Mayor of Microbe Metropolis

When Jop de Vrieze met the microbes that call him home, he suddenly realised he had responsibilities

THERE they are: my microbes. I feel like someone who's just been introduced to a group of lost relatives. Staring through a microscope, I see a cluster of *Staphylococcus epidermidis* bacteria sitting together in a Petri dish. They look like a bunch of grapes. Until yesterday, they were living in my armpit.

I had set out on a quest to learn about my microbiome and how it affects my health. It soon made me think of myself quite differently. Looking down that microscope, I no longer felt like an individual – I was the mayor of my own microbe metropolis.

There are many trillions of microbial organisms living in and on our bodies, outnumbering our own cells 3 to 1. We have battled them for years, with antibiotics and disinfectants. But as we get to know them better, a lot turn out to be our allies. "It's like we've been breaking down our house and only started appreciating it when we've already destroyed it to a great extent," says Margaret McFall-Ngai at the University of Wisconsin-Madison. "It's a complete wake-up call."

It wasn't just my own cells I had to look after, but the multitudes that call me home – from the downtown districts in my gut to the suburban sprawl of my skin. Bad management could get me into trouble. Imbalances in microbial flora have been linked to many conditions, from inflammatory bowel disease and type 2 diabetes to cancer, heart disease and depression. Upset the good guys and I risk letting a bad crowd move in. So how do I keep them happy?

Let them eat veg

The gut is the powerhouse of my microbial world. Vast numbers of bacteria live in my intestines, feeding on my leftovers. They help break down undigested food, contributing about 10 per cent of my energy and producing a variety of molecules that have an effect on my metabolism, immune system and even brain. *Faecalibacterium prausnitzii*, for example, plays a role in regulating sugar uptake, and having too few has been linked to Crohn's disease. Then there's *Bacteroides fragilis*, which keeps my immune system on its toes, and the lactic acid bacteria that help me handle stress by producing appropriate neurotransmitters.

A healthy immune system creates the right environment to attract species like these, while keeping others out. "The microbiota shape the immune system and the immune system shapes the microbiota," says Martin Blaser at New York University. "It's a two-way system."

If they eat what I eat, how does my diet affect them? To get a rough idea, Willem de Vos at Wageningen University in the Netherlands helped me set up a small experiment. For four weeks, I followed four consecutive diets. The first week I ate as I normally would – a little bit of everything. In the second week I ate a vegetarian diet and in the third week I ate meat and starch but no fruit or vegetables. In week four I returned to my regular diet but ate probiotic yogurt with every meal. At the end of each week, I took a stool sample to de Vos and his team, who analysed the fragments of microbial DNA it contained.

The dietary changes shifted my gut microbiome quite a bit – as a recent study showed, diet can alter microbiome make-up in just a few days. My microbes took a hit when I changed my normal diet. But the most interesting shift came when I gave up fruit and vegetables. During my meaty week, populations of certain species that reduce inflammation dropped, including *Clostridium* and *Prevotella* species. At the same time, other populations bloomed to take their place. For example, the number of *Bacteroides* went up (see diagram, page 44). *Bacteroides* are typical of Western diets that are high in animal protein and saturated fat and some studies have linked having too many of them to obesity.

Eating fruit and veg doesn't just keep different gut populations in balance, though. Bacteria also process plant fibres into short-chain fatty acids, which regulate several processes in the body and keep the gut barrier healthy. A weak gut barrier can allow harmful bacterial products to enter the body, with potentially dangerous results. For example, metabolic endotoxemia – a disruption of the metabolism that can lead to conditions such as type 2 diabetes – may be triggered by changes in gut flora. As for probiotic yogurts, after a week they had little effect on my relative population numbers. My lesson? Keep eating my greens, but don't worry too much about the rest. ›

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