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What's Up With the Bacteria In Your Gut?
by **Rebecca Rupp**

We've known for decades that that the lush collection of bacteria that populate our guts plays a part in digestion. The famous after-effects of bean-eating—tactfully known in the 16th century as "windinesse"— are due to our resident microbes, chomping up an assortment of bean oligosaccharides (short chains of linked sugars) that our own enzymes can't deal with, and generating in the process an unfortunate excess of bloating gas.

While gut bacteria play an essential (if not always socially tactful) role in human nutrition, a wealth of recent research now shows that they do far more. In fact, the key to whether we're fat or thin, cheerful or depressed, healthy or chronically ill, may lie in the gut microbiome. Biologically, we're the puppets of our bugs.

When it comes to gut bacteria, at least in the beginning, it's all about mom. We start accumulating our resident bacteria at birth, following our unsterile passage through the birth canal; and we pick up even more through mother's milk. Milk contains a population of complex carbohydrates that can only be digested by bacteria, specifically by *Bifidobacterium infantis*, a helpful bacterium that makes itself at home in the baby's digestive tract and helps prevent infections. Milk, in other words, doesn't just feed the baby; it also functions as a probiotic, providing infants with a growing population of beneficial microbes, and as a prebiotic—supplying those microbes with something to eat.

Generally, by the time kids turn three, following the introduction of solid foods and a lot of crawling around on the floor, their internal bacterial ecosystems are fully established. This means, inevitably, that they've come in contact with large numbers of fecal particles, which occupy a great deal more of the world than most of us care to think about. According to microbiologists, the environment is pretty much coated in poop.

Creepy though this may sound, it's a good thing. Acquired bacteria provide us with enzymes and vitamins, such as vitamins B and K, help us battle infections, and manufacture neurochemicals essential for our mental health and well-being. An estimated 90 percent of the body's serotonin, for example—a brain neurotransmitter that affects mood, sexual activity, appetite, sleep, memory, and learning— is made by gut bacteria.

Our personal bacteria also protect us from a wide range of ailments whose increasing prevalence, scientists now believe, may reflect that fact that something, bacteria-wise, is going seriously wrong. The modern rise in obesity, allergies, asthma, rheumatoid arthritis, Type I diabetes, multiple sclerosis, irritable bowel syndrome, cirrhosis of the liver, cardiovascular disease, and anxiety attacks – perhaps even autism – may be related to the bacterial populations in our guts.

The root of all evil here may be a leaky epithelium. The epithelium, the all-important lining of the digestive tract, ordinarily acts as a barrier between the teeming bacterial world of the gut and the rest of the body. Resident bacteria ordinarily keep epithelial cells healthy by providing them with short-chain fatty acids and other nutritive factors. In the absence of the appropriate nurturing bacteria, however, the starved epithelium breaks down, allowing bacteria and toxic

bacterial byproducts to enter the bloodstream. This sends a signal to the immune system, alerting it to the presence of invaders, which can lead to persistent inflammation and eventually, a host of chronic diseases.

In other words, many modern plagues may be occurring because our microbiomes aren't what they used to be. In industrialized nations, overuse of antibiotics, a sanitized lifestyle, and a diet heavy in processed foods have all contributed to mass internal microbial die-off. The result is an impoverished Western microbiome. We've now got a far less diverse internal population of bacteria, and we've lost many helpful species altogether.

Martin Blaser of the NYU School of Medicine, author of *Missing Microbes: How the Overuse of Antibiotics Is Fueling Our Modern Plagues*, uses as a prime example a corkscrew-shaped bacterium called *Helicobacter pylori*, known to be the causative agent of peptic ulcers, that thrives in the acid environment of the human stomach. At the beginning of the last century, nearly every stomach in the world harbored *H. pylori*; today just five percent of American children carry it. This sounds, initially, like a plus—who needs an ulcer?—but Blaser points out that *H. pylori* plays essential roles in mediating the metabolic and immune systems, and in regulating ghrelin, the hormone that tells the brain we're hungry and stimulates appetite. In the absence of bacterial controls, too much ghrelin may egg us on to over-eat.

While microbiome research is still in its early days, one thing is clear: a diet of junk food doesn't do our bacteria any good. In one much-publicized experiment, genetic epidemiology professor Tim Spector of King's College in London convinced his adult son Tom to spend ten days on a dedicated fast-food diet of fries, burgers, chicken nuggets, and Coca-Cola. Tom started out with a gut population of 3,500 bacterial species; by the end of his fast-food binge, he'd lost a third of these.

So how to maintain a healthy microbiome? Scientists and medical doctors generally advise that the thriving commercial pre- and probiotic supplement industry be taken with a grain of salt. Such products to date are unregulated. And in any case, there's not yet consensus on what constitutes a healthy microbiome.

There are, however, some general rules. Recommended for the good of the gut is a diet rich in probiotic fermented foods such as yogurt, sauerkraut, kimchi, and miso soup, and in fiber-rich prebiotic foods, such as whole grains, fruits, and vegetables. It's also a good idea to avoid processed foods, which may feed*you*, but don't provide much sustenance for your gut bacteria.

Exercise seems to benefit not just us, but our guts. One study, comparing rugby players to non-athletes, found that the rugby players had more diverse microbiomes, with higher proportions of at least 40 different bacterial species.

And, while antibiotics are certainly sometimes necessary, we should be cautious about overusing them. Studies show that that the gut microbiome can take up to a year to bounce back after a course of bacteria-blitzing antibiotics.

Finally, in the service of gut microbiome diversity, you might want to expand your environment. The more diverse bacteria you pick up, the better. So meet new people, pat the dog, dig in the garden, and play in the dirt. Bugs are good.