

## **A Horror Story**

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Once upon a time there was a microbe that lived on the skin of humans. Its favorite place to reside was in the warm, humid environment of the nostrils, an environment that it shared with many other microbes of other species. The microbe of which I speak would have liked to have multiplied in number so that it could have this warm, cozy place all to itself, but the other microbes had the same idea, so they all coexisted in an uneasy equilibrium. This arrangement suited them all, because they each had their fair share of space, but, if one microbe moved just a little bit, there followed a melee of jostling to claim the empty territory. Jabbing and elbowing at each other kept them all on guard and gave none an advantage. No microbe dared sleep lest other microbes push him out of the way to claim his space. And so they remained alert, and it kept them busy and tired them, but it was the best they could do.

This constant competition for advantage made all these microbes opportunistic. Should there be a new territory, or a weakened competitor microbe, or a change in the environment more to the liking of one microbe compared to the others, and “Shazam!” that microbe would transform quickly into Capt. Marvel microbe and would take over the joint. In most cases, the human who supplied the nose would never notice. At worst he would sniffle a little more than normal until the balance was restored.

On occasion, however, one of the more dangerous and aggressive microbes would find itself with a rare chance to have some fun. It may have been a cut or skin abrasion, or it may have been a weakened human immune system. Whatever it was, this particular

microbe, with its skills sharpened by constant microbial competition over the years, would go crazy. It would grow and multiply in numbers until there were so many they were beyond counting. They were all family and they were all intent on making the most of the situation.

If you get a whole bunch of brothers and sisters working together, then they can do marvelous things. What these microbes could do would be to control their own environment; baking, and making, and staking their collective claim to this new space. Each helped the others, and soon they could become unstoppable. Of course, this did no good for the human upon which they were growing.

So other humans stepped in. Humans are a proud people, and they do not like to admit defeat to a bunch of lowly microbes, no matter how well organized the microbes are. These other humans spied on microbes originally in competition with the deadly microbes and learned their secrets. They learned that one tactic the competitive microbes used was chemical warfare: they produced biochemicals that could kill microbes on contact.

It didn't take these other humans long before they duplicated these chemicals, and they patented them, and they called them "antibiotics." If the competitive microbes had known all this, they would have objected to human use of their innovations and hired lawyers to argue their cases. But, as luck would have it, lawyers don't listen to microbes, especially ones in their noses who can't afford retainers.

So, these other humans used these antibiotics against the runaway deadly microbes. Yikes! They were very effective. They killed every microbe in sight—the deadly ones as well as all others. The crisis was over and life went back to normal.

But wait! Lurking in a far corner somewhere was a sinister deadly microbe who had somehow avoided deadly contact with the antibiotic. He survived, and he vowed to get even. So, he went to his lab and cooked up a potion. In his mind was a vision of all his brothers and sisters who had been caught unawares by the antibiotic attack and had succumbed to the deadly chemical onslaught. This thought gave him the will to find the antidote.

If the antibiotic strategy was the only weapon used by the competitive microbes, then they would not have been very competitive at all. There were many such tactics used and they were very successful because they acted as one-two-three punches. One would not be very effective but three might knock out a neighbor microbe.

Unfortunately, the humans did not appreciate this fact, and so relied exclusively on this one chemical punch. And, for a while, this punch continued to be an effective weapon for humans against microbes not to their liking. All too soon, however, the microbes found out how to thwart human intentions. Some developed tougher skins; others changed their habits of hanging out together; still others put on rain coats to keep the deadly biochemicals at bay.

And, when this happened, the humans noticed, and sought other poisons deadly to microbes. The pattern repeated itself over and over: poison discovered, poison used, poison effective for a while, and poison overcome by the microbes.

Eventually, the microbes developed the skills to play this game very well, and considered it to be a challenge to test their mettle. They became so good at it that, for each and every new poison discovered by humans, it took the microbes less and less time to deal with it.

Fortunately, most of the microbes inhabiting the warm, cozy recesses of humans were not particularly dangerous, and so did not draw attention to themselves. When they overcame the challenges thrust upon them by their human hosts, they merely played among themselves or caused a few sniffles, or maybe even produced a few extra vitamins for their human. They were hardly noticed at all by the human.

There were, however, some microbes that liked to cause trouble. When just children, they played malicious pranks, and one prank led to another until they joined gangs and fought with each other and with their neighbors. They painted graffiti on their tenement walls and damaged anything that looked good. They littered in all the open spaces, for they cared not for order and cleanliness. They disdained authority. What they didn't destroy, they stole, and sold for cash. They learned how to make drugs and to use them in bad ways. These were *bad* microbes, and humans soon became aware of their ill natures, and the dangers they posed to the human sense of order and health.

When humans tried to subdue these bad microbes with their antibiotic poisons, they found that they were no longer effective. There was hardly anything that humans could do to beat back these ruffians, and the humans began to be afraid. Some humans even panicked, and cried, and threw up their hands and sought help from the authorities. The newspapers and TV and radio began to call these "flesh-eating microbes," and this caused even more hysteria among the humans who envisioned painful and horrible images of their flesh dropping away upon the ground while the microbes laughed at the expense of their human hosts.

The humans had one more devastating weapon in their arsenal. This was a doomsday weapon developed for the ultimate purpose of destroying all life should the

need ever arise. These substances the humans called “disinfectants,” and no creature had ever survived being doused with a disinfectant.

So, authoritative humans suggested that disinfectants be used to destroy all the bad microbes in places where they lived. They called for disinfecting hospitals, and locker rooms, and homes wherever these flesh-eating microbes were likely to live.

And so the people were relieved. Disinfection would save the day; disinfection would solve the problem. They relaxed.

But there were two lessons that humans still had not learned. First, microbes and all life is resilient, and when a single weapon is pointed at them, they can duck and avoid being shot. Disinfectants had been used for many years by humans in their homes, in their soaps, in their toilet-bowl cleaners, in their refrigerators, in their deodorants, and in their mouthwashes. The obsessions that people had with cleanliness threatened to make disinfectants just as ineffective as antibiotics. Overuse leads to uselessness. Any microbes not killed by a disinfectant could come back and show the rest how to survive the attack. Any microbe not killed by a disinfectant would find fertile ground not occupied by any other living thing upon which to grow and reproduce.

The second lesson not learned is that these battles against horrible microbes are not waged alone. Humans have always had help from the natives—other microbes that also want to overcome the bad bugs. There has always been a civil war among microbes, and humans have chosen sides based upon the effects these microbes have upon humans. Using disinfectants knocks out human allies as well as human enemies. And so, it is hard to see anything but a temporary victory for humans if they haven’t learned these two lessons.

There is no absolute level of safety in the world of biology. There will always be disease and death, because this is how competition works. While humans can move the balance toward their favor, they can't escape the fact that they are still biological creatures subject to many of the same rules and limitations governing all others. And that may be the biggest lesson still to be learned.