What is the most disgusting substance you can imagine? Most of us would say that human feces has to rank right at the top of any list. But life is filled with ironies. Human feces is emerging as a potential treatment for ankylosing spondylitis. Let me explain why.

Ankylosing spondylitis is a disease in which our immune system plays a critical role. Our immune system has many components and many checks and balances. The heart and soul of the immune system is the white blood cell or leukocyte. One type of white cell, the lymphocyte, plays a very prominent role in immune-mediated diseases like ankylosing spondylitis. We know that the immune system is vital in this disease because of studies on pathology in joint tissue, because of studies with laboratory animals, and perhaps most of all, because therapies that are beneficial for ankylosing spondylitis work by affecting some aspect of the immune response.

Our immune system evolved to protect us from the danger that lurks with invading micro-organisms such as bacteria or viruses. The immune system is so vital to life that even plants and bacteria have evolved clever ways to defend themselves with an immune response.

But the immune system must be selective in its approach. If the immune system attacked all bacteria, the body would be destroyed. For example, bacteria live on your skin, in your mouth, and throughout your digestive system. In fact, you have ten bacteria living in your intestines for every mammalian cell in your body. From this perspective, ninety percent of every living being is bacteria! If our immune system deployed its weapons to destroy the bacteria that happily co-exist with us, wide-spread inflammation would result wherever bacteria are present. In fact, this is the currently accepted theory as to what causes Crohn’s disease and ulcerative colitis, the two most common forms of inflammatory bowel disease. Our immune system attacks some of the bacteria in our intestines, resulting in diarrhea and abdominal pain.

Bacteria need to find a public relations firm to represent them. Most of us hear “bacteria” and we think of infections and the harm, even death that can result from many different bacterial infections. But bacteria are also essential for life. For example, much of the vitamin K produced within our body is made directly by bacteria. One of the most essential roles for bacteria is to educate the immune system. Mice can be raised “germ free” so that no bacteria ever live within the gut. In these germ free mice, an effective immune system never develops. While it’s absolutely true that bacteria can do harm, it’s also true that bacteria are essential for life.

So how does this relate to ankylosing spondylitis? Well, first of all, ankylosing spondylitis and inflammatory bowel disease have a lot in common. In ankylosing spondylitis, the majority of sufferers have microscopic amounts of bowel inflammation that can be detected by colonoscopy. And conversely, in inflammatory bowel disease, some patients develop arthritis in the spine and elsewhere as is characteristic of ankylosing spondylitis. Inflammation inside the eye or uveitis also occurs in both inflammatory bowel disease and ankylosing spondylitis.
Last year, my colleagues and I reported on the gut bacteria in rats that have the human HLA B27 gene, the gene that readers of Spondylitis Plus will recognize as the one that most affects the likelihood to develop ankylosing spondylitis. Our observations appeared in the journal, PLoS One. (PLoS stands for the Public Library of Science. The journal is available for free on the internet.) We found that the bacteria in the rat intestine were altered just by being HLA B27 positive. In March, 2015 scientists from Australia and Italy reported in the journal, Arthritis and Rheumatology, that bacteria in the intestine are also altered in patients with ankylosing spondylitis.

Of course, it’s possible that these changes in bacteria have nothing to do with what is causing ankylosing spondylitis. Except that there are models in rats and in mice in which an illness that resembles ankylosing spondylitis can be induced. And in both the rats and the mice, elimination of the bacteria pretty much eliminates the joint and bowel disease.

The crudest way to change your gut bacteria would be through a technique now known as FMT, fecal microbiota transplant. While the idea of ingesting someone else’s bowel movement sounds absolutely disgusting, in 2013 a study in the New England Journal of Medicine showed that FMT could be life saving for a bacterial infection known as C diff colitis. One does not actually ingest poop. Instead the bacteria from the bowel movement are isolated and then swallowed as a capsule or passed directly into the stomach through a tube, or given rectally as an enema. This same approach has been used to treat inflammatory bowel disease, and while it is not universally effective, the results are encouraging.

A more elegant and more appealing approach to fecal transplant would be replacing or changing just a single type of bacteria, as is attempted with a probiotic. The complexity of the bacterial ecosystem in the gut with nearly 100 trillion inhabitants makes it difficult to find a single or limited number of culprits that cause ankylosing spondylitis, but this is a possibility. The progress in this area of research is very encouraging.

Gut bacteria are also very much affected by diet since what we ingest provides the substrate for bacteria to live. Diet is as complicated as the bacterial ecosystem in the gut. We are still learning which foods might have an anti-inflammatory effect. Antibiotics also change the gut microbiota, but this effect is temporary because bacteria quickly develop resistance.

Bacteria produce a number of chemical products that affect the health of our intestines. One of these chemicals, for example, is propionic acid. A change in the microbiome would result in changes in the chemical balance within the gut. Possibly this chemical balance could be restored without actually changing the bacteria. One strategy might be to simply drink propionic acid. A number of laboratories have recently reported exciting data in laboratory animals suggesting that propionic acid or other so called short chain fatty acids could be used to improve the health of the bowel. And while we do not know this for sure, I think that it is very likely that a healthier bowel would be an effective treatment for ankylosing spondylitis. The benefit from sulfasalazine for some patients may come from this basis.

The microbiome is a term that is used to describe all the micro-organisms and their products associated with the human body. Intense study of the microbiome has been undertaken for less than a decade. The coming decade should help us discover more specific microbial changes associated with ankylosing spondylitis. We will also gain more knowledge about how diet affects the microbiome and we will develop ways to restore the health of the bowel, sometimes by replacing or eliminating specific bacteria and sometimes by replacing or eliminating the products that bacteria make or induce within the intestine. In the meantime, FMT, the transplantation of bacteria from feces, is being actively studied to treat inflammatory bowel disease. My colleagues and I hope that by 2016, we will be allowed by the FDA and ethics committees to try the same strategy in a limited number of patients with ankylosing spondylitis.

I have been studying ankylosing spondylitis for 37 years. Until recently, no one could have convinced me that feces might just be the key to understanding this disease.