

The New Endangered Species: The Human Gut Microbiome

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✓ Fact Checked

February 27, 2023

STORY AT-A-GLANCE

- › The film, “The Invisible Extinction,” warns that the human microbiome is endangered, putting humans at risk
- › The film highlights the work of microbiologists Dr. Martin Blaser and Gloria Dominguez-Bello — a husband-wife team — who are looking into both the problem and a potential solution to save microbial diversity
- › The overuse of antibiotics, elective C-sections and processed foods are “driving the destruction of our inner ecology,” according to the film
- › The dramatic increases in chronic diseases, including Type 1 diabetes, asthma, obesity, gastroesophageal reflux disease and inflammatory bowel disease, may be linked to the loss of bacterial diversity in our guts
- › Dominguez-Bello is president of The Microbiota Vault, a global nonprofit initiative attempting to “conserve long-term health for humanity” by storing and preserving microbiota samples and collections

The documentary film, “The Invisible Extinction,” is sounding the alarm that the human microbiome is endangered, putting humans at risk. “Bacteria have been the dominant life form on Earth. Everything about human life depends on bacteria,” the film begins.¹

Researchers are only beginning to tap the surface when it comes to unveiling the complex relationship microbes have with human health and disease. But it’s known that

microbial diversity in your gut is a good thing, while decreased diversity in the gut microbiome has been linked to chronic conditions such as obesity and Type 2 diabetes.

In general, gut microbial diversity decreases with age,² but even younger people are being affected. The documentary homed in on three likely reasons why – the overuse of antibiotics, elective C-sections and processed foods, which they say are “driving the destruction of our inner ecology.”³

Making a Mess of Microbial Diversity

The film highlights the work of microbiologists Dr. Marty Blaser and Gloria Dominguez-Bello – a husband-wife team – who are looking into both the problem and a potential solution to save microbial diversity. In explaining why he chose to focus the film on the research of Blaser and Dominguez-Bello, after speaking with many microbiologists, co-director and producer Steven Lawrence explained to Sloan Science and Film:⁴

“Marty’s research, which is quite broad, defines the problem, whereas Gloria’s looks for the solution – whether it’s preserving indigenous people’s microbes, thinking about how we can make c-section births less detrimental in the long term, in addition to advocating for fewer elective c-sections.

There are people around the world doing important, foundational research, which will hopefully filter down into a much more nuanced view of what it means to be healthy. We can all be healthy physically but have very different microbiomes; there is a protectiveness in diversity within ourselves as well as within our species, and I think that’s what Gloria’s work on the microbiota vault [discussed below] is about.”

The microbiome refers to all the microbes that live in and on your body. Not only does it play a role in digestion but it’s also foundational to immune system function. In fact, your gut microbiome affects nearly all your physiological systems.

In my interview with Rodney Dietert, Professor Emeritus of immunotoxicology at Cornell University, he explains that we’re **microbial beings**, as “more than 99% of your genes are

from microbes, not from your chromosomes."⁵ You have approximately 3.3 million microbial genes, mainly bacterial. Across the entire population of humans, there are just under 10 million different microbial genes, so you won't necessarily have all of them.

You also have 22,000 to 25,000 chromosomal genes (these genes are what were analyzed through the Human Genome Project), which means you only have about 2,000 more chromosomal genes than an earthworm. As noted by Dietert, since we have about 3.3 million microbial genes, that means we're more than 99% microbial, genetically.

Yanomami Indigenous People Most Microbially Diverse

Research by Dominguez-Bello and Blaser involved characterizing the fecal, oral and skin bacterial microbiome of the Yanomami, an isolated group of indigenous people who live in the Amazon rainforest. In a study published in *Science Advances* in 2015, they wrote:⁶

"These Yanomami harbor a microbiome with the highest diversity of bacteria and genetic functions ever reported in a human group.

Despite their isolation, presumably for >11,000 years since their ancestors arrived in South America, and no known exposure to antibiotics, they harbor bacteria that carry functional antibiotic resistance (AR) genes, including those that confer resistance to synthetic antibiotics and are syntenic with mobilization elements. These results suggest that westernization significantly affects human microbiome diversity ..."

By studying the microbiomes of these indigenous people, Dominguez-Bello believes we can gain clues as to what functions are lost in urban areas, where modern lifestyles are putting the microbiome at risk. In an interview with *People*, she explained:⁷

"These are peoples that are only now starting to be exposed to urban practices and medicine. So these are survivors, because you can imagine the mortality in places where there's no medicine. You fall from a tree, you are dead. You break a leg, you are dead.

One of every 10 mothers that are in labor, one mother or baby dies. So if you survive, you are really a survivor. And these are healthy people because the unhealthy ones have died. So we are very interested in understanding their microbiome. And what we find is that they have much higher diversity. In general, diversity is a marker for health. The more diverse the microbiome, the healthier the ecosystem.”

Why C-Sections May Be Robbing Babies of Microbes

The film also tackles cesarean section (C-section), which alters infants’ microbiota since they’re not exposed to their mother’s vaginal microbiota during birth. C-section delivery is associated with an increased risk of immune system and metabolic disorders, possibly due to altered microbes.

Research by Dominguez-Bello and colleagues revealed, however, that “vaginal seeding” of C-section babies successfully restores maternal microbes in the infant when done immediately after birth, naturalizing their microbiota.⁸ While it’s unknown if restoring the babies’ microbiota after birth leads to long-term health outcomes, Dominquez-Bello intends to find out. She told People:⁹

“If a baby is born via elective C-section, with no water breaking, they are not exposed to the mother's microbiome in the vagina. But we have shown that if we normalize, at least partially, the microbiome of a baby that is born by elective C-section by rubbing them with gauze soaked in fluid with their mother's microbiome, we can normalize the mouth microbiome of the baby during the first year of life.

Are we protecting kids against asthma, against Type 1 diabetes, against celiac disease, allergies, obesity by doing this? We are doing a 5-year clinical trial to find out.”

Early-Life Exposures May Be Key to Disease Prevention

Regarding early-life exposures, it's also been suggested that abnormalities with the gut microbiome early in life could play a role in autism. Blaser told People:¹⁰

"We know that the rate of autism has gone up dramatically over the last 80 years. And it's a disease of early life – it manifests within the first couple years. And so we are interested in the idea that the early life microbiome, as it forms, has a connection with the brain.

We know that the microbiome is talking to the brain. And so, a number of investigators have been interested in the idea that maybe an abnormal early life gut microbiome is having an altered conversation with the brain, and it's changing brain development."

Acute lymphoblastic leukemia (ALL), the most common type of childhood cancer, may also have a microbial link, according to Melvin Greaves of the Institute of Cancer Research in London, U.K.¹¹ Greaves' study suggests exposure to microbes in early life may be the ticket to preventing ALL, which can be done through:

- Vaginal delivery (versus caesarean)
- Breastfeeding
- Going to day care as a baby
- Exposure to older siblings

Past research supports these suggestions, including a 2002 study that found children who spent more time in daycare had a significantly reduced risk of ALL.¹² Breastfeeding was also associated with a reduced risk of ALL whereas introduction of formula within 14 days of birth was positively associated with ALL, as was exclusive formula feeding to 6 months.¹³

Antibiotics Are Decimating the Human Microbiome

Every year, about 10 doses of antibiotics are prescribed for every person on Earth. Even children take a mean of 2.7 courses of antibiotics by age 2 and 10.9 by age 10.

Exposure often begins even earlier, however, as more than half of women receive antibiotics during pregnancy or shortly after birth.

“This is in addition to an unknown level of exposure from agricultural use of antibiotics,” Blaser explained in the *Cleveland Clinic Journal of Medicine* in 2018.¹⁴ He believes that the dramatic increases in chronic diseases, including Type 1 diabetes, asthma, obesity, gastroesophageal reflux disease and inflammatory bowel disease, are linked to the loss of bacterial diversity in our guts — caused by the overuse of antibiotics:¹⁵

“Before modern times, microbes were transferred from mother to child during vaginal birth, from the mother’s breast during nursing, through skin-to-skin contact, and from the mother’s mouth by kissing.

Now, widespread cesarean delivery, bottle-feeding, extensive bathing (especially with antibacterial soaps), and especially the use of antibiotics have changed the human ecology and altered transmission and maintenance of ancestral microbes, which affects the composition of the microbiota.

The microbes, both good and bad, that are usually acquired early in life are especially important, since they affect a developmentally critical stage.”

In comparison to the Yanomami people in the Amazon jungle, who have high bacterial diversity, people in the U.S. have already lost 50% of their microbial diversity.¹⁶ This is why the risks of antibiotics must be carefully weighed against the benefits prior to use — and the use of antibiotics in the food supply must also be significantly reduced.

Processed Foods Destroy Your Microbiome

Another assault to your microbes comes in the form of processed foods. Fiber is “the single most important component of the diet to feed the microbiome,” Dominquez-Bello says,¹⁷ but it’s largely absent in processed foods. Chemicals in the food supply, such as the herbicide glyphosate, **also disrupt microbes**.

Consumption of whole foods is linked to higher gut microbiota diversity,¹⁸ as is consuming herbs and spices. Consuming capsules of spices – specifically cinnamon, oregano, ginger, black pepper and cayenne pepper – favorably affected gut bacterial composition after just two weeks.¹⁹ In another study, diversity of gut bacteria increased after four weeks of consuming herbs and spices, in three-fourths teaspoon or 1.5 teaspoon daily doses.²⁰

In addition to herbs and spices, consuming fermented foods is another solid strategy for optimizing the health of your gut microbiome. A study assigned 36 adults to consume a diet high in fermented foods or high-fiber foods for 10 weeks. Those consuming fermented foods had an increase in microbiome diversity as well as decreases in markers of inflammation.²¹

The issue is that many Americans do not consume these healthy whole foods on a regular basis, instead consuming processed junk foods devoid of fiber and nutrients and packed with additives. Artificial sweeteners have also been found to alter gut bacteria in adverse ways.²²

The Microbiota Vault

Dominguez-Bello is president of The Microbiota Vault, a global nonprofit initiative attempting to “conserve long-term health for humanity”²³ by storing and preserving microbiota samples and collections. The idea is to maintain a bank of microbes that could be used to restore human microbiota as it gradually becomes less diverse – or in the event it essentially goes extinct. Dominguez-Bello explained to People:²⁴

“We need to preserve the current biodiversity of microbes in humans of everywhere. And this is true also for the environment. We are making a complete mess of biodiversity, including microbial. Microbes are essential in every ecosystem, not only in humans or animals or plants, but also in the oceans. The whole thing is linked together by impact of human activities.”

We need to preserve microbes because they really modulate functions of Earth ... They modulate everything. They modulate our own gene expression. So there has to be more of that effort to preserve microbial biodiversity, to restore, because we will need restoration."

In the immediacy, in addition to avoiding elective c-sections, consider the following to protect your microbiome as much as possible:

Do	Avoid
Eat plenty of fermented foods – Healthy choices include lassi, fermented grass fed kefir, natto (fermented soy) and fermented vegetables.	Antibiotics , unless absolutely necessary. If you do use them, make sure to reseed your gut with fermented foods and/or a high-quality probiotic supplement.
Take a probiotic supplement – If you don't eat fermented foods on a regular basis, a probiotic supplement can be useful.	Conventionally-raised meats and other animal products, as CAFO animals are routinely fed low-dose antibiotics.
Boost your soluble and insoluble fiber intake , focusing on vegetables and seeds, including sprouted seeds.	Chlorinated and/or fluoridated water – This includes during bathing or showering.
Get your hands dirty in the garden – Exposure to bacteria and viruses in soil can help strengthen your immune system and provide long-lasting immunity against disease.	Processed foods – Excessive sugars, along with otherwise "dead" nutrients, feed pathogenic bacteria. Food emulsifiers such as polysorbate 80, lecithin, carrageenan, polyglycerols, and xanthan gum may have an adverse effect on your gut flora.

Do

Open your windows — Research shows opening a window and increasing natural airflow can improve the diversity and health of the microbes in your home, which in turn benefit you.²⁵

Wash your dishes by hand instead of in the dishwasher — Research has shown washing your dishes by hand leaves more bacteria on the dishes than dishwashers do.

Eating off these less-than-sterile dishes may decrease your risk of allergies by stimulating your immune system.²⁶

Avoid

Agricultural chemicals, glyphosate (Roundup) in particular is a known antibiotic and could potentially kill many of your beneficial gut microbes if you eat foods contaminated with it.

Antibacterial soap, as it kills off both good and bad bacteria and contributes to the development of antibiotic resistance.

Sources and References

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