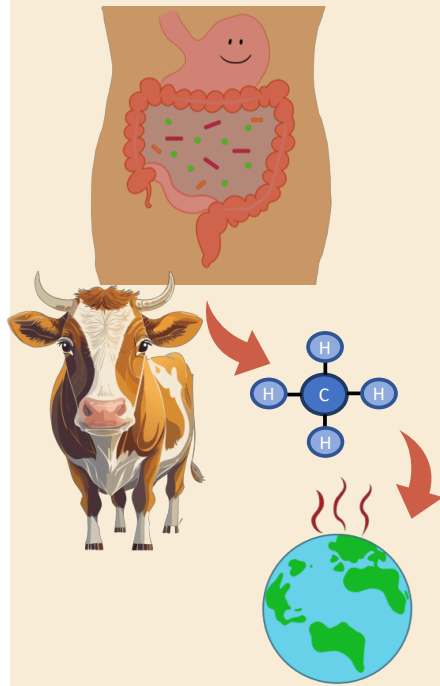
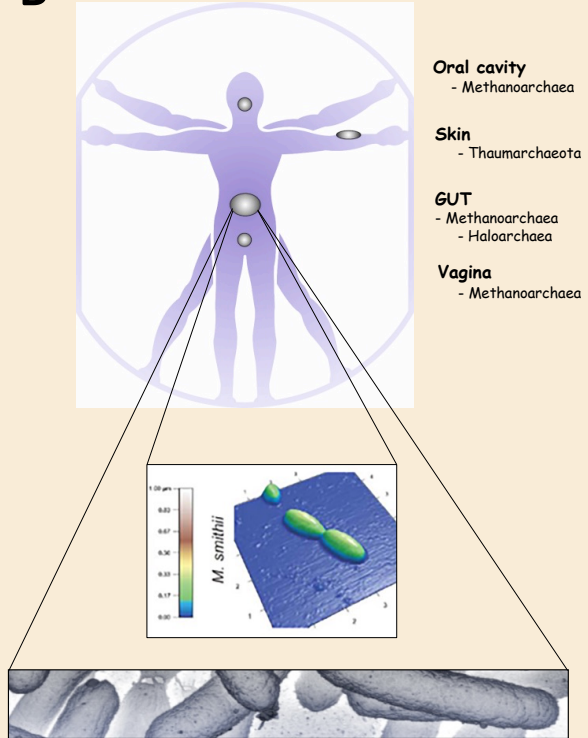


MicrobiomeHero: Brevi (*Methanobrevibacter smithii*) (Ruth Schmitz-Streit)

A *Methanobrevibacter*



B



Brevi A: Gas production by Brevi in our intestine and in the rumens of ruminants, like cattle and goats (major part) increases the methane concentration in the atmosphere. Since methane is a greenhouse gas, it can trap heat in the Earth's atmosphere and contribute to climate change. **B:** Human microbiome and presence of (Methano)archaea in different human habitats; the lower part shows Brevi visualized by two different imaging tools – atom force microscopy and transmission electron microscopy analysis. The figure was designed by Lisa Ladewig and Ruth Schmitz-Streit.

Claim to fame: The tiny tummy gas maker!

Methanogens are microbes that produce methane

Methanogenic archaea are major producers of methane in animal guts and paddy fields, and some species are involved in energy harvesting and the health of humans.

Brevi (*Methanobrevibacter smithii*) is a **super tiny microbe** that lives inside our body. We can't see it, but it's there – especially in our **tummy (gut)** and sometimes in our **mouth**.

Brevi is part of a special group of microbes called the archaea, which are single-celled organisms like bacteria. However, **archaea and bacteria are not** exactly the same. One of the main differences is in their **cell structure**. The outer cell envelope and the cytoplasmic membrane of archaea are made from different molecules than those in bacteria, which helps some archaea to survive in extreme environments like boiling hot springs, salty lakes, or places with no oxygen.

Archaea also have unique ways of making energy and they are more closely related to complex life forms like plants and animals (the Eukaryotes) than to bacteria. Indeed, we know today that Eukarya have evolved from archaea!

Methanogens are important members of our gut microbiota

Even though we can't see it with our eyes, **Brevi** is very busy inside us. Its job is to help break down the food we eat and, while it's doing that, it makes a special gas called methane. That's right, it actually helps create some of the gas that can make us feel bloated or even make us fart. It sounds funny, but it's just a normal part of how our bodies work.

So, in humans, **Brevi** is part of the so-called **gut microbiota**, the large community of microbes that lives in our digestive system. And **Brevi** is one of the most common methanoarchaea found in the human gut microbiota (see B, image above). This gut microbiota helps our body to digest food, protects against harmful microbes, and supports the immune system which helps us defend pathogens, which otherwise would make us sick.

In general, **Brevi** lives in environments with very little or no oxygen, such as in the **human gut** and occasionally the **mouth**. While helping to break down food that other microbes cannot digest, methanogenic archaea like **Brevi** use those molecules generated by other microbes to produce methane gas, which can lead to the build-up of intestinal gas.

Brevi and our health

A healthy gut microbiota in general depends on having the right mix of microbes in the right proportions to one another (bacteria and archaea) – this means not too many and not too few of each one. Eating a variety of **fruits, vegetables, and fiber-rich foods**, drinking **plenty of water**, getting **enough sleep**, and staying **physically active** all help to keep a healthy balance of microbes in our gut, supporting the good microbes and keeping the harmful ones in check. Which means this helps the good microbes do their job and keeps the harmful ones from causing problems.

Consequently, in certain small amounts, **Brevi** plays a helpful role, but if there are too many, it can be linked to **health problems**. Too much methane production may slow down how food moves through the intestine, leading to **constipation, bloating**, or discomfort. Scientists have also found a correlation between too high levels of **Brevi** and some diseases, e.g. **irritable bowel syndrome (IBS)**. However, although a correlation can be a useful hint for scientists seeking to understand a process, it is not a proof of guilt (see Correlation and Causality, in the Critical Thinking MicroChats Gallery). Consequently a lot of scientists currently try to determine whether this correlation between too many **Brevi**s and diseases reflects causalities.

In the mouth, too many **Brevi**s have also been linked to **bad breath** and **gum problems**. Most interestingly, even though it is predicted that more archaea live in our world than bacteria, as of today **no archaeon has so far been shown to be pathogenic**.

Methane is an important biofuel

Methane is important outside of our body too, e.g. in biogas plants which convert organic wastes like manure and solid materials in sewage/wastewater, where the methane produced by

methanogenic archaea is later used as an energy source for producing heat to warm up our houses, or electricity to run e.g. our kitchen machines.

And methane is a powerful greenhouse gas

However, if too much methane is produced by cows and other animals, as well as in rice paddy fields, and the concentration in our atmosphere increases more and more, it is bad for our climate (see image above). This is because methane is a powerful **greenhouse gas**, which means it can trap heat in the Earth's atmosphere and contribute to climate change. Although methane from microbes in the human gut is very small compared to other sources like cows or wetlands, scientists study methanogens to understand better all sources of methane and find ways to reduce greenhouse gases.

The importance of Brevi for us.

Without **Brevi** and its relatives, we and several animals would not be able to use our food efficiently and would be more sick than healthy. So **Brevi** is a good friend of ours and several animals, and we should be nice to it!