



THE HELPFUL ROLE OF GUT BACTERIA

Human Microbiome

Okay all of you germaphobes! This one is for you. This month's newsletter is about the human microbiome – all of the bacteria in our gut and the amazing things they do for us. It is my intent to help all the folks out there who are afraid of “germs” (bacteria) to see how important they are for our very survival. And for those of us on the other end of the spectrum, who are in awe of the importance of bacteria, I have included the actual names of different bacteria to deepen your understanding.

How about this fact for starters:

there are at least as many bacterial cells as there are our own cells in our bodies, and many researchers believe there are two to three times more bacterial cells than our own.

Imagine all of the places bacteria can live on us and in us, including the mouth, stomach, small and large intestines, nose, lungs, skin, vagina – you name it, they are everywhere! And thank

goodness, too, because now we are learning about all of the important functions that healthy bacteria do for us.

In recent years, scientists have learned that the bacterial balance in our gut – how many good, how many bad, and what species there are – has a role in diseases such as diabetes, heart disease, auto-immunity, and obesity.

Healthy bacteria help us to absorb certain nutrients, such as minerals, starches,

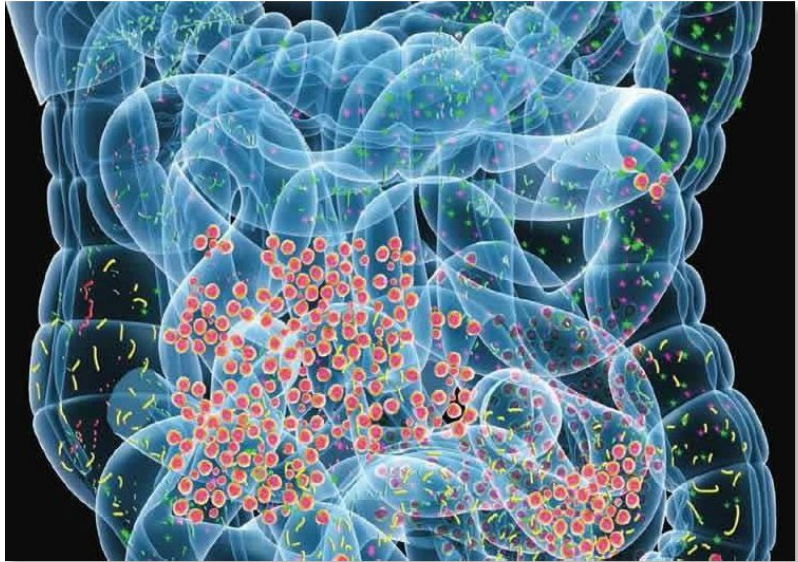
fibers, some fats, and sugars. They also make some nutrients that we need, including vitamins B3, B5, B6, B9, B12 and vitamin K2. Healthy bacteria even help us clear out toxins. As a matter of fact, bacteria DNA is more important for our very survival than our own DNA. All of this is according to the findings of the human microbiome project, which was completed in 2013. Just like the human genome project, which set about to decode our DNA and discover all of our genes, the human microbiome project (HMP) worked to uncover the DNA footprint of the bacteria that live within us and on us, and the roles they play for us.

It seems that the HMP was just a starting point for all of the information that we are learning about the human microbiome, and, just like the human genome project, we will be sorting out more and more layers of the interaction between man and bacteria for years to come.

This newsletter is designed to give you just a smattering of what we now know about the significant role that bacteria play in our health and in our lives.

Interestingly, at birth we are sterile. We are born

without bacteria in our intestines and elsewhere, and we pick up bacteria as we travel out of the birth canal. The first two years of life are crucial and can set the stage for health or illness. For example, if we live in the country or in the city, we pick up different microbes. If we are born vaginally or through cesarean section the composition of our microbiome will change.



Even more importantly, what we are fed, and what we eat every day of our lives, drastically affects the gut microbiome. If our diet consists of lots of fresh vegetables and fruits, we are more likely to have a healthy microbiome. On the other hand, if we eat junk food like chips and candy, our microbiome will consist of more bad bacteria. This is because whatever we munch on, our bacteria munch on as well.

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And then there is the question of really, who is hosting whom? The link between the gut and the brain has been clearly demonstrated, but did you know that if we have a lot of bad bacteria in our intestines, they actually send signals to the brain to

make us crave more bad food? And vice versa. If we have a lot of good bacteria we will crave more healthy food. It is as if the bacteria are controlling us, rather than the other way around.

It is amazing to me that our gut bacteria actually communicate with each other through a process known as quorum sensing. They release chemical signal molecules to tell each other important information such as if there are competing bacteria that they need to fight, if they should move to a new home, or settle where they are and build a biofilm, or even if the gut is under stress, life is hopeless, and they should all up and die (which they then do).

Why is a healthy microbiome so important?

Well, as I mentioned in my opening paragraph, bacteria have been implicated in a number of diseases. Remember that eighty percent of our immune system lies in our intestines.

Evolutionarily, we put a lot of the outside world into our gut, and the body had to have a good way of knowing if what was coming in was a stranger without danger or a stranger with danger. Every third cell that lines the intestinal wall is an immune cell, and these immune cells are constantly testing the milieu inside the gut to see what is going on. This gives you an idea of the extreme importance that the lining, or epithelium, of

the intestines has on the health of the body.

Here is where it gets really cool: Depending on the strains of bacteria in the gut, the immune cells of the body will be more sensitive or less sensitive to what is coming into the gut. You can imagine that if they are too sensitive, or too reactionary, these immune cells will constantly be sounding the alarm of the immune system, creating inflammation in the gut.

When the gut is inflamed, gaps open up between the epithelial cells that line the intestines, causing leaky gut. This allows the inflammation in the gut to spread throughout the body, thus contributing to disease.

Not only has leaky gut been linked to diseases of the intestines, such as irritable bowel, ulcers, inflammatory bowel disease, and celiac disease, it has also been linked to system diseases such as respiratory infections, depression, and autism. Leaky gut has also been linked to non-alcoholic fatty liver disease.

Certain strains of bacteria contribute to specific diseases.

The general microbial content of the intestines is not only important for healthy functioning of the immune system, but studies now support that certain strains of bacteria contribute to specific diseases. For example, higher levels of *Citrobacter*, *Klebsiella*, *Proteus*, and *P. Gingivalis* have been associated with a higher risk of rheumatoid arthritis.

Grave's and Hashimoto's diseases have been linked to higher levels of *Yersinia* and *Y. Pylori*. *Campylobacter* species has been linked to Guillain Barre Syndrome, while *S. Pyogenes* has been linked to rheumatic fever.

E.coli and *Proteus* have been linked to autoimmunity in general.

How about this one? Children with autism have higher levels of *Clostridium*, bad bacteria, and lower levels of *Bifidobacteria*, good bacteria. Or this one – two classes of bacteria have been linked to obesity – *Firmicutes* and *Bacteroidetes*. They actually have effects on the body to

increase fat storage.

Artificial sweeteners have been shown to increase the numbers of these two classes of bacteria in the gut.

Now here is the really fun part. Some poor researcher transplanted fecal bacteria from skinny mice into the colons of fat mice, and without any other change in diet, the fat mice became skinny! How's that for a weight loss program – fecal transplantation!

The list goes on and is not solely limited to bacteria in the intestines. Dentists have long known that periodontal disease leads to an increased risk for heart disease, but now we can actually name some of the bacteria behind this, including *Chryseomonas*, *Veillonella* and *Streptococcus*.

Scientists have also known for some time that *F. nucleatum* was linked to periodontal disease and to appendicitis, but more recent studies show that larger numbers of this bacteria have been linked with colon cancer. Now there is a solid motivation to brush and floss regularly!

Now that I have convinced every germaphobe that they are justified in their fear and hatred of bacteria by naming so many of the



problems bad bacteria can cause, let me balance the playing field a bit and talk more in depth about why we want to have lots of good bacteria cohabitating in and on our bodies.

Of course, healthy bacteria help with illnesses local to the gut.

Including infectious diarrhea, irritable bowel syndrome, and ulcerative colitis. There are several strains of both *Lactobacillus* and *Bifidobacterium* that help reduce infection with *E.coli* and *H. Pylori*, and improve markers associated with irritable bowel, ulcerative colitis, and even Crohn's disease. It is timely to know that *Bifidobacterium longum* has been shown to help with both the common cold and the flu. *Lactobacillus casei* has been shown to be helpful in reducing the risk of *Clostridium difficile* and other antibiotic-induced diarrhea.

It also makes sense that if there are bad bacteria that can cause heart disease, there must be healthy bacteria that can prevent it, and there are! Good old *Lactobacillus acidophilus*, the bacteria found in every cup of yogurt, has been

shown to improve good cholesterol, improve sugar control, improve markers associated with the metabolic syndrome (high cholesterol, high blood pressure, and high blood sugar), and to reduce the inflammation associated with heart disease. This is also true for *Lactobacillus paracasei* and *Lactobacillus reuteri*. As a matter of fact,



Lactobacillus reuteri helps to signal the liver to reduce production of cholesterol.

There are several strains of bacteria that have been shown to be effective in controlling a skin condition in children called atopic dermatitis. Basically, this is baby eczema. Perhaps the biggest of these is *Lactobacillus rhamnosis*.

What bacteria a mother has can greatly influence the health of her baby. For example, a strain of *Bifidobacterium lactis* has been associated with better birth weights in preterm children. Also, per studies done in the UK, the rates of ear infections and upper respiratory infections in babies and toddlers can be

significantly reduced by giving them Culturelle® as babies. Culturelle is not a fancy multi-strained probiotic. It contains only the simple, but powerful, probiotic *Lactobacillus rhamnosis*. How cool is that?

What I think is even cooler about probiotics and health is the effect they have on our mental well-being. Probiotics help us feel better in

several ways. Not only do they help us make important brain chemicals that help with mood, they also help to mitigate our stress response.

Remember our old friend cortisol?

Well, certain strains of bacteria help to reduce the cortisol response during stress. Another way that bacteria help the brain is to

help to reduce inflammation. Chronic inflammation has been shown to be linked to depression and cognitive disorders.

Since inflammation in the brain can start in the gut, some probiotics may exert their effects on the brain by reducing the inflammation in the gut.

All of this new information about how probiotics influence the brain has led to a new phrase to be coined, which is “psychobiotics” – probiotics that affect the brain. Psychobiotics have been shown to improve mood in both people with major depressive disorder and healthy individuals coping with stress.

In one study, patients with major depressive disorder were either given a probiotic pill that was a combination of *Lactobacillus casei*, *Lactobacillus acidophilus*, and *Bifidobacterium bifidum*. After eight weeks, the patients on the probiotic had significantly higher scores on the Beck Depression Inventory, a tool

used to test severe depression.

In a study of healthy volunteers, a probiotic containing *Lactobacillus helveticus* and *Bifidobacterium longum* showed lower rates of psychological stress, anxiety, depression, hostility, and improved problem-solving ability after just thirty days.

Many different probiotics help with stress and anxiety because they help to make healthy neurotransmitters. Our old friend *Lactobacillus rhamnosis* helps to make the neurotransmitter GABA, which helps us feel like everything is okay in life. *Lactobacillus plantarum* helps to make dopamine

and serotonin, so it helps with focus, motivation, drive, and feelings of joy. *Lactobacillus helveticus* was shown to be more effective than the

common antidepressant, citalopram, in reducing stress-induced anxiety, depression and cognitive changes in rats and other animals.

I don't think I need to wait for the study in humans to

know that I am going to give something that is so safe and potentially so effective a try the next time I am feeling stressed!

What can we do to improve the balance of gut bacteria and lead healthier, fuller lives? Hopefully, I have

convinced you of the important role of healthy bacteria in our bodies. While our healthy gut bacteria are under assault from toxins and pesticides, we can make a huge impact on our gut bacteria with our diet and with destressing.

As I have stated above, diets high in fiber, fresh fruits, and vegetables, and low in sugars and process food help to fuel our healthy bacteria. Remember our healthy bacteria eat what we eat, so like any creature we care about, we should feed them (and ourselves) good food.

When we eat fermented foods, we are not only supporting our healthy bacteria, but we are actually taking in probiotics in our diet. Fermented foods include yogurt, kefir, kombucha, and kimchi, sauerkraut, pickles, miso,

Isn't it interesting that the very bacteria that help us with stress are killed themselves when our stress goes on for too long?

tempeh, and natto, to name a few.

My favorite fermented foods are chocolate, wine, and sourdough bread, but I am sure they are probably not as good for my gut as some of the others on the list! Not only do fermented foods contain bacterial colonies to populate the gut, they help to create an environment that supports the growth of healthy bacteria by increasing the acidity in the intestines. Healthy bacteria thrive in a more acidic environment.

Fermented foods increase the production of digestive enzymes, and even help the pancreas function better, which can help people with diabetes. They also produce compounds that help to fight off bad bacteria.

It has been so extremely interesting to me over the past several years to see the

effects of stress on bacteria in lab work. In New York State, I am limited as to the degree of testing of bacteria that I can get, but at my disposal is at least a stool test for the DNA of good bacteria including Lactobacillus, Bifidobacterium, and healthy E.coli, and various strains of bad bacteria.

What I see, not uncommonly, is that Lactobacillus will be low, but Bifidobacterium and E.coli will be at reasonably good levels. This is a classic stress pattern!

Given all that they do for us, it is imperative that we take good care of our healthy bacteria. Meditation, rest, and taking time to “smell the roses” are now helpful on an even deeper level. We are not in charge of our own lives, we are also in charge of the lives of our billions of healthy bacteria.

Aside from diet and stress-reduction, I am still convinced that it is important to take a daily probiotic. This will be different for each person. While the science is there, we are not quite to the point clinically where we can fully test a patient’s microbiome, figure out what they are missing and add it back in a custom probiotic.

So, for now, it is a little bit of trial and error. Try different probiotics and see if one makes you feel enormously better than another. The effects of probiotics that you can discern quickly include would include reducing bloating, improvement constipation and improving mood.

Not all probiotics need to be refrigerated. Some probiotics are made from soil-based bacteria, which are overall heartier critters and have a long shelf-life outside of the refrigerator.

While I realize that I will not convince everyone, I hope that I have helped a few of you germaphobes rethink the role that bacteria play in our lives. For the rest of you, eat well, rest well, take a probiotic, and you will be well.

