

## Microbiota Our Friendly Neighbors Within

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Sometimes even Christians can struggle to see the connection between biblical teachings and the world around us. For example, most Christians know that the doctrine of the Trinity is considered an important foundational teaching of the Church. Fewer Christians recognize that this truth implies that God, by his very nature, is relational.<sup>1</sup>

Since God is relational, it makes sense that people, who were created in God's image, were created to have relationships. The Bible emphasizes many different relationships, including our relationship to God and our relationships with one another. It goes beyond this too. The fact that God is, by nature, relational is reflected throughout all of creation, even down to the microscopic world.

### Louis Pasteur and the Discovery of Pathogens

Louis Pasteur was a gifted scientist who demonstrated that certain microscopic organisms (microbes) were able to cause disease.<sup>2</sup> As he and other scientists continued investigating, more and more diseases were found to be caused by microbes, especially bacteria. This resulted in bacteria having a very negative public image.

My grandmother, who was born in 1901 and was trained as a nurse, had the opinion that the only good bacterium was a dead bacterium. My grandmother was diligent to use plenty of bleach to kill any nasty microbes. While our family lived with her, I developed pneumonia. Many years later I found out that when I get pneumonia, it is the result of a strong allergic reaction. One of the things I found I am allergic to is bleach.<sup>3</sup> My grandmother had certainly meant well, and fortunately I survived. The experience was a good reminder that there is always more to learn.

The existence of pathogens (disease-causing microbes) is not difficult to explain within the biblical worldview. When God created the world, everything was very good (Genesis 1:31). Just as the triune God has always existed in loving harmony with Himself, so His creation was in harmony.

At that time there were no pathogens. Yet people were given a choice and they chose to disobey God. Sin entered the world, and with it broken relationships, pain, and death (Genesis 3).<sup>4</sup> This understanding has helped creation scientists investigate why some bacteria can become pathogenic.<sup>5</sup>

If all microbes caused disease, it would be more difficult to explain their existence within a biblical worldview. Despite the bad reputation, few microbes cause disease. For example, there are more than 2,000 known species of bacteria that occur on or within humans, mostly in the digestive tract, as commensals. This means that these bacteria benefit us while we give them a place to live. In contrast, only about 100 species of bacteria are known to cause disease in humans if their numbers get out of control.<sup>6</sup> So, in reality, harmonious relationships between humans and microbes are the rule, not the exception. While microbes are important in many areas for life, we will focus here on microbes that live in the digestive systems of humans and animals.<sup>7,8</sup>

### Microbiota

Microbiota refers to the normal microbes living within the digestive systems of humans and animals. Most of these microbes are bacteria, but protozoans, fungi, and viruses can be part of the microbiota.<sup>9</sup> These microbes are very important for maintaining the health of the host. In fact, the digestive system is designed to monitor the microbes within. Through complex biochemical interactions, there is actual communication between the gut lining and the microbiota to establish a healthy equilibrium. If there is a problem in this monitoring system, disease can result. For example, there are receptors that are normally found on the surface of the cells that line the digestive system that are involved in communication with the microbiota. A mutation affecting one receptor of this monitoring system is associated with Crohn's disease.<sup>10</sup>

Microbiota perform many important tasks for us: They help us digest our food. For example, people are not very good at digesting some starches; so, bacteria help us out with this. They can also break down chemicals that do not belong in our bodies, which protects us from the toxic effect of those chemicals. They help keep unhealthy pathogens in check so they do not harm us. They make certain vitamins for us. Microbiota are important for

the proper development and function of the digestive and immune systems. Rodents that were raised with no exposure to microbes not only have digestive and immune abnormalities, but also an exaggerated stress response and difficulty learning.<sup>11</sup>

Not all animals have the same microbes in their digestive systems. I was reminded of this while I was a veterinary student. Someone had dropped off a baby groundhog at the veterinary hospital. Since it had no owner, it was given to a vet student so she could care for it. As that vet student, I noticed the little guy seemed to be “dragging” and not doing very well. I thought some antibiotics might be helpful. I vaguely remembered a lecture that had discussed that certain antibiotics were not suitable for certain small mammals, but I couldn’t remember the details. I asked another student about it. That student thought it would be fine to give the groundhog penicillin. Assuming that student knew what he was talking about, I gave the little guy a dose appropriate for his body weight.

The groundhog, like other rodents, has primarily gram-positive bacteria in its microbiota.<sup>12</sup> Penicillin targets primarily gram-positive bacteria. I had meant well, but, unfortunately for the little groundhog, the penicillin killed his gut microbiota and he did not survive. At least I had not made that mistake on someone’s pet hamster.

### **Cows Eat Grass; Microbiota Digest It**

Grasses, leaves, and other fibrous plant materials are difficult to digest. This is because they contain cellulose and other compounds<sup>13</sup> in the plant cell wall that no animal can break down by itself. Some animals have a specialized digestive tract and special microbiota so they can regularly eat these types of food.

Cattle and other ruminants<sup>14</sup> have a large stomach divided into four chambers. When cattle swallow grass, it goes into the largest chamber. Later, it can be brought back up and re-chewed. This makes the pieces smaller, giving the bacteria more surface area to work on. Eventually, the food moves its way through the rest of the digestive tract.

I had one nutrition teacher in college who said, “You don’t really feed the cow, you feed the bacteria inside the cow. If you keep the bacteria happy, the cow will be happy.”

One thing that can create a problem is a sudden change in diet. For example, cattle are sometimes fed grain. If too much grain is introduced too suddenly, the cow may get sick and not want to eat at all. The sudden change disturbs the balance in the microbiotic community. A different makeup of microbiota and different conditions in the stomach are associated with digesting grain.<sup>15</sup> Slowly introducing grain allows the microbiotic community time to adjust to these new conditions gradually so the cow won’t suffer.

In addition to ruminants, other animals can eat foods high in cellulose. Some are called foregut fermenters because they have a front portion of the stomach where microbes digest the cellulose. Foregut fermenters include camelids,<sup>16</sup> sloths, hippopotami, and kangaroos.<sup>17</sup> Other animals, such as horses, elephants, koalas, and rabbits, are hindgut fermenters. In these animals bacteria in the colon and cecum, which come after the stomach, digest the cellulose. It is amazing to see all the variety God has placed within his creatures. There are different microbes available to help each animal to digest the food it needs to survive.

### **Conclusions**

It is important to realize that the world God created is consistent with what we know from the Bible. The biblical worldview gives a reason for why relationships are so important in the world around us: a triune God, who is inherently relational, created a world that reflects Himself. It also gives us a reason why these relationships are sometimes harmful: sin has brought broken relationships and death into this world. While evolutionists recognize that relationships are important and often interpret their findings within their worldview, they have no logical basis for why this phenomenon should exist.<sup>18</sup>

It is also important not to rush to sweeping conclusions in areas where new scientific discoveries are being made. Those who believed that all bacteria were harmful had a biased, inaccurate view of bacteria. When people rush to conclusions that some things are useless (for example, vestigial organs, pseudogenes, other “junk” DNA) or always harmful (for example, viruses, mutations), they are likely to be wrong. While the evidence of brokenness from sin may be what is initially most obvious, a deeper look may reveal incredible design that can only be attributed to an all-wise Creator.<sup>19</sup>

### **Footnotes**

1. Bird, M., 2008. The Trinity. *Answers in Depth* 3:67–70.
2. Gillen, A.L. and F.J. Sherwin, 2008. Louis Pasteur’s views on creation, evolution, and the genesis of germs. *Answers Research Journal* 1: 43–52.

3. In college I had blood work done when I got pneumonia and that doctor was surprised by my high eosinophil count, an indication of an allergic reaction. If I am placed in the same room as someone who is smoking (for more than just a few minutes) I will always develop pneumonia. I had pneumonia numerous times when I was younger. Now that I am aware of what causes it (that is, an allergic reaction wipes out my natural resistance), I have been able to avoid the problem.
4. Sin broke our relationship with God. Adam and Eve tried to hide from God (Genesis 3:8). We all need a Savior because we too have sinned (Romans 3:10–12, 23). Sin harms relationships between people (Genesis 3:16b; James 4:1–3) and between people and nature (Genesis 3:17–19). In fact, all nature is described as groaning (Romans 8:20–22), since it is no longer in complete harmony as it was at Creation.
5. For more, see  
Gillen, A.L., 2009. The genesis of methicillin-resistant *Staphylococcus aureus*. *Answers in Depth* 4:66–72.
6. Neish, A.S., 2009. Microbes in gastrointestinal health and disease. *Gastroenterology* 136(1):65–80.
7. Francis, J., 2008. The matrix: Life's support system. *Answers* 3:42–43, 52–54.
8. Francis, J., 2009. The organosubstrate of life. *Answers in Depth* 4:18–28.
9. Collins, S.M. and P. Bercik, 2009. The relationship between intestinal microbiota and the central nervous system in normal gastrointestinal function and disease. *Gastroenterology* 136(6):2003–2014.
10. Neish, Ref. 6.
11. Collins and Bercik, Ref. 9.
12. Humans and most other mammals have primarily gram-negative bacteria in their microbiota. For rodents, antibiotics that target different types of bacteria are generally used, such as trimethoprim and sulfas.
13. Hemicellulose and lignin.
14. Such as deer, sheep, and goats.
15. Russell, J.B., R. E. Muck, and P.J. Weimer, 2009. Quantitative analysis of cellulose degradation and growth of cellulolytic bacteria in the rumen. *FEMS Microbiology Ecology* 67(2):183–197.
16. That is, camels, llamas, alpacas, and others in this kind.
17. Clauss, M., A. Schwarm, S. Ortman, D. Alber, E.J. Flach, R. Kühne, J. Hummel, W.J. Streich, and H. Hofer, 2004. Intake, ingesta retention, particle size distribution and digestibility in the hippopotamidae. *Comparative Biochemistry and Physiology A: Molecular & Integrative Physiology* 139(4):449–459.
18. Neish, Ref. 6. This author claims understanding symbiosis from an evolutionary standpoint is helpful. He gives no reason why a very individualistic world wouldn't be expected, since communication is highly complex. He gives no explanation why parasites are not more common, since it fits better with Darwin's idea of "struggle of the fittest." It is true that change over time is seen. For example, the composition of microbiota can change with diet. Also, gene expression can be adjusted so microbes can live in the host (involving complex communication). This suggests awesome design consistent with a triune Creator who can communicate. It does nothing to suggest common ancestry of all life.
19. The problem we have of resistance developing in bacteria (to antibiotics) or other pests (to various pesticides) is possibly from mechanisms that enable life to continue to reproduce and fill the earth (Genesis 1: 21–22; 8:15–17). Researchers have noted that mutations appear to be more common in genes affecting how an organism interacts with its environment. Given the importance of communication and relationship in biology, these mechanisms may be essential for adaptation in this world. This is an area of fruitful research that should be of interest to creation biologists. For more, see  
Anderson, K.L. and G. Purdom, 2009. Analysis of Barry Hall's research of the *E. coli ebg* Operon. *Answers in Depth* 4:43–59.