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Germs at Home

Article

PART 1

MANAUS, Brazil. You may live in a jungle hut or a high-rise apartment. Either way, your home is covered in bacteria. Now, new research from the Amazon rainforest suggests that city dwellers might want to open a window.

Photo credit and all related images: Humberto Cavallin/University of Puerto Rico/Science Advance via AP

Microbiologist Maria Gloria Dominguez-Bello, left, collects temperature data from the floor of a hut in Peru. She led a study in Peru and Brazil about bacteria in homes.

Scientists traveled from remote villages in Peru to a large Brazilian city to begin tracking the effects of urbanization on the diversity of bacteria in people's homes. In other words, they wondered, "Do city homes have different types of bacteria than rural homes?" It's a small first step in a larger quest to understand how different environmental bacteria help shape what's called the microbiome. That's the trillions of bacteria that share our bodies and play a critical role in our health.

Everyone carries a unique assortment of microbes. They exist on the skin, in the nose, and in the gut. This microbial zoo begins forming at a person's birth. It aids in digestion and protects us from illness. Some of these bacteria are good for a person's health, while others are harmful. What influences the balance between good and bad bacteria? That varies, depending on factors like a person's diet or any medicine he or she may take. Environmental exposure plays a role, too. The hygiene hypothesis, for example, suggests that immune-related conditions such as asthma and allergies are on the rise in some parts of the world because of a lack of early contact with once-common bacteria. This hypothesis seems to be strengthened by the fact that children who grow up on farms or around animals tend to have fewer of those immune-related ailments.

Increasingly, scientists studying the microbiome are investigating indoor spaces where people spend a lot of time, particularly homes. One of those scientists is microbiologist Maria Gloria Dominguez-Bello. She led the study in Peru and Brazil.

"Very little is known about the microbes of the built environment," said Dominguez-Bello.

To track the effects of urbanization, Dominguez-Bello's team studied the microbial communities of 10 houses and their inhabitants from each of three Peruvian locations. They looked at a village of hunter-gatherers; a slightly more modern rural village; and Iquitos, a medium-sized city not accessible by roads. The scientists also looked at the bacteria in homes in the more populated Brazilian city of Manaus.

The housing styles were different in each setting. In the jungle, large families typically shared open-air huts with no outside walls; in rural villages, homes had walls, but the room dividers didn't reach the roof; and in the city, homes were larger, with standard rooms and smaller families.

The team discovered that as people living in the Amazon rainforest become more urbanized, the kinds of bacteria in their homes change. The more crowded jungle and rural homes in the study contained bacteria mostly found in nature, such as those commonly found in soil and water. But the urban homes contained bacteria that typically live on people.

The researchers discovered that the more urbanized a dwelling, the more human bacteria live on its walls and floors. This is true even though urban dwellings have fewer people living in them. In fact, in city dwellings, the researchers could tell just by the microbial fingerprints on the walls whether the room was a kitchen, bathroom, or living room. In Manaus, a collection of microbes normally found in the mouth—including various species of strep bacteria—and in the gut were the most important in telling rooms apart.

"That's amazing," Dominguez-Bello said, adding, "The walls talk."

Unlike the less urban homes that are open to air circulation, urban walls were acting as traps as people shed bacteria, the team reported. Dominguez-Bello was so struck by the findings that she insisted the windows in her New York office be unsealed so she could open them.

These results are similar to those from research done in U.S. homes and hospitals about the role of ventilation, said microbiologist Jack Gilbert of the Argonne National Laboratory and University of Chicago. Gilbert was not involved in Dominguez-Bello's study. But he has conducted a study of his own. Gilbert was able to match which family lived in different locations by the bacteria they shed inside their homes.

"Our modern homes are set up perfectly" for studying microbes, Gilbert said.

The Associated Press contributed to this story.

PART 2

Dig Deeper

Most single-celled organisms without a nucleus are classified as bacteria. Bacteria are found in almost every environment. They perform a range of tasks. Some bacteria contain chlorophyll. These bacteria use sunlight for energy. They are an important food source in oceans. These bacteria also release oxygen gas, which animals need to breathe.

Bacteria without chlorophyll perform different tasks. Some bacteria break down parts of dead plants and animals. This helps recycle matter. Some bacteria release chemicals into the environment. These chemicals provide a food source for other organisms. Scientists often group bacteria by the roles they play in the environment.

- **Producers**

  Some bacteria can change energy from sunlight into energy that can be used by cells. They are called producers. These bacteria are a food source for organisms that cannot make their own food.

- **Decomposers**

  Decomposers get energy by breaking down materials in dead or decaying organisms. Decomposers help other organisms reuse materials found in decaying matter.

- **Parasites**

  Some bacteria live in a very close relationship with other organisms. They may be found either inside or on the surface of other organisms. Some of these bacteria may have no effect on their host organisms or host cells. Some bacteria help their hosts. Other bacteria are parasites, organisms that harm their hosts.

Bacteria may help or harm other organisms. These are just a few examples:

Helpful Bacteria

- One shovelful of ordinary soil contains trillions of bacteria. Every fallen leaf or dead animal is covered with bacteria. These bacteria break down the matter in dead bodies and waste materials. These broken-down materials are then available for other organisms to build their bodies.
- Bacteria that live in your intestines help you break down food and provide you with vitamins, such as vitamin K.
- Cities use bacteria to break down sewage. Bacteria in sewage-treatment plants live on the material dissolved in liquid sewage. These bacteria help make the water clean enough to be released into rivers or oceans. Other bacteria can break down oil.
- Bacteria can change materials that do not come from living things. This makes them available for other organisms. For example, some bacteria can change nitrogen gas to nitrogen compounds. This process is called *nitrogen fixation*. It makes nitrogen available to plants in a form that is useful to them. Plants use this nitrogen in making proteins, which are an important part of every cell.

Harmful Bacteria

In the late 1800s, scientists discovered that bacteria cause some diseases. Much of the scientific research into harmful bacteria developed because bacteria caused disease in humans. Tuberculosis, cholera, and strep throat are examples of disease caused by bacteria. Bacteria also may cause disease in many other animals and in plants.

Bacteria can cause symptoms of disease in three ways:

- They can take over parts of the body. They will multiply in body tissues and dissolve cells.
- They can poison the body. They do this with the chemicals they produce and release.
- They can poison the body with chemicals that are part of the bacteria themselves.

One way to fight bacterial disease is with vaccinations. Vaccines help an organism to prepare to fight diseases it might get in the future. Humans get vaccinations for bacterial diseases. Cats and dogs do as well.

Dictionary

accessible *(adjective)* able to be reached

decomposer *(noun)* an organism that feeds on and breaks down dead plant or animal matter

diversity *(noun)* variety

microbe *(noun)* a very small organism that can be seen only with a microscope

parasite *(noun)* an organism that absorbs nutrients from the body of another organism, often harming it in the process

producer *(noun)* an organism that captures energy from sunlight and transforms it into chemical energy that is stored in energy-rich carbon compounds

ventilation *(adjective)* having to do with supplying fresh air in an enclosed space

Activity

PART 1

Question 1

Consider this quote from the Article:
"That's amazing. The walls talk."

In light of the main ideas of this Article, what caused microbiologist Maria Gloria Dominguez-Bello to make such a public statement?

(A) Researchers learned that various species of strep bacteria are most common in the bathrooms in city homes.

(B) Researchers learned that each human has a both good and bad bacteria living inside and outside the body.

(C) Researchers found that they could match families with their dwellings by looking at the bacteria that typically lives on people.

(D) Researchers found that microbial samples from urban homes could be identified by the rooms from which they were taken.

Question 2

The best alternate headline for this Article would be _____.

(A) Immune-Related Illnesses Less Common

(B) New York Windows Open at Last

(C) Jungle Homes Are Easy To Build and Maintain

(D) Your Microscopic Roommates

Question 3

Which two words from the Article are the closest **antonyms**?

(A) Microbes and bacteria

(B) Similar and standard

(C) Urban and rural

(D) Dwelling and location

Question 4

Which of these is a statement of opinion?

(A) Strep bacteria helped researchers learn from which rooms microbe samples were taken in homes.

(B) A properly maintained ventilation system is the most important thing in a hospital building.

(C) Scientists found that city homes contain more human microbes than jungle homes.

(D) Huts in the rainforest contain bacteria typically found in water and soil.

Question 5

The reader can infer from the Article that _____.

(A) A fund will be created so that the crowded rural homes of Peru can be sanitized and be fitted with sealed windows.

(B) Microbes from urban dwellings in Peru and Brazil will be collected and introduced into rural dwellings.

(C) Research on microbes like the study done in Peru and Brazil may one day influence the way homes are designed and built.

(D) Officials in Brazil will demand that urbanization be halted due to recent levels of bacteria in jungle dwellings.

Question 6

Which two words are the closest **synonyms**, as they're used in the Article?

(A) Results and findings

(B) Microbiologist and inhabitant

(C) Diet and medicine

(D) Accessible and remote

Question 7

Suppose Sima wants to find out about microbiomes. She would find **most** of her information _____.

(A) At a conference regarding the rate of urban sprawl in Manaus, Brazil

(B) At a family meeting of hunter-gatherers who reside in the country of Peru

(C) In a research paper that examines the economics of Iquitos, Peru

(D) In a biology textbook within a chapter on the human body

Question 8

Which passage from the Article best supports the idea that urban dwellings pose different health risks than rural homes?

(A) You may live in a jungle hut or a high-rise apartment. Either way, your home is covered in bacteria.

(B) It's a small first step in a larger quest to understand how different environmental bacteria help shape what's called the microbiome.

(C) To track the effects of urbanization, Dominguez-Bello's team studied the microbial communities of 10 houses and their inhabitants from each of three Peruvian locations.

(D) The team discovered that as people living in the Amazon rainforest become more urbanized, the kinds of bacteria in their homes change.