More Bacteria for Your Buck

Should you be washing your money as well as your hands?

All bacteria have just one cell and are some of the smallest forms of life on Earth. Where can you find bacteria? Just about everywhere. One group of researchers found that even the dollar bills that most people carry around with them are perfect homes for all kinds of bacteria. The bills – and the bacteria – travel from person to person with every purchase, and some of these germs are even quite dangerous!

Before You Read:

Think About It – Did your parents ever warn you not to play with money when you were little? "Don't put that near your mouth. You don't know where it's been!" People usually worry about coins because they often fall on the ground. But as you know, money comes in two varieties. The surface of coins is hard and smooth, while bills are soft and somewhat rough.

IYCB: Do you think more bacteria live on dollar bills or on coins? Why?

Read:

Here is what researcher found in the cracks and crevices of your cash.

Dirty Money

Dollar bills support a rich flora of bacteria, some of them infectious, say research physicians Theodore W Pope and Peter T. Ender of the Medical Center of Wright-Patterson Air Force Base in Ohio.
They worked with Michael A. Koroscil at Beavercreek (Ohio) High School, who originated the idea for a science-fair project. The group counted the kinds of bacteria living on 68 dollar bills collected from people in line at a high school sporting event and a grocery store.

The researchers incubated each bill in nutrient broth for up to a day and then grew any bacteria in culture dishes to identify them. More than half the bills hosted bacteria that commonly infect people in hospitals or those who have depressed immune systems, the team reported. Five of the bills contained a bacterium that can sicken healthy people, either *Klebsiella pneumonia* (which causes pneumonia) or *Staphylococcus aureus* (which can cause deadly infections). The researchers identified a total of 93 different types of bacteria living on the bills, and two-thirds of the bills had at least one type.

Flora: a group of plants, bacteria, or other microorganisms
Infectious: capable of spreading disease
Incubated: maintained a precise temperature or other conditions so organisms could develop
Nutrient broth: a "soup" of substances used to feed organisms
Culture dish: a dish used to hold tiny organisms while they grow
Hosted: made a home or provided space for organisms
Depressed: weakened

Explore:

Because paper money is woven, it offers plenty of nooks and crannies where bacteria can make their homes.

IYCB: Name three other objects in your home that have tiny crevices where bacteria could grow.

Like all living things, bacteria also need water to survive. Paper absorbs moisture from the air or objects around it – another reason bacteria thrive on dollar bills.

IYCB: would the three objects you named also provide moisture for bacteria? If not, name three other objects in your home that would provide a moist environment for bacteria.

Bacteria also need nutrients to survive. This is why food spoils – bacteria are making both a meal and a home of the food. Bacteria can get their nutrients from many sources. It might be from the same things that we eat, or from the things we throw away, from the skin oil on our hands, or even from our waste products.

IYCB: Protected places, water, and nutrients – these are the three things that bacteria need. Knowing this, where do you think would be the best places to find bacteria in your home? List three.

Propose Explanations:

Germy Money

IYCB: Why do you think the researchers were so interested in studying the bacteria on dollar bills? Why would bacteria that live on money be more dangerous to people than bacteria that live inside your sneakers, for example?

The bacteria that live on paper money are usually not a great threat to our health. However, over 50% of the bills in the research study carried bacteria that could cause disease. Even so, most people do not get sick from handling paper money. The people most at risk are those who are already sick or who have a weakened immune system.

IYCB: Why do most people stay healthy after handling money? Why are the bacteria on paper money more dangerous to people who are already sick?

IYCB: Describe ways that we can avoid spreading germs on dollar bills.

Take Action:

Health is Wealth Using what you've learned about bacteria, design a new type of money to replace dollar bills. The new money should not give bacteria a good place to live and grow.

IYCB: Draw your new money and explain why it would avoid the problems of paper money.

The Bad Guys

These guys are small, but deadly!

Some bacteria are deadly. One of the best known is *Yersinia pestis*, the bacterium responsible for the bubonic plague, or "Black Death" as it was commonly called. Over the course of history, bubonic plague has killed hundreds of millions of people around the world.

Before You Read:

Make a Prediction One way humans get the bacterium that causes bubonic plague is from the bite of a flea that usually lives on rats. The bubonic plague spread across the world in A.D 540.

IYCB: How do you think it could have traveled from one continent to another?

Read:

Here is how one of the smallest life forms wiped out entire populations of people.

Killer Germs

The bubonic form of the plague is characterized by large buboes, which are swollen lymph nodes in the neck, armpits or groin…Bubonic plague victims characteristically flex and extend their arms in attempts to lessen the pain of the buboes. Infection of the blood can lead to bleeding beneath the skin, which causes the characteristic black splodges on the skin. These symptoms are accompanied by a very high fever, headache, shaking chills, and delirium and are followed by death in fifty to sixty percent of cases when left untreated.

…In A.D. 540, during the reign of Emperor Justinian, a pandemic (an epidemic that spreads across whole continents) broke out in Pelusium, Lower Egypt, and spread throughout Alexandria and on to Palestine. From there it traveled the

world. At the peak of the crisis, estimates suggest that ten thousand people were dying each day. Maybe one hundred million people died in all. Historians say this scourge contributed to the fall of the Roman Empire.

Lymph nodes: small structures in the body that remove and kill bacteria and other microorganisms
Flex: bend
Extend: straighten
Splodges: patches or large, uneven spots
Delirium: mental confusion
Scourge: a source of widespread suffering

Explore:

How the Plague Travels Deadly bacteria often travel through animals before reaching human beings. The first organisms bubonic plague bacteria infect are fleas that live on rats. The bacteria do not kill the fleas. When the infected fleas bite the rats, they pass the bacteria to them, and soon the rats die. If the fleas cannot find another rat, they may then move to a human and bring the deadly bacteria with them.

IYCB: Suggest some ways that people could keep the plague from spreading.
IYCB: Draw a diagram to show how *Yersinia pestis* bacteria usually travel to humans.

Propose Explanations:

Think About It In 1665 the Black Death attacked London and killed about one third of the city's population of 500,000 before dying out.

IYCB: What do you think would have happened to *Y. pestis* bacteria if the plague had wiped out the entire city?
IYCB: The plague often spread in cities. What is it about cities that makes them such good homes for infectious bacteria? What are some of the ways you can protect yourself from bacteria wherever you live?

Bacteria at Work

Is "bacteria" just another word for disease? Not at all!

Most of the bacteria we hear about are harmful to humans, but that's just because bad guys always make the headlines. Most bacteria are not harmful to us at all. There are many different kinds of bacteria living inside our bodies that help keep us healthy.

Read:

A 13-year old student named Rachel wrote an essay about bacteria and won the Young Naturalist Award from the American Museum of Natural History for her work.

BACTERIA GOOD GUYS

Bacteria are responsible for much more than just diseases. There are thousands of kinds of bacteria. Most of them are harmless to humans.

Vast numbers of bacteria live in our bodies. One example is found in the intestine. The bacteria help us with digestion and to produce vitamins. In exchange, they soak up a little extra food for themselves. Neat, huh? Most dairy products are made by or with the help of bacteria. Some dairy foods are cheese, buttermilk, yogurt, and sour cream. Some other kinds of foods that involve bacteria in their production are pickles and high fructose corn syrup. Can you imagine our soda without high fructose corn syrup? A hamburger with no cheese or pickles?

Bacteria are very important in medicine. Doctors and scientists have figured out how to use dead or weakened bacteria to prevent other bacterial diseases. This process is called vaccination. Vaccination has helped us all become a lot healthier than we were a hundred years ago…Bacteria do so much for us, where would we be without them?

Explore:

"Good" or "Bad"? Bacteria are doing the same thing we're doing – trying to stay alive. Unfortunately, what some bacteria do to stay alive means harm to us. For example, some bacteria that cause food to spoil do not harm people. But when those bacteria break down food, they give off chemicals that are poisonous to us. However, there are also bacteria that help us while they help themselves, such as the bacteria in our intestines. Bacteria are also what turn milk into yogurt and cabbage into sauerkraut. One scientist has even found sewer bacteria that release a gas that may someday be able to be used as a fuel!

IYCB: Is there really such a thing as "good" bacteria and "bad" bacteria? Why do we call bacteria "good" or "bad"?

Propose Explanations:

Helpful Bacteria A group of scientists did an experiment using the following hypothesis: A daily dose of certain intestinal bacteria may keep children who are in hospitals from getting diarrhea so they won't have to spend extra time in the hospital. The diarrhea is usually caused by a virus that the children catch while they are in the hospital.

The scientists tested their hypothesis by giving one group of children a dose of beneficial bacteria called Lactobaccillus GG twice a day during their hospital stay. Another group was given a placebo, a pill that doesn't have any effect. The scientists found that the risk of getting diarrhea was 80% lower in the group that received the bacteria than in the group that didn't.

IYCB: Based on what you know about "good" intestinal bacteria, suggest a possible reason for these results.