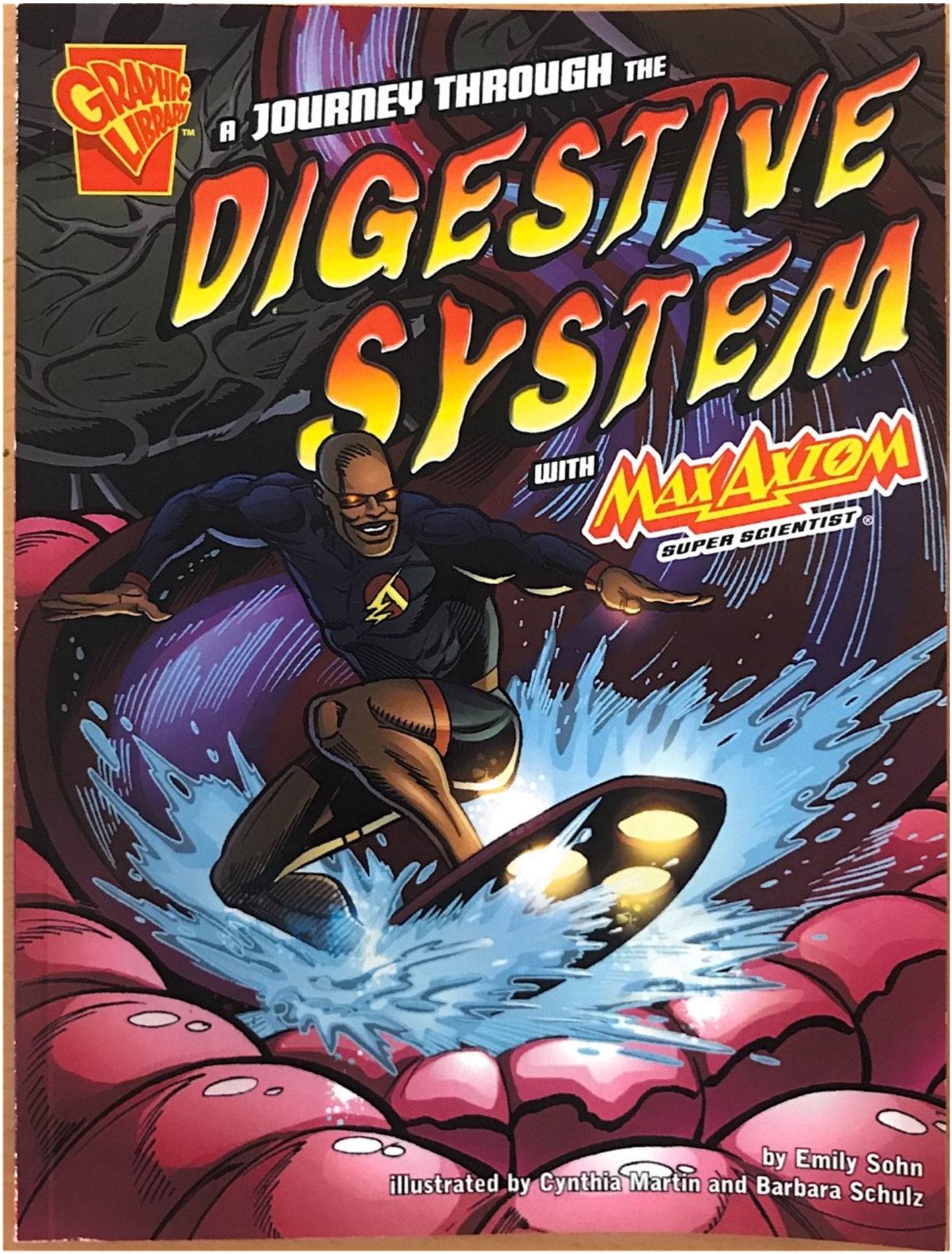
GRAPHIC LIBRARY
A JOURNEY THROUGH THE
DIGESTIVE SYSTEM
WITH
MAX AXIOM
SUPER SCIENTIST
by Emily Sohn
illustrated by Cynthia Martin and Barbara Schulz

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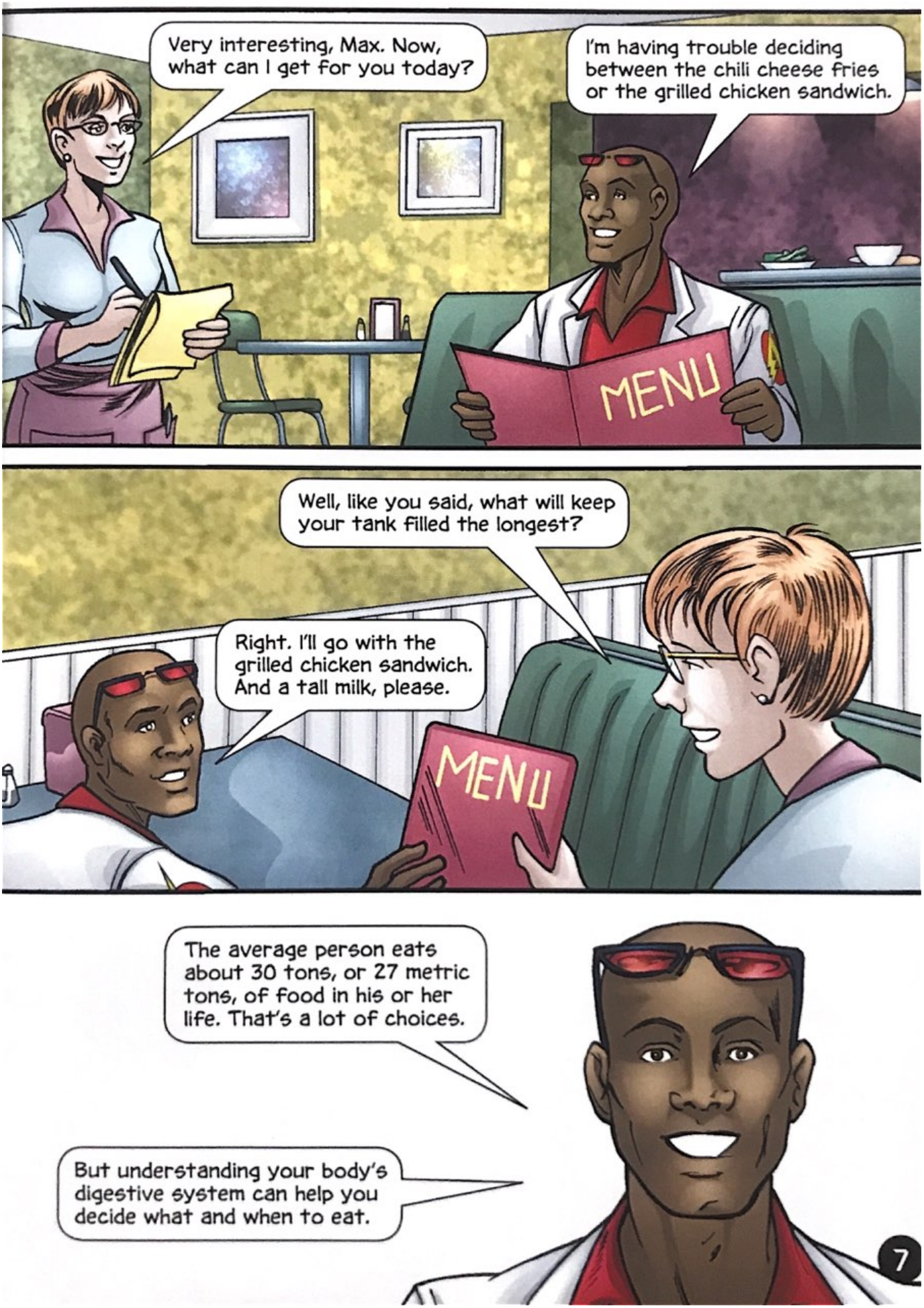
SECTION 1
GETTING HUNGRY
Approaching his favorite local diner, Super Scientist Max Axiom has no idea where the next meal will take him.
Boy, I'm hungry.
GRRRUUUUMMBBLLE
All I can think about is food.
FARMERS' MARKET
HOT DOG
You know, everyone needs to eat.
Like gasoline in a car, food is fuel. Without it, our bodies would sputter to a stop.
DINER
geri's
OPEN

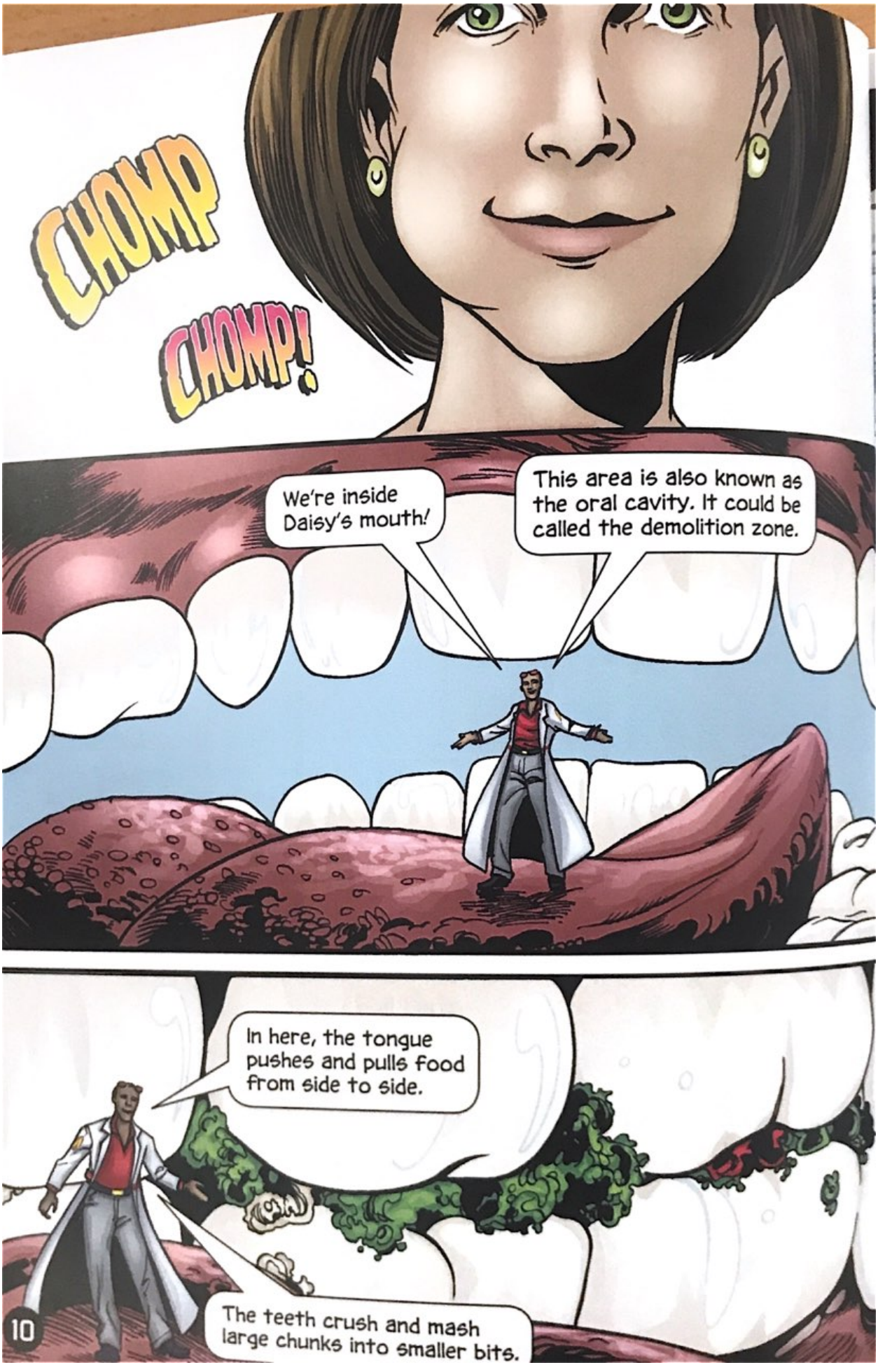

Just seeing people eat makes my mouth water and my stomach grumble.
These reactions mean my body is revving up for digestion. Digestion is the body's process of breaking down food for use as energy.
GRRUUUMBBLLE
Now that I think about it, food can have power over us.
DINER
Geri's
Come on. Let's find out why we crave food and how our bodies use it.


Life would be much easier if I didn't have to eat all the time.
Ever wonder why we get hungry in the first place?
Like this high-tech monitor, hunger signals your body when it's low on fuel.
BEEP!
BEEP!
When your blood energy is low, the brain doesn't function properly so it signals your body to eat.
BEEP!
The nutrients and vitamins in food give us energy and keep our organs working well.

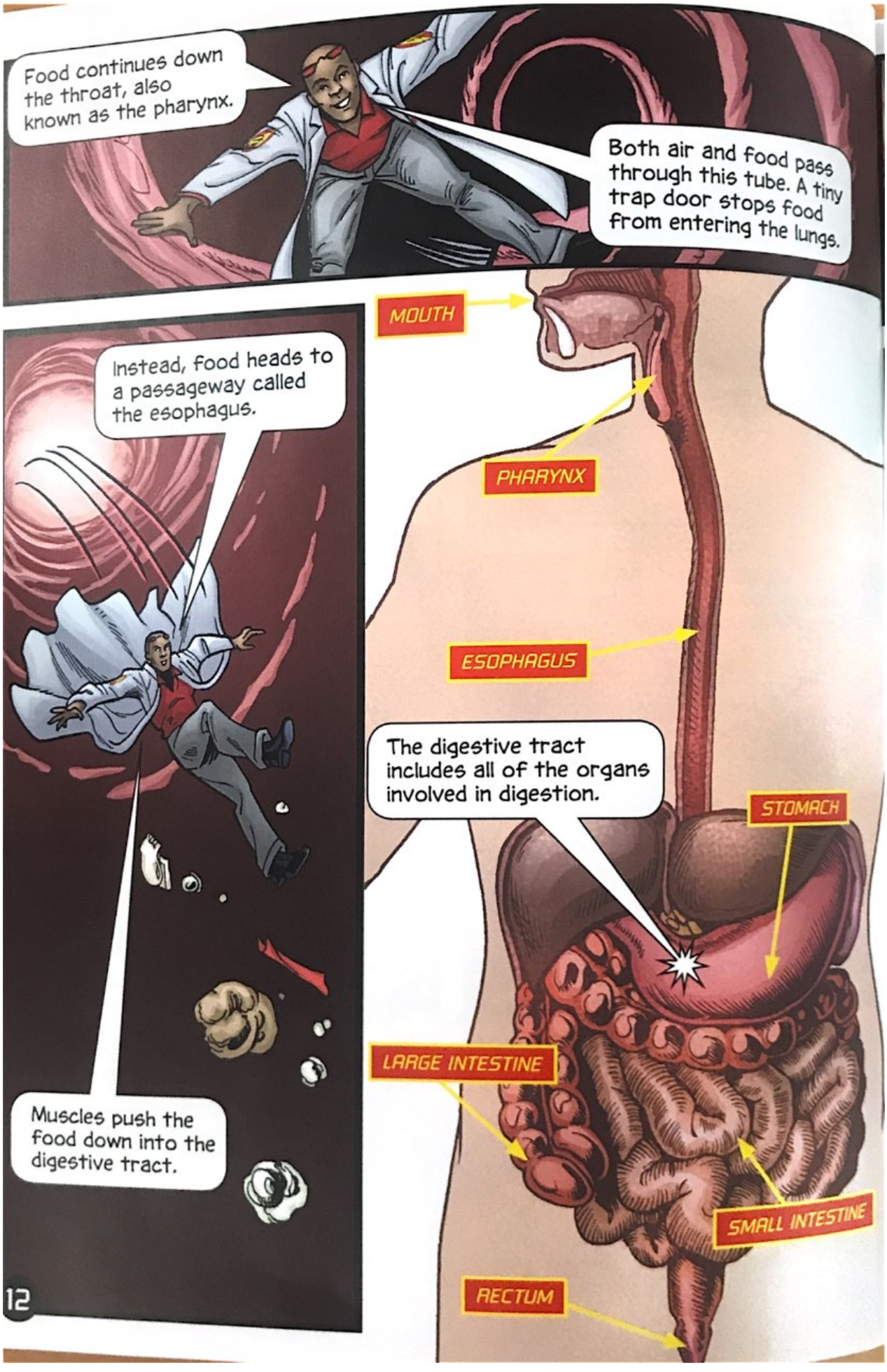

Very interesting, Max. Now, what can I get for you today?
I'm having trouble deciding between the chili cheese fries or the grilled chicken sandwich.
MENU
Well, like you said, what will keep your tank filled the longest?
Right. I'll go with the grilled chicken sandwich. And a tall milk, please.
MENU
The average person eats about 30 tons, or 27 metric tons, of food in his or her life. That's a lot of choices.
But understanding your body's digestive system can help you decide what and when to eat.

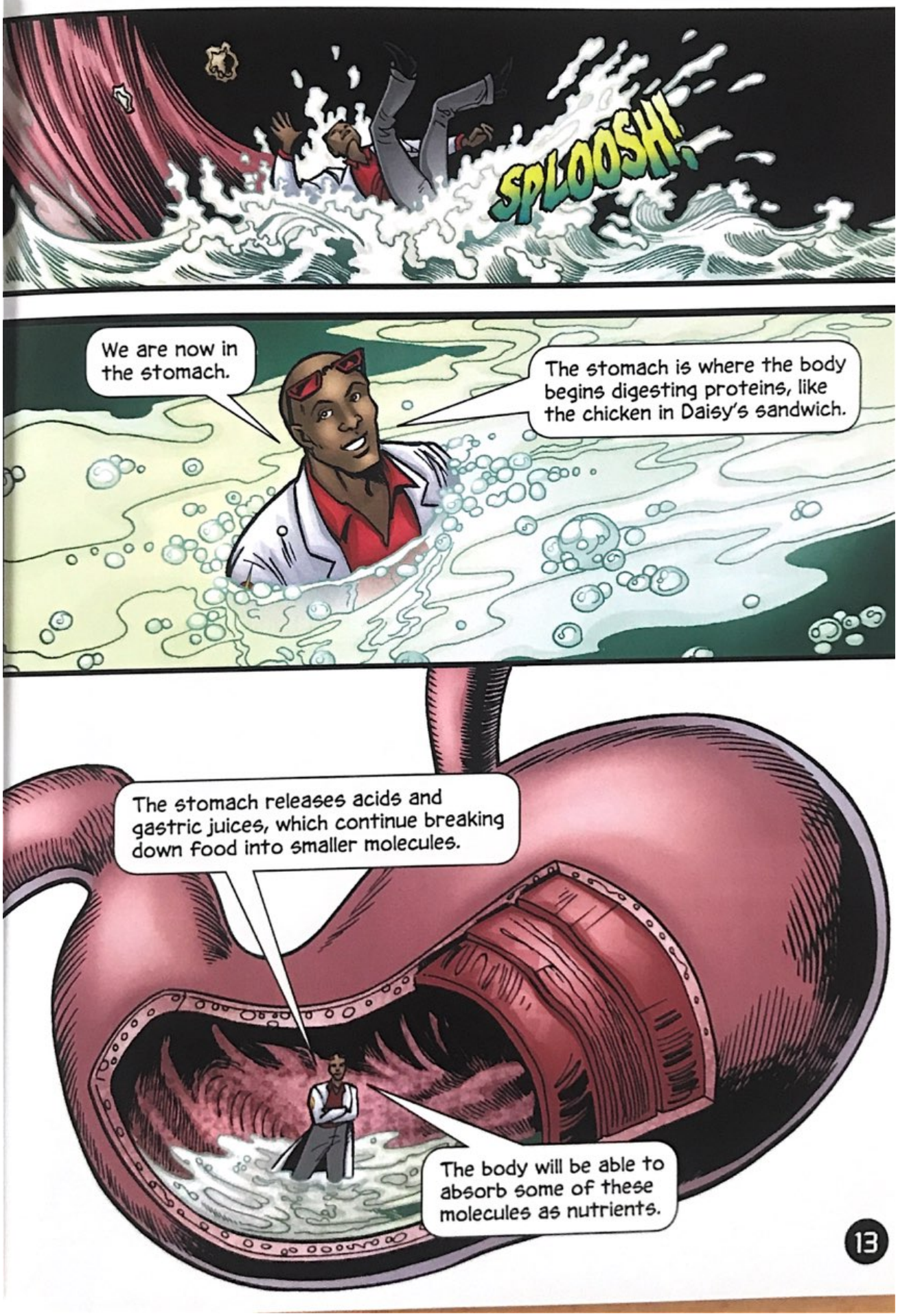

SECTION 2
TAKING THE PLUNGE
Digestion begins with ingestion.
Although ingestion sounds complicated, it's just a scientific word for eating.
Hey, there's my friend Daisy and her daughter Lily. Looks like they're about to ingest some lunch.
Their food looks so good . . .
I have an idea! Daisy's a nutritionist. She teaches people about the best foods for their bodies.
By shrinking and following her meal, we'll get a look at the digestive system in action.

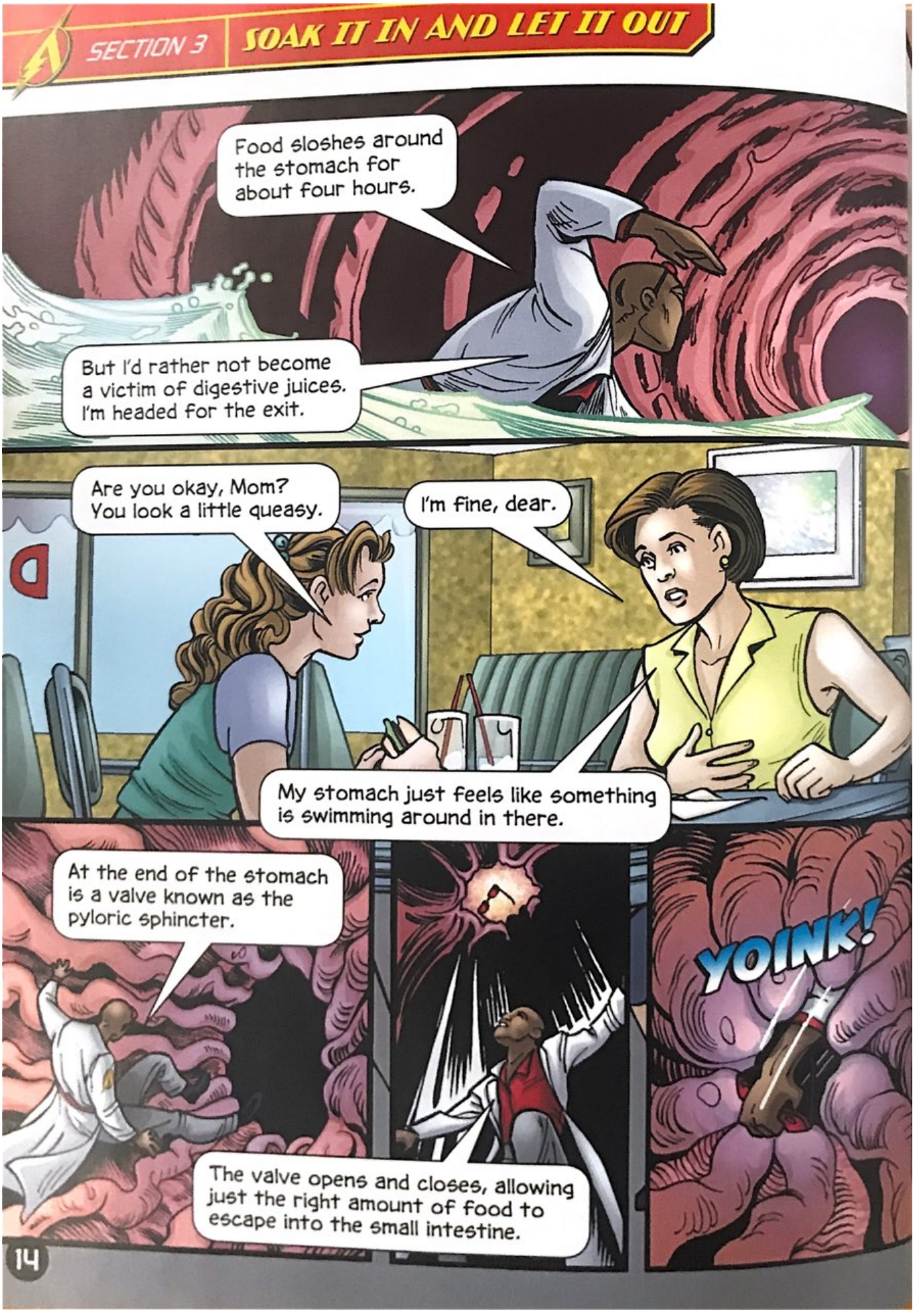

Besides, I have some time to kill until my food comes.
Whoa! Hopefully, I won't get killed in the meantime.
Whew! Now, I'll just hop onto Daisy's sandwich.
Uh-oh! Maybe this wasn't such a good idea.

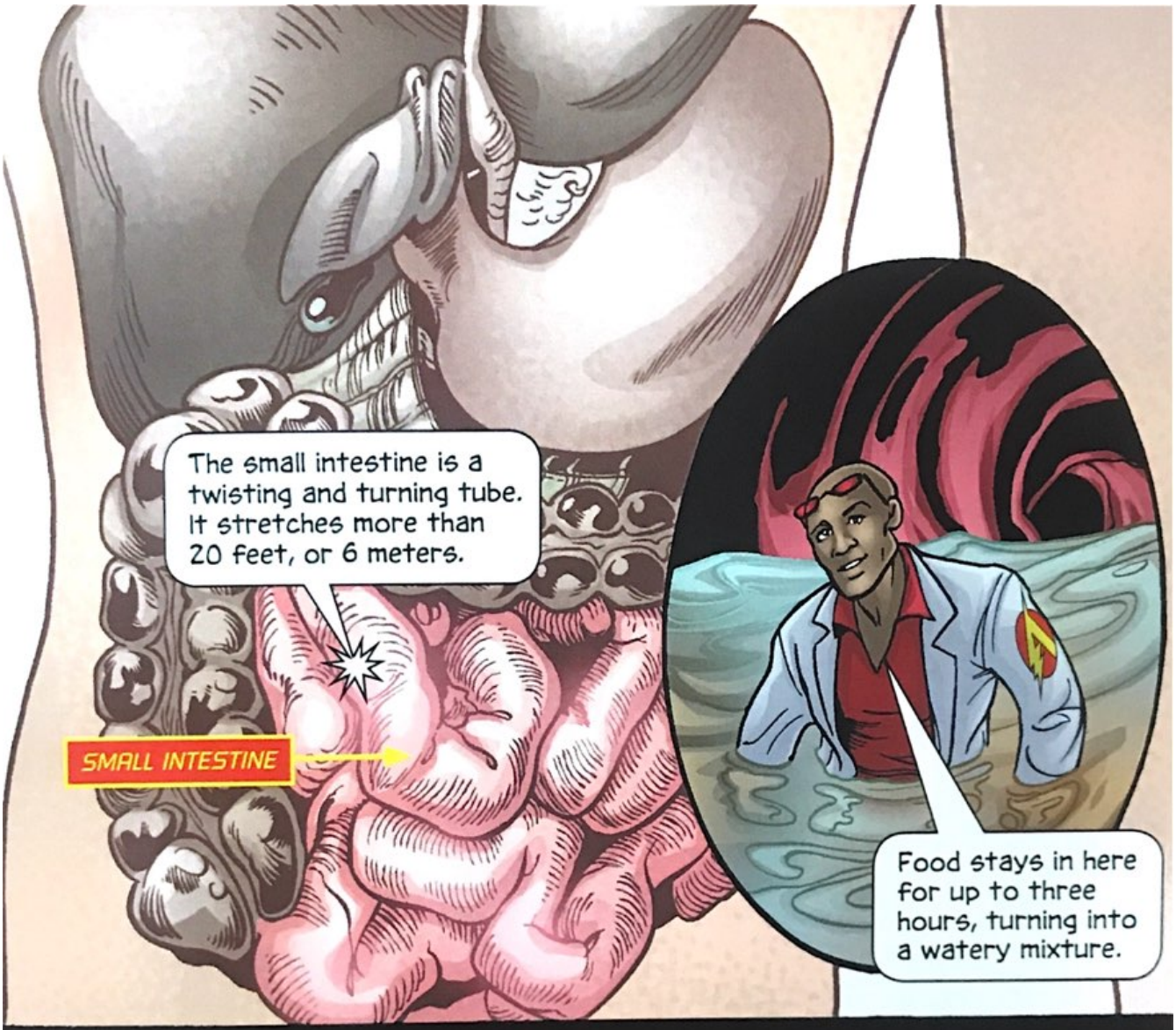

CHOMP
CHOMP!
We're inside Daisy's mouth!
This area is also known as the oral cavity. It could be called the demolition zone.
In here, the tongue pushes and pulls food from side to side.
The teeth crush and mash large chunks into smaller bits.


At the same time, saliva gushes out of the salivary glands.
Also known as spit, saliva makes food wet. But it's more than just water.
Saliva contains enzymes that break down food.
Once the food is soft and mushy, it's ready to be swallowed.
The blob of food that gets swallowed is called a bolus. And I'm about to follow the bolus to its next stop.
GULP


Food continues down the throat, also known as the pharynx.
Both air and food pass through this tube. A tiny trap door stops food from entering the lungs.
Instead, food heads to a passageway called the esophagus.
Muscles push the food down into the digestive tract.
MOUTH
PHARYNX
ESOPHAGUS
The digestive tract includes all of the organs involved in digestion.
STOMACH
LARGE INTESTINE
SMALL INTESTINE
RECTUM

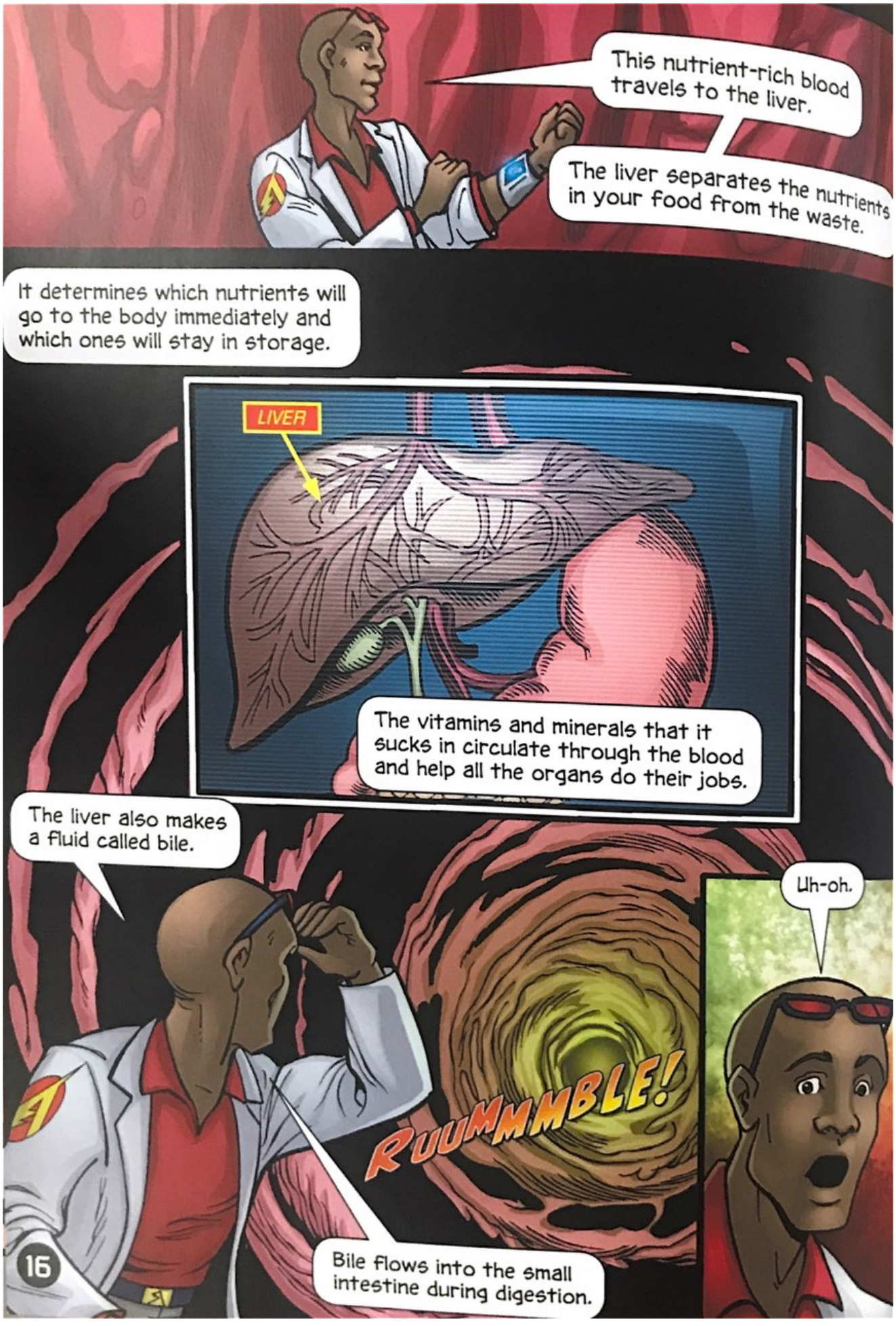

SPLOOSH!
We are now in the stomach.
The stomach is where the body begins digesting proteins, like the chicken in Daisy's sandwich.
The stomach releases acids and gastric juices, which continue breaking down food into smaller molecules.
The body will be able to absorb some of these molecules as nutrients.


Food sloshes around the stomach for about four hours.
But I'd rather not become a victim of digestive juices. I'm headed for the exit.
Are you okay, Mom? You look a little queasy.
I'm fine, dear.
My stomach just feels like something is swimming around in there.
At the end of the stomach is a valve known as the pyloric sphincter.
The valve opens and closes, allowing just the right amount of food to escape into the small intestine.
YOINK!

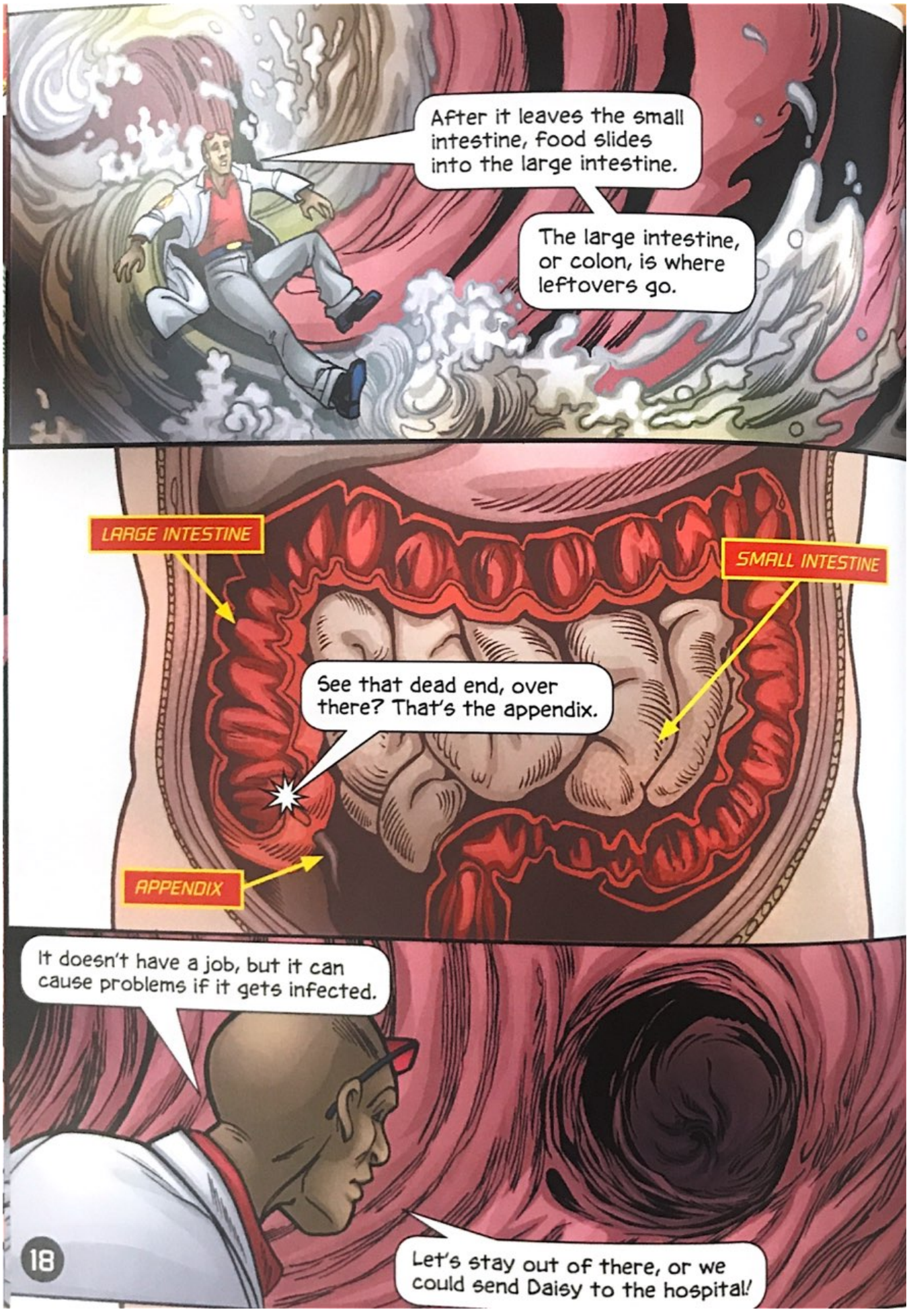


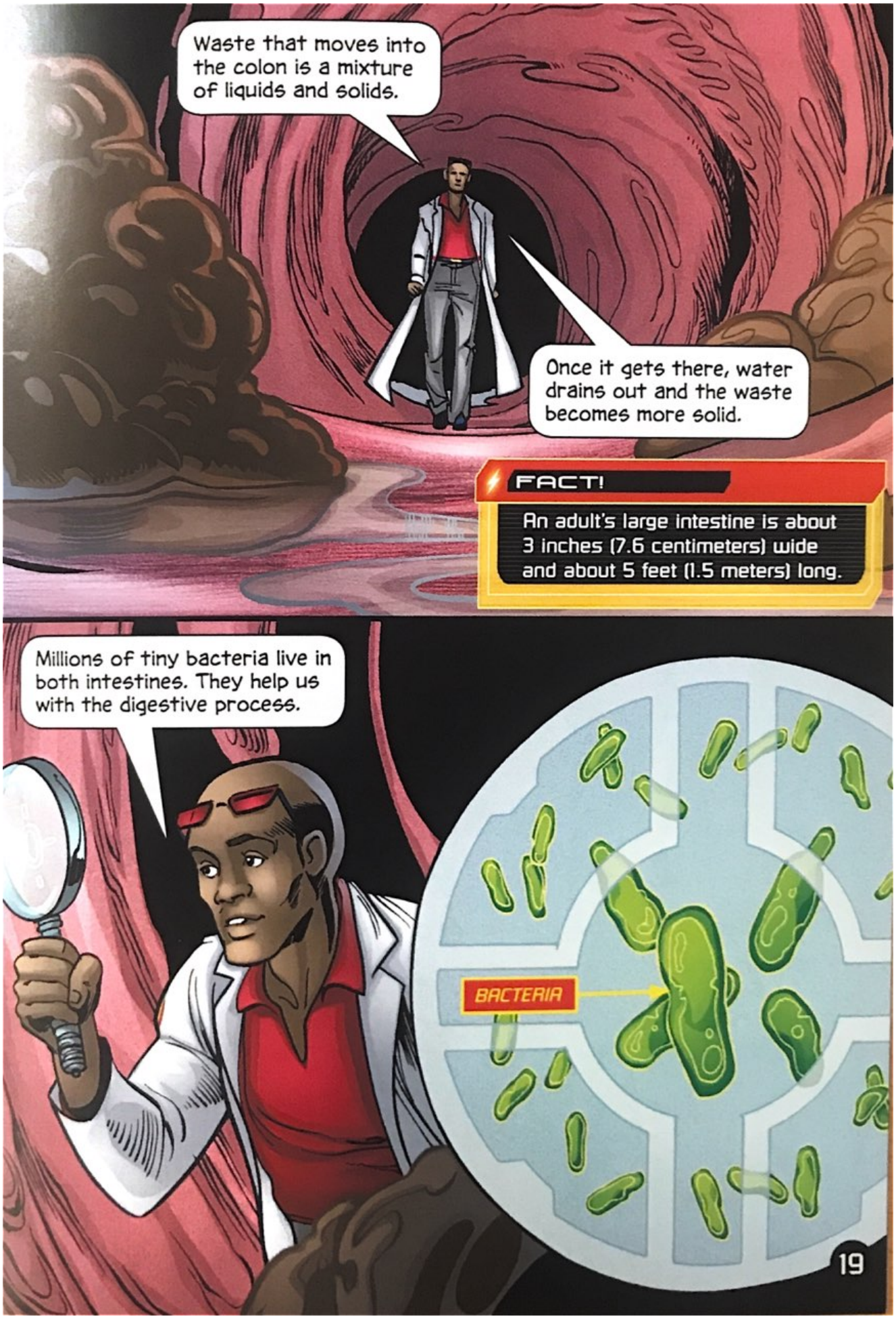
FACT!

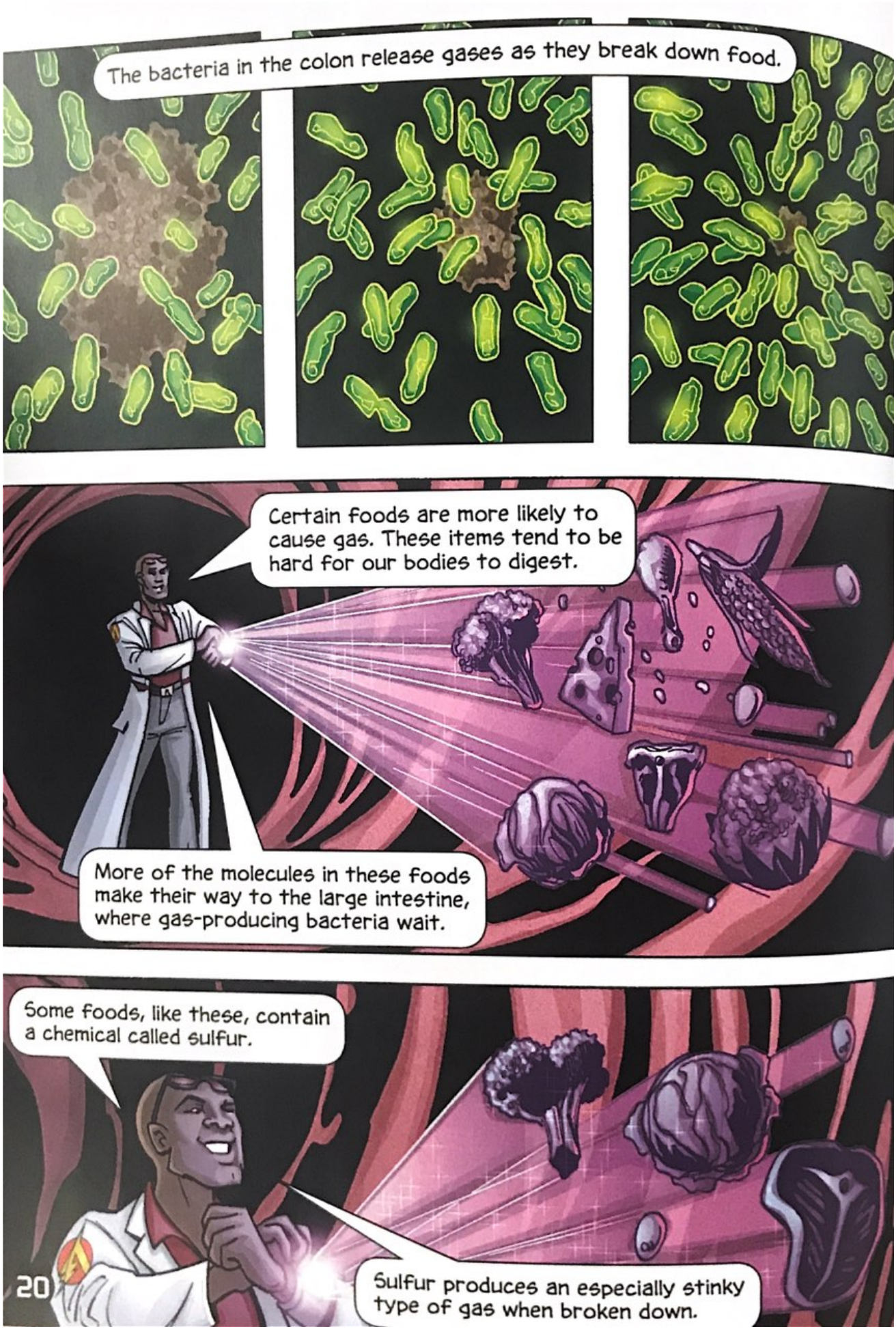
The area that absorbs nutrients in the small intestine is huge. If you opened it and laid it flat, it would cover approximately the surface area of a tennis court.


This nutrient-rich blood travels to the liver.
The liver separates the nutrients in your food from the waste.
It determines which nutrients will go to the body immediately and which ones will stay in storage.
LIVER
The vitamins and minerals that it sucks in circulate through the blood and help all the organs do their jobs.
The liver also makes a fluid called bile.
Uh-oh.
RUUMMMBLE!
Bile flows into the small intestine during digestion.
16


Guuussshh
Yuck!
Bile looks gross, but it helps the body absorb fat.
The gallbladder stores excess bile from the liver that can later aid in digestion.
The pancreas helps by spitting out juices that break up fats, carbohydrates, and proteins.

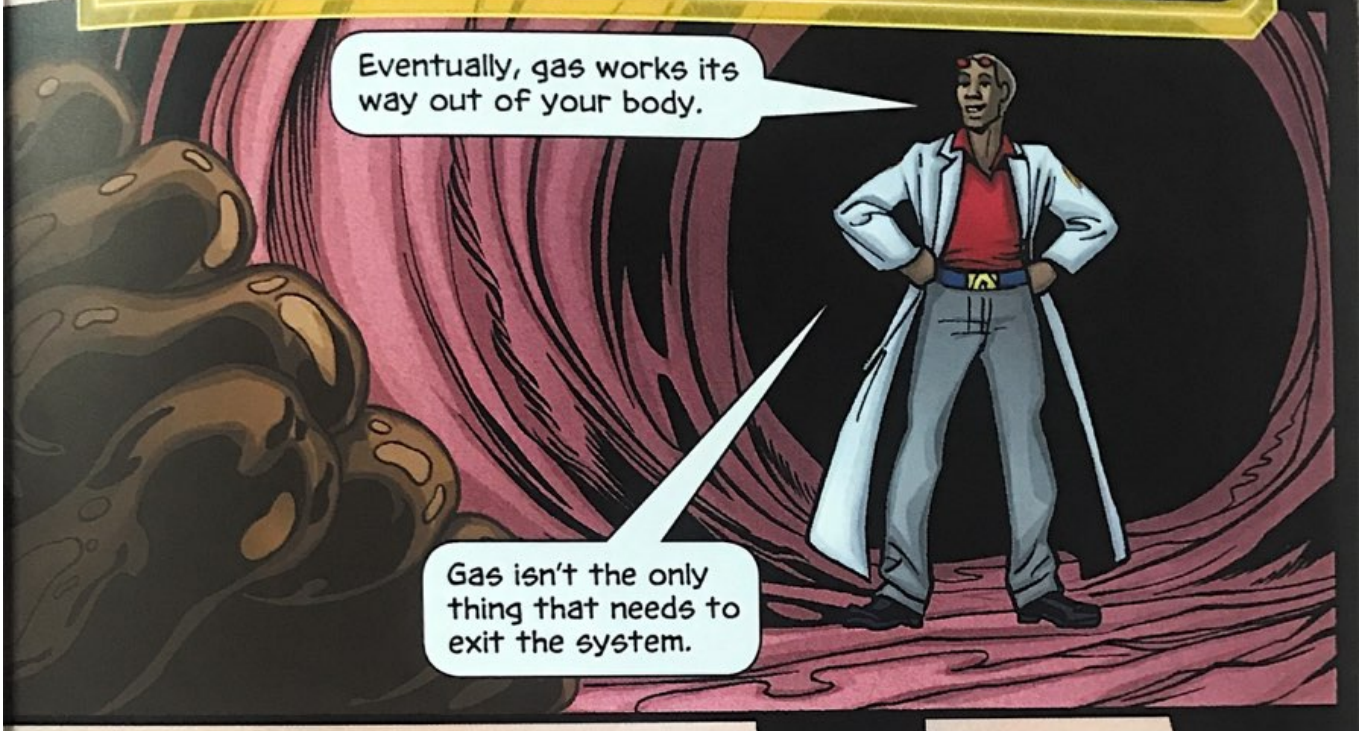

After it leaves the small intestine, food slides into the large intestine.
The large intestine, or colon, is where leftovers go.
LARGE INTESTINE
SMALL INTESTINE
See that dead end, over there? That's the appendix.
APPENDIX
It doesn't have a job, but it can cause problems if it gets infected.
Let's stay out of there, or we could send Daisy to the hospital!

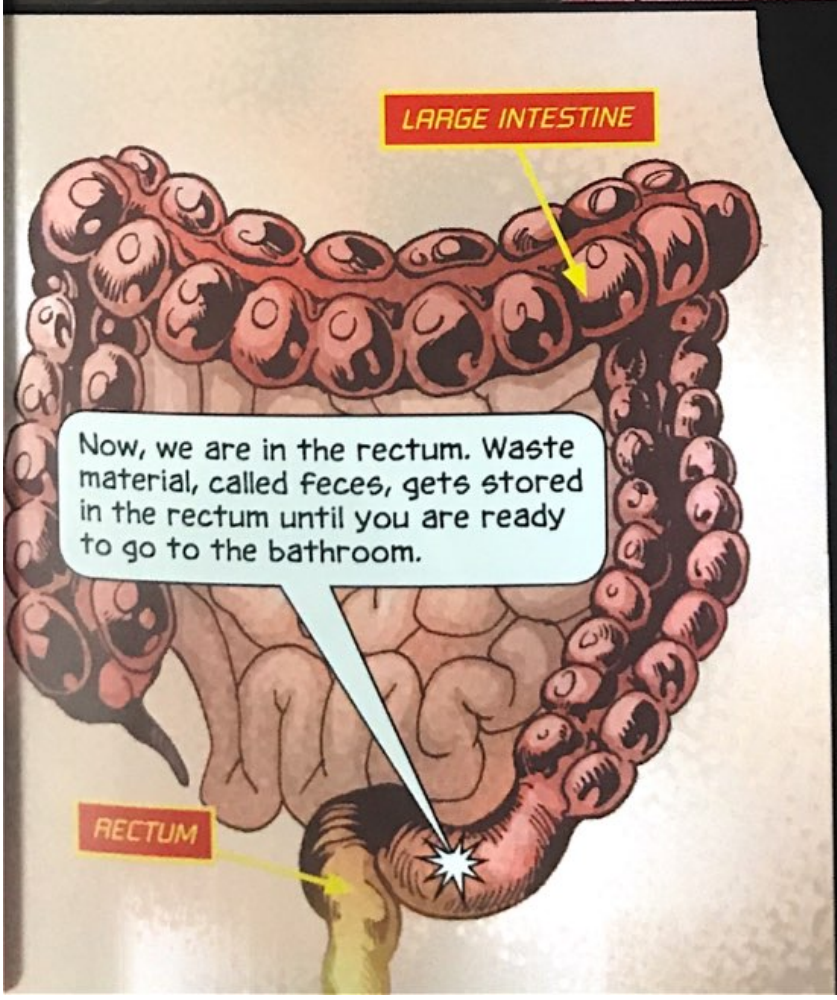

Waste that moves into the colon is a mixture of liquids and solids.
Once it gets there, water drains out and the waste becomes more solid.
FACT!
An adult's large intestine is about 3 inches (7.6 centimeters) wide and about 5 feet (1.5 meters) long.
Millions of tiny bacteria live in both intestines. They help us with the digestive process.
BACTERIA


The bacteria in the colon release gases as they break down food.
Certain foods are more likely to cause gas. These items tend to be hard for our bodies to digest.
More of the molecules in these foods make their way to the large intestine, where gas-producing bacteria wait.
Some foods, like these, contain a chemical called sulfur.
Sulfur produces an especially stinky type of gas when broken down.

FACT!

When bacteria digest beans, they release a lot of gas, but it's sulfur-free and not usually smelly. Swallowed air is another cause of non-stinky gas. It contains mostly smell-free nitrogen and carbon dioxide.






BURZZTT
Lily, make sure to finish your salad.
Mom, why do you always tell me to eat so many vegetables?
Vegetables supply your body with nutrients. And eating well is a big part of living a long, healthy life.
Then what about chicken, Mom?
Chicken has lots of protein. Your body breaks down and uses protein to build strong muscles.
You guys are talking about one of my favorite subjects!
Max!

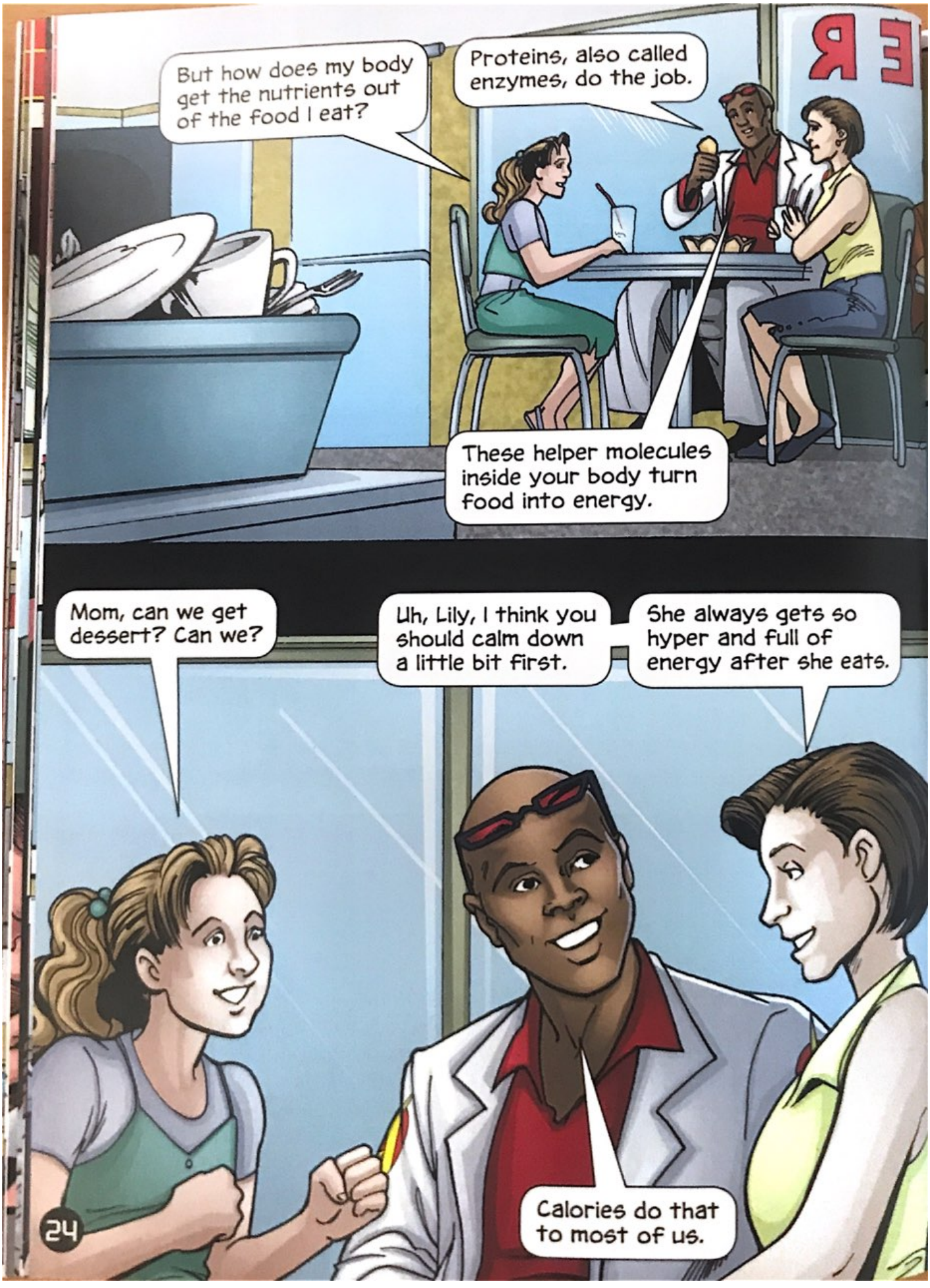
THE PYRAMID PLAN

ACCESS GRANTED: MAX AXIOM

The MyPyramid food guide uses colored bars to promote a healthy diet of the major food groups:

- orange = grains
- green = vegetables
- red = fruits
- yellow = oils
- blue = dairy products
- purple = meats, beans, and nuts

The person running up the stairs represents the importance of exercise.


But how does my body get the nutrients out of the food I eat?
Proteins, also called enzymes, do the job.
These helper molecules inside your body turn food into energy.
Mom, can we get dessert? Can we?
Uh, Lily, I think you should calm down a little bit first.
She always gets so hyper and full of energy after she eats.
Calories do that to most of us.


What's a Calorie?
Your body has to break down food into a form that it can use as fuel.
The amount of energy in the food you eat is measured in Calories.
I learned about them at school. People burn Calories while exercising.
That's right. The body uses bits of energy to run, think, and breathe.
To maintain a healthy weight, the body needs to burn the same amount of Calories as it takes in.
Max, your order is ready!
Ooh, I almost forgot how hungry I was. I'll see you two around.
Bye Max!