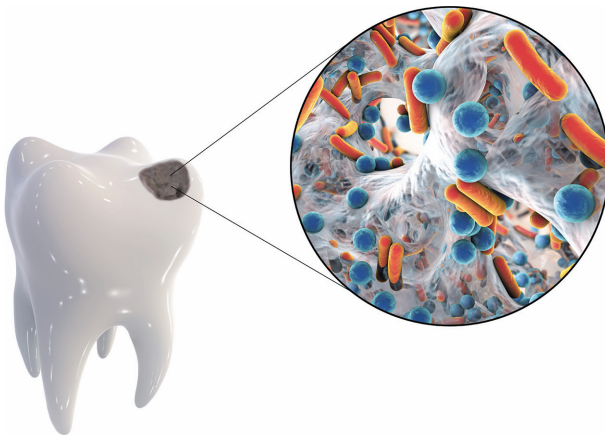


Bacteria in the Mouth: The True Story of Why You Get Cavities

When West finally got around to going to the dentist, the dentist found several cavities that needed to be filled. "Why do I have cavities?" West asked. "I brush my teeth twice a day. What else can I do to avoid cavities?"

"Brushing is very helpful," the dentist said, "but it's not the only thing you can do to prevent cavities. Cavities are actually caused by bacteria, and those bacteria can sometimes cause cavities in your teeth even if you try to take good care of your teeth and see the dentist regularly."



Inside a cavity that forms in a tooth, there are many different kinds of microscopic bacteria.

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Bacteria are everywhere: on our bodies, on the surfaces we touch, and even in our mouths! Most of the bacteria in and on our bodies are harmless, and some are even beneficial. Others, like the ones that cause tooth decay, not so much. Bacteria that live in our mouths are tiny—only about 1/500 the width of a human hair. But the big issue isn't their size, it's their number. On average, a human mouth plays host to over 300 different species of bacteria and over 1 billion bacteria total!

So what do these bacteria in our mouth DO exactly?

Bacteria are living things—they move, eat, grow, reproduce, and discharge waste, and to do so, they need space. The mouth is an ideal habitat for microbes. Saliva keeps the mouth warm (around 35°C) and moist, and the pH of saliva (about 6.95) is ideal for microorganism growth. Continuous flow of saliva also allows for bacteria to adhere to surfaces in the mouth. Although all the surfaces in the mouth benefit from saliva and serve as habitats for bacteria, there is one surface that is a particularly good "home"—the teeth. Unlike skin, tooth surfaces rarely shed once they are formed, so once a bacterial colony forms on the tooth's surface, it won't be removed as a result of shedding.



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Bacteria form a biofilm called plaque on tooth surfaces. Here, a dental professional is scraping the plaque off the teeth.

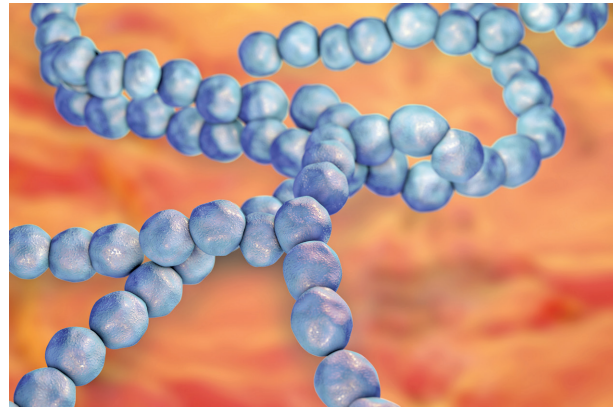
When a baby's teeth first erupt from the gums, the tooth's surface enamel is coated with saliva and bacteria that are already present in the mouth. These bacteria come originally from food, surfaces, or people that have come in contact with the baby's mouth. Over time, more bacteria enter the

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mouth environment and land on the tooth's surface. Once they land and collect on the tooth surface, bacteria grow and stick together in organized complex community groups called biofilms (which we refer to as dental plaque). Biofilms help protect the bacteria from other microbes and viruses, allowing the bacteria to survive, grow, and reproduce.

Do all bacteria cause tooth decay?

The short answer? No. Not all bacteria present in our mouths cause tooth decay. Two types of bacteria—*Streptococcus gordonii* (*S. gordonii*) and *Streptococcus oralis* (*S. oralis*)—are frequently found in mouths without tooth decay and have a role in maintaining healthy gums. One type of bacteria, however, *Streptococcus mutans* (*S. mutans*), can be particularly problematic. All three *Streptococcus* species consume carbohydrates, or sugars, left on tooth surfaces after eating. Once the bacteria use the carbohydrates for energy to grow, they eliminate waste products as acid. This acid lowers the pH of the saliva. If all three bacteria are common in our mouths, and two of them actually help keep our mouths healthy, why do we get cavities?



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Chains of *Streptococcus* bacterial cells.

Scientists worked to answer this same question by looking closely at how the three types of bacteria (*S. gordonii*, *S. oralis*, and *S. mutans*) respond to changes in their environment. Researchers grew the three bacteria at a constant temperature (37°C) and pH (7.0). Then, scientists washed the plates with a glucose solution (sugar water) to provide food for the bacteria, and then either maintained the pH or allowed it to change.

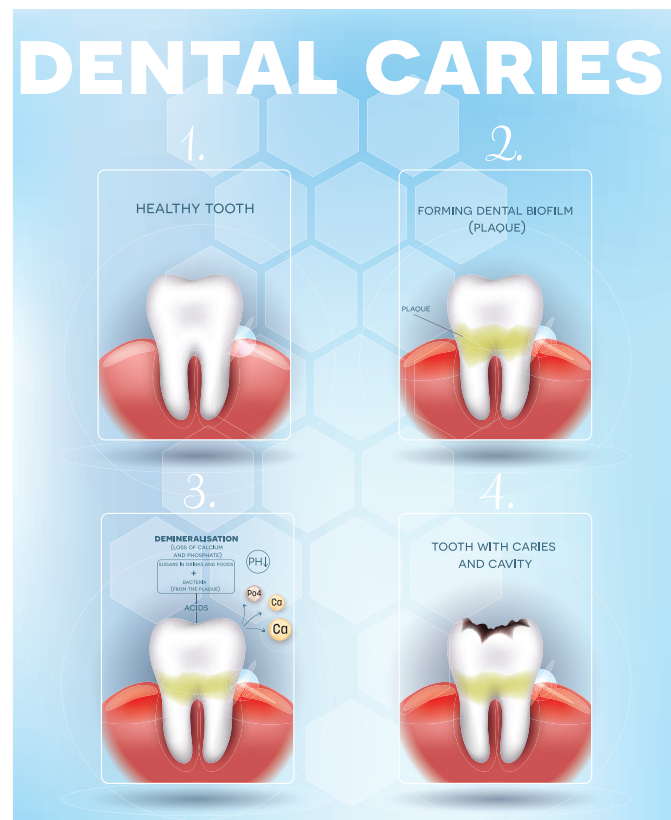
Bacteria	% of total before treatment	% after 10 glucose washes	
		With pH control (pH 7)	Without pH control
<i>S. gordonii</i>	28.3	25	0.2
<i>S. oralis</i>	15.2	16.9	1.3
<i>S. mutans</i>	0.3	1	18.9
All others	56.2	57.1	79.6
Final pH	7	7	3.83

Before any glucose washes, *S. gordonii* and *S. oralis* were much more common than *S. mutans*. This is representative of a healthy mouth with little tooth decay. Then, after 10 glucose washes with a controlled pH of 7.0, the nonpathogenic *S. gordonii* and *S. oralis* were still dominant over *S. mutans*. However, with glucose washes and uncontrolled pH, *S. mutans* took over. This helped scientists to understand that it wasn't just sugar on the teeth that allowed *S. mutans* to take over, but also a low pH.

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Since all three bacteria species consume sugars and produce acid as a waste product, when more sugar is present more acid is produced. The more acid that is produced, the lower the pH of your saliva. This change in environment, like in the scientists' experiment, allows *S. mutans* to thrive!

S. mutans populations continue to grow and thrive in areas where it is more acidic and there are constant food sources. For example, when little pieces of sticky sugars get lodged in the pits of your molars, those sticky sugars offer the bacteria a constant food source. Over time, the bacteria consume more and more sugar and produce more and more acid, which wears away at your tooth enamel, essentially making the pits deeper so that food is more prone to getting stuck there. Over time, this constant cycle of providing *S. mutans* food and wearing away of your tooth enamel leads to tooth decay, also known as cavities (or what the dentist will refer to as caries). Uncontrolled growth of *S. mutans* for long periods of time can also lead to inflammation in your gums, which can be painful and can lead to additional damage to teeth and gums.



The process that leads to cavities.

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So how do we get rid of these little creatures?

The key is to break up the populations of *S. mutans* as soon as they find a space to grow and thrive. Brushing and flossing regularly will clear away food residue and starve the bacteria, keeping its growth in check. Other studies have found that tooth decay is related more to the frequency of eating than to the amount of sugar. Saliva naturally washes away some of the residual food during the period between meals. Snacking or drinking sugary drinks all day keeps a thin layer of sugar on the teeth all the time, providing a constant source of food for bacteria and enabling them to grow and reproduce. So, if you want to save yourself a trip to the dentist, limit the between-meal snacking and brush, brush, brush!

Sources:

Friedman, Jason Yeshaya. "The Role of *Streptococcus Mutans* in the Formation of Dental Caries: An Ecological Perspective." *The Science Journal of the Lander College of Arts and Sciences* 5, no. 1 (2011): 5.

Loesche, Walter J. "Role of *Streptococcus Mutans* in Human Dental Decay." *Microbiological Reviews* 50, no.4 (1986): 353–380.

University of Chicago Dentistry. "The True Story of Why You Get Cavities, According To a Billion Microbes." 2017. <https://dentistry.uic.edu/patients/cavity-prevention-bacteria>

Wanek, Christopher. "The Truth About Tooth Decay." LiveScience. November 6, 2007. <https://www.livescience.com/2011-truth-tooth-decay.html>

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