’ve always wanted to do that.”

She steps delicately over the crystals we still haven’t cleaned up.

“You have a microscope?”



“I just got it today.” Inside, my stomach is leaping for joy and happiness that Alison has finally come to see my lab so we can

start to be best friends. We even have the same hairstyle, half-knotted up and scraggly. Scientists don't always have time to do their hair.

“I've always wanted to look at a bug under a microscope,” Alison says.

“I have a dead fly in my window sill at home if you want me to bring it over.”

“Sure! I love dead flies.”

And I know it sounds weird but she totally gets what I mean.

Aunt Kara is taking the top off my petri dish. “You girls might want to plug your noses for a minute.”

She plucks off part of the fuzzed blob with a wooden pick and smooshes it onto a slide. She switches the microscope lens.

“Fungus,” Aunt Kara declares, and Alison and I clump around the microscope trying to see at the same time.

“Ewww!” The tiny fuzzy blob looks like a hundred strings under the microscope. I quickly hide the cover of the plate so my new best friend doesn’t realize this fungus came from my foot.

“This person needs a doctor!”
I say like it’s not my foot at all and I’m just making nice conversation.



**“Not necessarily,” Aunt Kara says.
“Everyone has fungus and bacteria
on their feet. Only sometimes does it
mean a trip to the doctor.”**



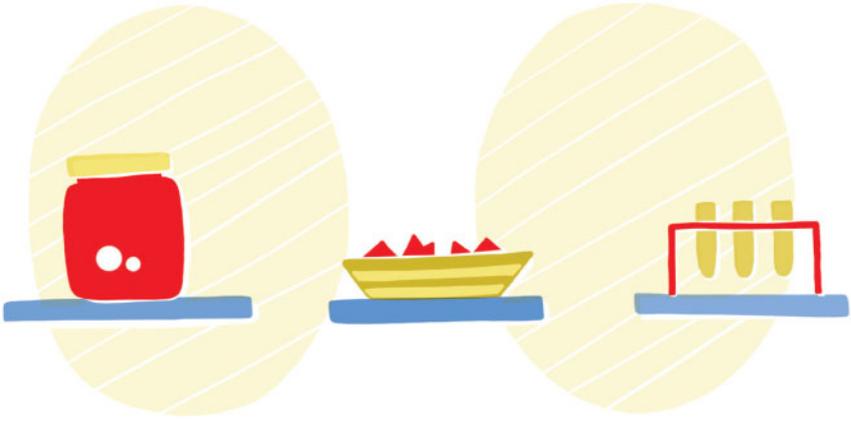
Alison and I take turns looking and we draw pictures of fungus under a microscope in my lab notebook.

Aunt Kara pats me on the back and I see she's looking at sad James sitting in the doorway with his sad friend Adam.

I groan. "Fine," I say to James.

"But you can only look for a second."

He hops up and rushes to the microscope.



“And don’t touch ANYTHING.”

Aunt Kara says she’s proud of me. I let everyone use the microscope for a long time until James wants to pick something out of his nose and put it on a slide. Then I show them all of my top secret projects. And nobody even breaks anything. In fact, it’s been pretty fun explaining my experiments to them.

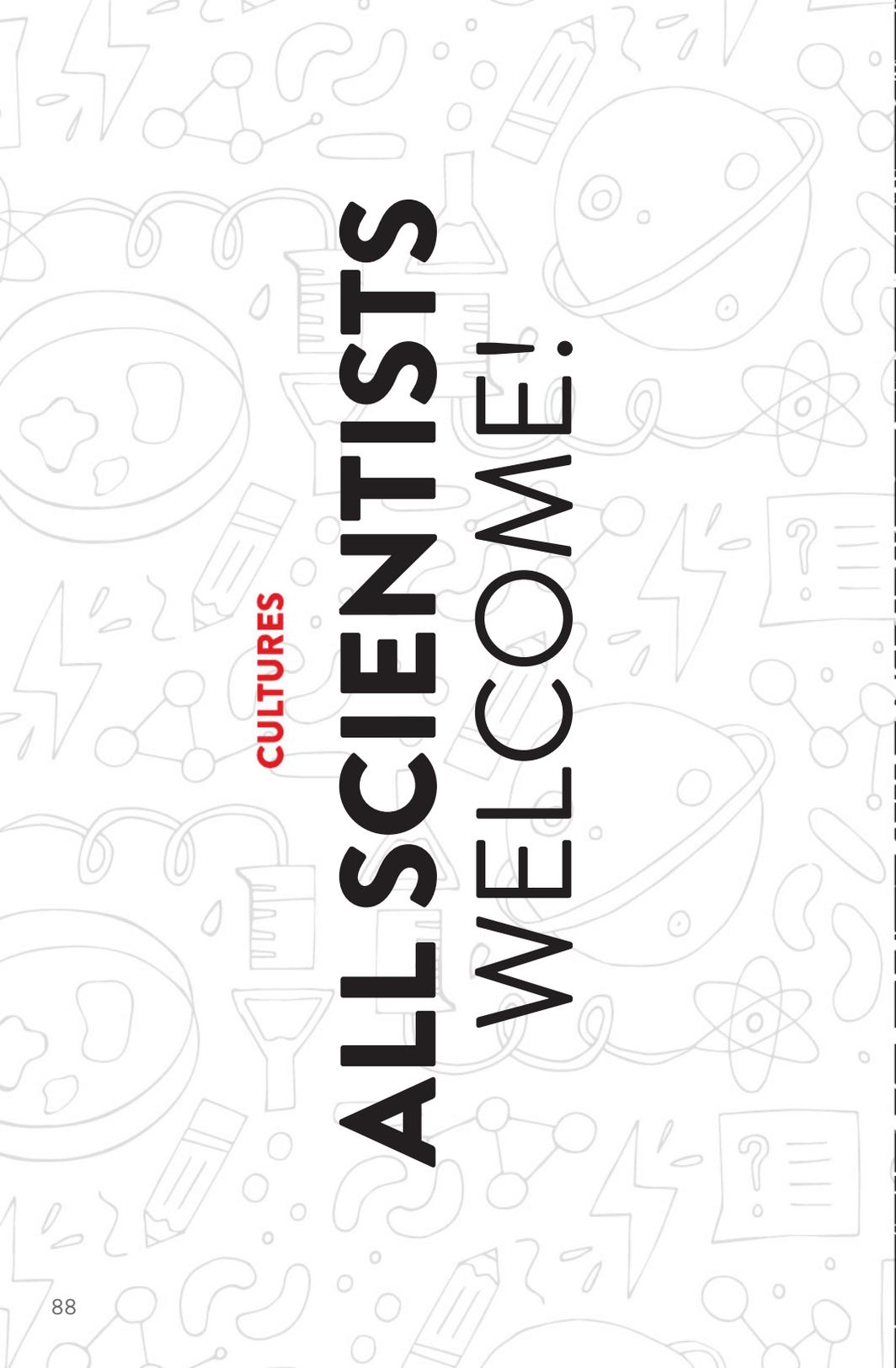
Soon, Adam and Alison have to go home but Alison says she'll come back with her dead fly after dinner. And then Aunt Kara has to go upstairs and talk to Mom who is also her sister. James helps me sweep up the crystals and we find one piece that is only a little bit broken and I let him keep it.

On the way out, I turn the lights off, hang up my lab coat, and properly dispose of my lab gloves. James runs up the stairs ahead of me to show Mom his new crystal, but I stop.

“I'll be right there!” I call after him because I have one more thing to do.

I take my SCIENTISTS ONLY sign off the door and toss it into the trashcan. Because, after today, I'm realizing that science is more fun when it's for everyone.



The background is a dense, repeating pattern of light gray line-art icons. These icons include various scientific symbols such as globes, lightbulbs, pencils, molecular structures, and question marks, creating a theme of science and education.

CULTURES

ALL SCIENTISTS WELCOME!

CULTURES
ACTIVITY BOOK

BELONGS TO:

MAYA LEARNED THAT
SCIENCE IS MORE FUN WHEN
EVERYONE IS WELCOME!
TEAR OUT THIS PAGE & COLOR
IT IN TO HANG OUTSIDE
YOUR LAB LIKE MAYA!



HOW TO:

MAKE A NAKED EGG

MATERIALS:

- One egg
- A cup or glass
- Vinegar



STEPS:

1. Place an egg at the bottom of a glass.
2. Pour vinegar over the egg until it's completely covered.
3. Allow the egg to sit in the vinegar for 12-24 hrs.
4. Carefully pour the liquid off and replace with fresh vinegar.
5. Allow the egg to sit for another 12-24 hrs.

After a few hours you will start to see bubbles on your egg. Since egg shells are mostly made of calcium carbonate, the vinegar (acetic acid) will react with the calcium in the egg shell and produce bubbles of carbon dioxide. The egg shell will break down in the vinegar and dissolve.



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findings
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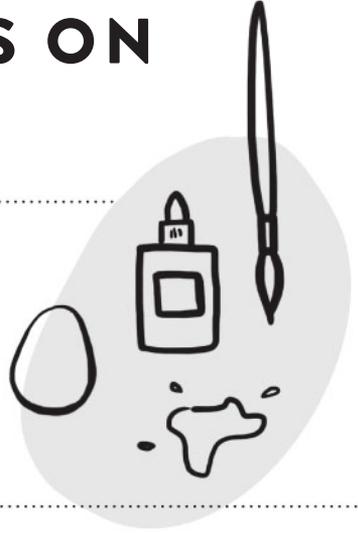


HOW TO:

MAKE CRYSTALS ON AN EGGSHELL

MATERIALS:

- One egg
- Alum powder
- Food coloring
- A bowl
- Water
- Glue
- Paintbrush



STEPS:

1. Carefully crack an egg lengthwise into two halves and discard the egg. Crystals need something to grown on, so the more of the eggshell you can keep intact, the better.
2. Paint the inside of one of your eggshell halves with glue and cover with Alum powder.
3. Allow your eggshell to completely dry.
4. Microwave 2 cups of water in a microwave safe bowl.
5. Add 40 drops of food coloring and $\frac{3}{4}$ cup of Alum powder.
6. Mix until the Alum powder is fully suspended in the water. If there are still Alum crystals remaining at the bottom of your bowl, microwave for another 30 seconds to 1 minute and mix again.
7. Allow your crystal solution to cool for 30 mins.

 Record your findings here!

8. Place your eggshell into the solution and leave for at least 12 hours. If you are not satisfied with the resulting crystals, microwave your crystal solution for 2 mins again, allow it to cool for 30 mins, and place your eggshell back into the solution. Leave for another 6-12 hours.
9. Carefully remove your eggshell from the solution as wet crystals are delicate. Allow to dry.

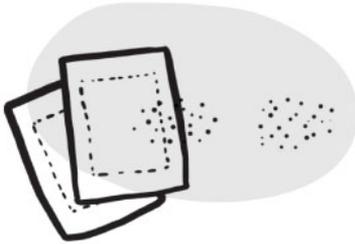
The crystal solution you create is saturated with Alum. As the solution cools and Alum particles settle to the bottom of your bowl, they will attach themselves to your eggshell and form crystals. You will notice crystallization in the bowl as well. The longer you allow your eggshell to sit in the crystal solution, the bigger your crystals will grow. You can repeat the process several times until you are satisfied with the result.

HOW TO:

MAKE YOUR OWN PETRI DISH

MATERIALS:

- Disposable bowl with lid or petri
- 1 beef bouillon cube
- 1 cup water
- 2 tsp sugar
- 1.5 packets of unflavored gelatin
- Sterile swabs or Q-tips



Record your findings here!



STEPS:

1. **Mix together the water, beef bouillon, sugar, and gelatin. Bring the mixture to a boil.**
2. **Stir until the gelatin is fully dissolved.**
3. **Cool the solution for 10 mins.**
4. **Carefully pour the solution into your petri dish or container. You'll want about 1/2 inch to 1 inch of liquid at the bottom of your container.**
5. **Allow the nutrient gel to cool completely and solidify. You can keep your petri dishes covered in the refrigerator for up to three days.**

The beef stock and gelatin solution creates a solid gel that provides nutrients for microorganisms to grow. You can press your fingers onto the gel (or your toes), carefully without breaking the gel, and see if anything grows. Make predictions and swab an area that you think has a lot of microorganisms such as a kitchen counter, under your bed, or the TV remote. Run the swab across your petri dish in a zig-zag pattern. Microorganisms grow best in warm places, so once you've taken all of your samples, put a lid on your petri dishes and place in a warm area of the house for a day or two.

! **IMPORTANT SAFETY NOTE** //

Once you see visible growth on the plate it is NOT safe to open and needs to be disposed of as a biohazard. Contact a local hospital, doctor, veterinarian, or dentist to see if they can dispose of the plates for you!

//

**WHICH MICROBE
ARE YOU?**

CIRCLE YOUR
ANSWERS BELOW
TO FIND OUT!

MICROBE PERSONALITY QUIZ

1) Which of these colors do you like the best?

- A. Orange
- B. White
- C. Blue

2) What is most likely to be found in your room?

- A. Bouncy ball
- B. Ruler
- C. Slinky

3) What do you like to drink?

- A. Milk
- B. Water
- C. Smoothie

4) How would your friends describe you?

- A. You are a hard worker
- B. You like to cause trouble
- C. You help others feel better

5) What do you like to do on a warm summer day?

- A. Eat ice cream
- B. Keep cool inside and watch a movie
- C. Go swimming outside

**LOOK ON THE
NEXT PAGE TO ADD
UP YOUR ANSWERS
TO SEE WHICH
MICROBE YOU ARE!**

IF YOU GOT MOSTLY A'S...

YOU ARE **LACTOCOCCUS LACTIS**

(ALSO KNOWN AS LACTIC ACID)!

*You're made up of round cells and often like hanging out with friends.**You're an extremely hard worker and are highly valued for your skills!**You also know how to kick back and enjoy a delicious dairy treat!*

DID YOU KNOW?

L. lactis is very important for making dairy products! As Cury discovered, when the bacteria is added to milk, it helps to make cheese. It is also an important part of pickling vegetables! Do you like pickles? If it wasn't for *L. lactis*, pickles wouldn't exist!

IF YOU GOT MOSTLY B'S...

YOU ARE **ESCHERICHIA COLI**

(ALSO KNOWN AS E. COLI)!

You have your good and bad days. Sometimes you are helpful and offer to do chores around the house. But other times, you cause trouble for those around you. You're typically found inside and don't like to spend too much time outside in the sun.

DID YOU KNOW?

E. coli can be good and bad! *E. coli* is naturally found inside you, in your gut. The harmless *E. coli* help to keep bad bacteria out of your stomach. Sometimes bad *E. coli* gets in ground water or can contaminate fresh produce and beef at the grocery store. If you drink dirty water or eat food that hasn't been cooked or washed properly, you can swallow the bad *E. coli* and get sick.

IF YOU GOT MOSTLY C'S...

YOU ARE **ARTHROSPIRA PLATENSIS**

(ALSO KNOWN AS SPIRULINA)!

Some say you are the superhero of microbes! You always do your best to help others around you. Your affinity for curing sick people might be a sign – maybe you'll grow up to be a doctor!

DID YOU KNOW?

A. platensis was regularly eaten by the Aztecs! It smells and tastes similar to seaweed but has lots of vitamins, minerals, protein, and beta-carotene (found in carrots!).