American Museum of Natural History

INFECTION DETECTION PROTECTION

How do microbes **HELP** you?
How can they **HARM** you?

Solve the **MIXED-UP MICROBE MYSTERY**

ACHOOO!
Learn how the *flu* can spread to *you*

WASH YOUR HANDS—
and **9** other tips to avoid disease

Bacteria in the Cafeteria

If you could look at this lunchroom through a high-powered microscope, you'd see a "bazillion" bacteria. Some of them, known as germs, can make you sick. But most kinds of bacteria are totally harmless to humans. Some are even helpful to us.

Go on a MICROBE QUEST to solve the MICROBE RIDDLE.

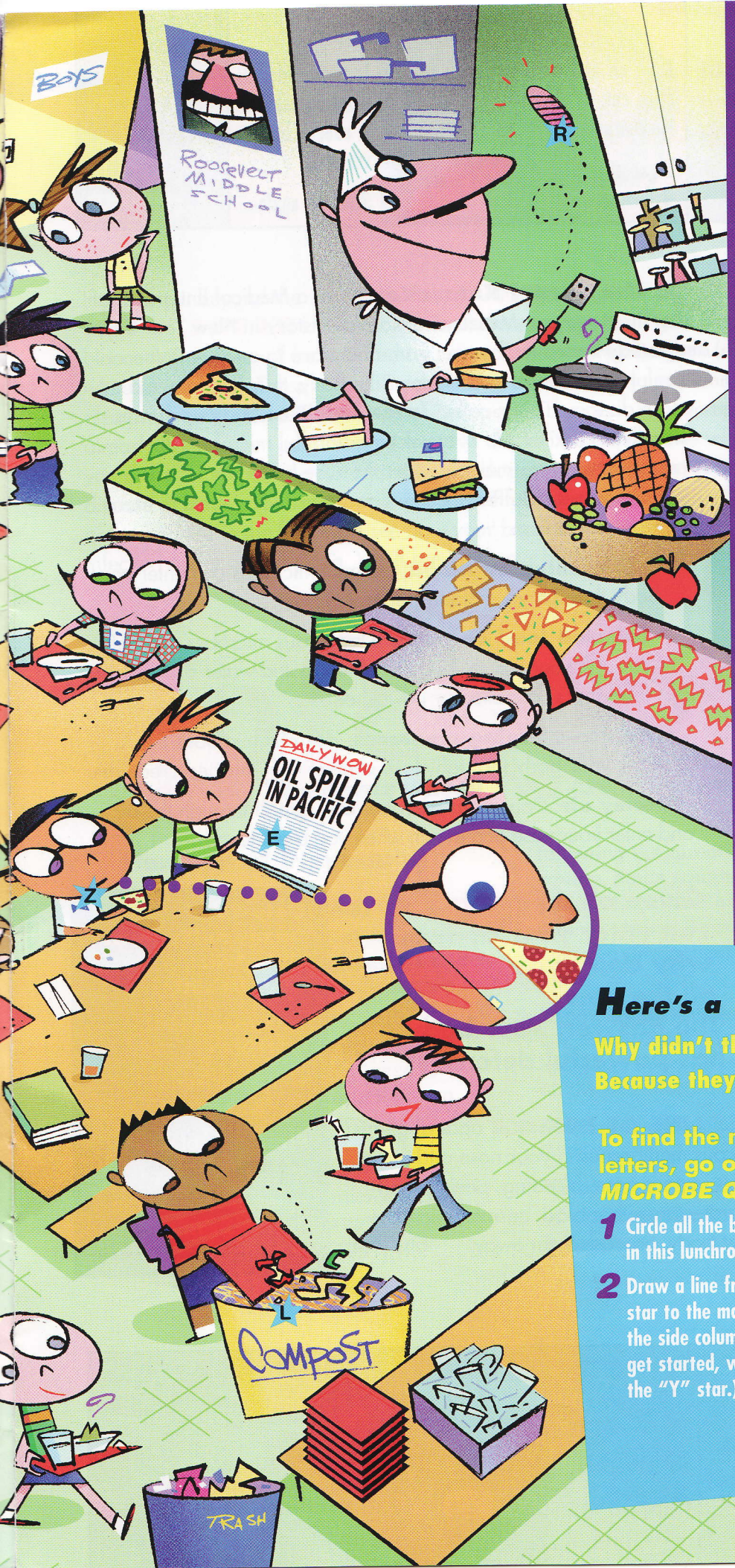
C It takes real "guts" to live in here. These bacteria are busy digesting food. Get this—there are more bacteria in your intestines than the total number of people who have ever lived.

J Every time you take a breath, you're inhaling billions of bacteria that are floating in the air. Don't worry! It is rare that these bacteria will make you sick.

L Bacteria in the soil break down dead twigs and leaves and help this flower bloom.

Y She can drink all she wants because the school's water has been specially treated with chlorine. If the water were contaminated, it could easily spread diseases such as typhoid and hepatitis.

I Her soccer team had a great game, but her knees took a beating. Good thing she has cleaned and bandaged her knees. That way, billions of dangerous bacteria can't get into her body.



L Toss your banana peels in here! These bacteria break down organic waste and turn it into compost. The principal, Ms. Sanchez, puts compost on the school's garden to help the vegetables grow.

S Did you know that yogurt contains live bacteria? Who knew microbes could make something so tasty?

Z If he doesn't brush and floss, the bacteria in his mouth will cause plaque and tartar—not to mention bad breath.

E Some kinds of bacteria clean up the environment by gobbling chemical waste such as oil spills.

F This guy just came out of the bathroom. His hands could be dirty, so he's scrubbing up before chowing down.

R Raw meat can be loaded with bacteria that could make you sick. Good thing this burger is being cooked—otherwise he would be serving a bacteria burger.

Here's a MICROBE RIDDLE:

Why didn't the two bacteria get married?
Because they like to be single ___ ___ ___ ___ ___.

To find the missing letters, go on a *MICROBE QUEST*:

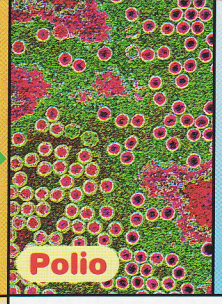
1. Circle all the blue stars hidden in this lunchroom.
2. Draw a line from each hidden star to the matching star in the side columns. (To help you get started, we did this with the "Y" star.)
3. For each star, read the bacteria fact that goes with it and ask yourself: "Do these bacteria help people?" If you answer YES, write the letter on the line below.

HELPFUL BACTERIA:

___ ___ ___ ___ ___

4. Put these letters in the right order to find the answer to the riddle above.

START



Blocked by skin on the hand.

Back to **START**.

Land on an open cut. Enter bloodstream.

Move ahead 4 spaces.

Land inside a person's nose. A sneeze blasts you out.

START again.

ROLL AGAIN

Infection!

You're now beyond the **SECOND LINE OF DEFENSE!**

Hi, I'm Varuni Kulasekera. I'm a Medical Entomologist at the American Museum of Natural History in New York City, and I study how microbes get from one place to another. When harmful microbes, or germs, enter the body, they multiply and cause disease. This is called **infection**. Your body's defenses usually do a killer job of squelching harmful microbes. But sometimes germs multiply faster than the body can handle—and you get sick. People come in contact with germs in many ways, including:

- **Contaminated blood**: Harmful microbes can enter your body through your bloodstream.
- **Infected food or water**: Dangerous microbes can enter through your mouth if you drink untreated water or swallow food that's uncooked or unwashed.
- **Disease-carrying creatures**: Harmful microbes can enter your body through close contact with infected creatures.
- **Germy air**: Dangerous microbes can spread through the air and enter your nose and mouth when you breathe.

Given all the ways germs can enter your body, why don't you get sick all the time?

The answer: Your body has powerful defenses!

Your body's **FIRST LINE OF DEFENSE** against germs includes skin, mucous membranes in your nose and throat, tears, the tiny hairs in your nose, bleeding, peeing, and sweating. These protectors either block harmful microbes from entering your body, or wash them away.

Help Your Immune System Help You Stay Healthy

- get 7-8 hours of sleep every night
- eat a variety of healthy food
- drink lots of water every day
- play outside so you get fresh air and exercise

GO BACK 3 SPACES

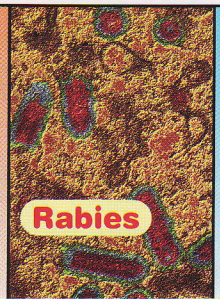
The person has been vaccinated against you.

Go back to **START**.

ROLL AGAIN

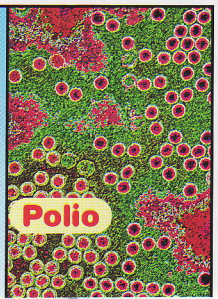
You divide and multiply in the body.

Go forward 2 spaces.



Antibodies kill you.

Back to **START**.



Person sprays disinfectant on the cut—you're history, germ!

Back to **START.**

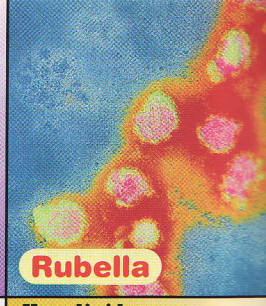
GO BACK 2 SPACES

Hands aren't washed before eating.

Move ahead 2 spaces.

The person has been vaccinated against you.

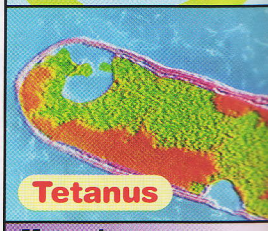
Go back to **START.**



You divide and multiply in the body.

Go forward 2 spaces.

ROLL AGAIN



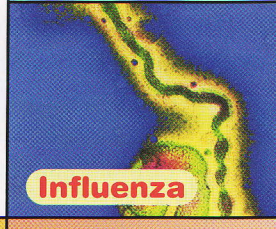
Macrophages attack and eat you alive.

Return to **START.**

GO BACK 2 SPACES

You struggle with the person's immune system.

Roll again.



You're now beyond the **FIRST LINE OF DEFENSE!**

If germs get beyond the **FIRST LINE OF DEFENSE**, your blood has a **SECOND LINE OF DEFENSE** known as the **immune system**. If germs enter the bloodstream, they will be attacked by cells called **macrophages** (also known as white blood cells). These cells will gobble and dissolve any foreign microbes. Our bodies also produce **antibodies** that go after specific diseases. For example, if you have already had chicken pox, then your body's chicken pox antibodies will make sure that you don't catch that disease again. If your doctor gives you a **vaccine** for a particular disease, it helps your body create antibodies for that disease. Then your body will be able to fight it in the future. To see how your body battles microbial invaders, play the infection game on this page. You'll see how your body defends itself against infection.

Infection!

The game where YOU are the germ!

Number of Players: 1-4

Before the Game:

1. Draw small pictures of microbes that appear on the game board and tape them to pennies. These are your playing pieces.
2. Find a die or create your own by numbering six small pieces of paper from 1-6, folding them up and selecting them from a cup.

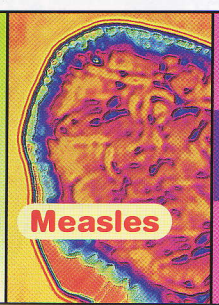
How to Play:

1. Each player puts a microbe on START and takes turns rolling the die, moving the microbe, and following the directions on each square. Some squares are microbe photos. Each kind of microbe appears twice. If you land on the microbe photo that is your playing piece, roll again.
2. Keep playing until each microbe has reached the infection square. You don't need an exact roll to land on the infection square.
3. Keep track of the number of rolls it takes each microbe to get infected.

What does this tell you about how the body fights infection?

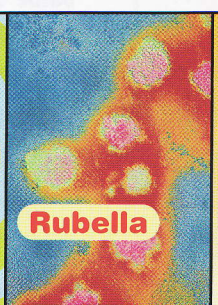
You struggle with the person's immune system.

Roll again.



GO BACK 5 SPACES

ROLL AGAIN



You're attacked by macrophages.

Return to **START.**

Antibodies recognize you. Bye-bye.

Back to **START.**

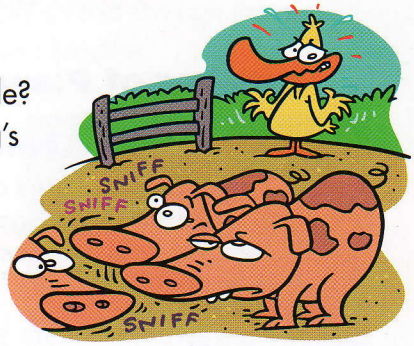
Hi, I'm Louise–most people call me Lou–and I live in Kansas. I feel pretty rotten now. I have a sore throat, a cough, and achy muscles. Doctor Petrie said I caught the flu–that's short for influenza. My friends Sue, Hugh, and Stu also caught it. I hear it's going around (and not just to people whose names rhyme!) My dad's giving me lots of stuff to drink and making sure I sleep a lot. I asked Doctor Petrie, "Where does the flu come from?" She said, "Many scientists think the flu comes from ducks in China." How can a virus travel around the world?

You'll see, my friend, you'll see...

How Lou Got the Flu

Six months ago on a farm in China, there was a duck that carried a flu virus in its body. The duck was never lonely because over a billion ducks live in China. About a billion people live there, too.

So, how did it get from the DUCK to me?
You'll see, my friend, you'll see...



People can't become infected with duck viruses, so how did this flu spread to people? Pigs! Min Peng, a farmer in China, raises pigs. When the duck flew over Min Peng's farm and pooped on the ground, a pig sniffed the duck virus into his body.

So, how did it get from the DUCK to the PIG to me?
You'll see, my friend, you'll see...

The pig spread the virus to many of the other pigs on the farm. One day, one of the baby pigs touched Min Peng's face, and—you guessed it—Min Peng caught the flu virus.

So, how did it get from the DUCK to the PIG to the FARMER to me?
You'll see, my friend, you'll see...

He was sick for a few days. Later, Min Peng went to the market. Mei-li Yuan bought some red bean ice cream from him. When Min Peng was giving her change, he accidentally sneezed on the money. "I'm so sorry," said Min Peng, "I'm just getting over the flu." "I hope you feel better soon," said Mei-li Yuan, and took a bite of the ice cream.

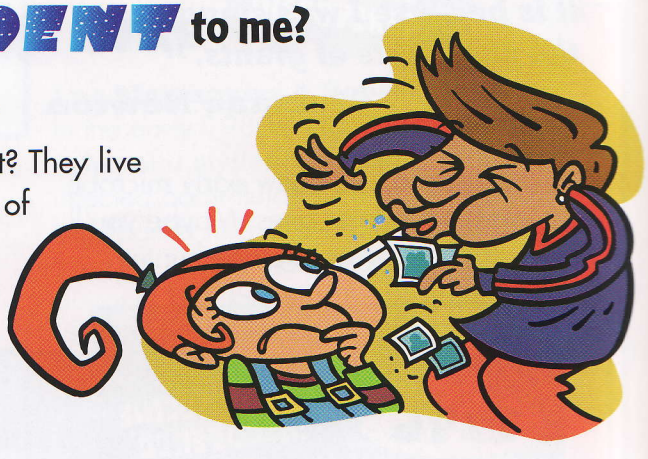
So, how did it get from the DUCK to the PIG to the FARMER to the SHOPPER to me?

You'll see, my friend, you'll see...

The next night, Mei-li Yuan was studying for an exam with her friend Maria, who is from the United States. While they were studying, Mei-li Yuan and Maria got thirsty. Since there was only one soda, they shared it.

So, how did it get from the DUCK to the PIG to the FARMER to the SHOPPER to the STUDENT to me?

You'll see, my friend, you'll see...



The next week, Maria flew home to visit her family. Guess what? They live on our street. Maria came over to visit and to show us pictures of China. She still had some sniffles from the flu but was feeling better. My dad made his famous pepper steak, but he used too much pepper and when he served Maria—

ACHOOO!

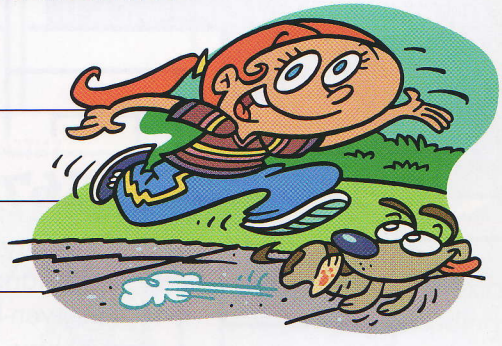
She sneezed right next to me. And that's how I got the flu from a duck in China.

After a few weeks, I felt much better. Can you make a list of three things you could do to prevent the flu from spreading to other people?

1. _____

2. _____

3. _____



But I Got A Flu Shot Last Year...

Some infectious diseases, like small pox and polio, can be prevented with a single vaccination. Influenza, however, is trickier to outsmart, since this virus can easily mutate. Even if your body has built up antibodies for one kind of flu, it doesn't mean that it has protection against all kinds of flu. The flu virus is like a moving target. So each year scientists try to predict what type of flu virus will be traveling to the U.S. Sometimes the scientists create the right vaccine and many people are protected; other times they're wrong and the flu wins.

MICROBES ON THE GO

When an infectious disease spreads to many people in an area at the same time, it's called an epidemic. When an epidemic happens in many cities at once, it's called a pandemic. Microbes are like microscopic hitchhikers. They can travel great distances, going quickly from person to person and even around the world. And microbes don't need passports!