HUMANS AND THEIR DANCE WITH MICROBES THROUGHOUT HISTORY

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We have many beneficial symbiotic microbes all over on and in our bodies, but occasionally some bad actors become parasitic, that is, using our bodies for food and causing harm in one way or another, depleting nutrients, causing disease, or resulting in death. It is not in their advantage to cause disability or death of the host that feeds them, but sometimes their plans go awry, resulting in major harm to the host. Then we enter the realm of "infectious disease." I am reporting on a book by Paul Ewald, Plague Time, regarding the evolution of pathogenic microbes and their drama with humans. Before that, I will review the story of medical treatments and microbes in our civilization.

Our understanding of microbes has an illustrious history. Before the germ theory arrived, many infectious diseases were thought to be caused by many factors, such as "humors" in Western medical traditions. In Chinese Traditional Medicine and in Ayurveda the balances and imbalances of many factors affect overall health and therefore resistance to infections. Western medicine in medieval times was fairly crude in comparison. Then with Antonie van Leeuwenhoek's microscope used to observe the little "animalcules," and with Louis Pasteur's sterilization and "pasteurization," the germ theory developed, attributing infectious disease to these microbes. Infectious disease was the major cause of death at that time. Long before Pasteur, Dr. Ignaz Semmelweis in 1818 had showed that if physicians washed their hands, they could dramatically reduce deaths from "child bed fever." Of course, as usually is the case, he was ostracized by the medical profession for introducing a new theory, especially *because* it was *successful*.

Then with the development of sulfonamides in the 1830's and the widespread use of penicillin in the 1940's, and the dramatically successful treatment of life-threatening infections, the germ theory became mainstream, and people were thought to be hapless victims of dangerous microbes lurking to pounce at any time. The pendulum had swung to germ phobia, ignoring the many other factors that contributed to a healthy or unhealthy immune system, such as nutrition and other lifestyle factors and herbs, making up the "terrain" upon which the microbes chose to enter. This has resulted in excessive cleanliness and use of disinfectants, neglect of natural medicines, overuse of antibiotics, and antibiotic resistance.

Since then we have discovered many beneficial or neutral bacteria and virii in many parts of the body, mostly in the gut, skin, mouth, and respiratory tract, but also in small numbers in other parts of the body formerly considered to be sterile, including the blood and the brain. We also have some "endogenous" retrovirii, RNA virii that help our own genetic development and management of our DNA. So we have come to realize that microbes are a natural part of our bodies and external environment. Even Louis Pasteur at the end of his life, after debating with Antoine Bechamp, contending that what was most important was the microbe, not the terrain, at last admitted, "Bechamp was right. The terrain is everything, not the microbe."

Our immune system is an "elegant defense," to quote Matt Richtel, who wrote a book by that name, describing it as a cross between a ballet dancer and a bouncer. Some others have described the immune system with the metaphor of a team of attorneys deciding what belongs where. This amazing immune system helps to keep microbes where they belong, sometimes inside the body but fenced off from the more delicate systems and tissues, and for some not allowing them entry at all. The balance of many health factors can support a healthy immune system or not. Much of the public recommendations for preventing Covid neglect talking about helping the body's terrain to protect a healthy immune system.

Things like sleep, stress management, confronting addictions, good nutrition, clean food, water, and air, exercise, avoiding sugar and alcohol, etc., all are important to protect against pathogenic virii.

Paul Ewald, an evolutionary biologist, writes about the complex relationship that humans and other animals have with microbes in his book, Plague Time. The title is not meant to alarm people, but he discusses how we can affect the evolution of microbes for their benign or pathogenic development and contagion by our behaviors and what we do to the microbes. He discusses acute infections as well as chronic ones, and the possibility of stealth pathogens that may be living in the body for decades and may contribute to chronic disease such as cardiovascular disease, cancer, and other chronic inflammatory conditions. Much of the latter cannot be proven by Koch's postulates the gold standard of proof of microbes causing disease, but then again, it would be unethical to do such human experimentation to deliberately introduce infection to prove a point. Many of the highly significant correlations of microbes with these chronic conditions are remarkable and deserve attention and study. Many of the accepted microbial causes for gastric ulcer, liver cancer, cervical cancer, AIDS, Burkitt's lymphoma, adult T-cell leukemia, Kaposi's sarcoma, etc. have been decided by correlation, not by Koch's postulates.

To understand infectious disease, it is necessary to know molecular biology (the hardware, if you will) and also the evolutionary biology (the software) that governs microbial behavior. This discussion may seem a little wonky, but it helps to study this to understand the outcomes of microbes' behavior. Evolution determines the survival, not only of the whole species, but of the individual actors within that species. Sometimes natural selection's effect on short term survival differs from that for long term survival. Multiplying rapidly and being highly contagious helps the short term survival of the microbe and propagation of the species. Multiplying more slowly and causing less severe acute illness allows it to survive longer in the host. Since microbes multiply so rapidly, evolutionary changes can happen quickly, and it is important for us to understand these dynamics when we want to prevent or reduce the contagion or lethality of a disease.

The germs do not consciously plan strategies, but natural selection directs the pathogens as if they were cleverly doing strategic planning. If they by chance get a behavioral mutation that helps their survival, then of course, that is the behavior that persists. The microbes need to do two things to survive: 1. To use the host (you or me or an animal) for food. 2. To spread from that host to other hosts (because they cannot survive outside a host, and they always need new hosts). If they cause too much harm from # 1 as to cause the death or disability of the host, they have less opportunity to spread to other hosts, and they can't live on a dead host. That doesn't help their reproductive capabilities and propagation of their species. That is why a more deadly virus doesn't usually cause a pandemic and is usually replaced by other more successful virii. Those are the ones that cause just enough symptoms like coughing and sneezing to transmit itself to other hosts, the domino effect, but not cause too much disability and immobility, so people can move about and spread it to other hosts. So the germs do not have an "evil intent" to cause illness, but minor sickness of the host is sometimes just "the cost of doing business."

The SARS Cov-2 virus has so recently jumped species that it has not yet mastered human hosts' dynamics, and people's immune systems are also not so adept at handling a new virus, that the organism is killing too many people now and triggers peoples' danger responses with masks and distancing. (Likewise those who do take precautions are the people and groups that are more likely to survive.) When people don't follow those precautions, it allows the more deadly strains to persist, because of ease of transmission of deadly or non deadly strains. With time, virii that jump species usually become milder because eventually the milder mutated variants allow people to congregate more

safely and freely and to spread those strains, and then the milder virus becomes the predominant ones. Also mutations that give more contagion also become the more prominent ones, as we have seen with SARS Cov-2. Most pathogens that jump species tend to be benign, but occasionally one like ebola is deadly. SARS Cov-2 is somewhere in between. Ebola came from spiders, causing no problem to spiders because the two have lived together for probably millions of years. Since ebola jumped to humans, whose immune systems know nothing about ebola, and since ebola does not know how to live with humans amicably, the combination is deadly, but it is not likely to cause a pandemic because it is not spread by respiratory droplets and sprays. The flu of 1918, H1N1, developed a mutation that was more deadly *and* contagious, probably due to unusual circumstances in the war, with transmission of the bug among immobilized soldiers in foxholes and subsequent massive migration of those soldiers after the war. That deadly pandemic probably will not be repeated because of different human environmental circumstances. This is an example of how human behaviors and circumstances affect the evolution of the virii.

Now for other virii that jump from animals to humans, who knows what is next? Dr. Ralph Baric, PhD, at University of N. Carolina Dept. of Epidemiology, has studied corona virii for over 30 years, and notes that there have been 3 new corona virii affecting humans in the last 21 years, and 3 new emerging corona virii in swine in the 21st century. He warns that this will continue to be in our future to have new virii coming from animals to humans. Human population explosion and invading animals' natural habitats, destruction of natural habitats and less biodiversity of animals available, creating pressure to jump species, making pets of wild animals, butchering wild animals for sale, in general more exposure of animal-human contact, makes it more likely that there will be more virii that will jump from animals to humans. If they are contagious enough to cause mild illness in many and severe illness in some, as with SARS Cov-2, there could be more serious pandemics on the horizon. I note that the medical system deals with pandemics and epidemics in piecemeal fashion, quickly looking for a drug with to treat it, scrambling to make a vaccine. If we studied antiviral herbs, grew the herbs and stocked up on them, they would likely be effective, since they work on many different virii. Also, we could stop invading and destroying animals' natural habitats so much.

For vector borne illnesses like malaria, yellow fever, and dengue, these can be more deadly and/or disabling because a very sick, disabled, non-ambulatory person can still transmit the disease by being bitten by a mosquito. So the best way to prevent the spread of malaria is to use netting to prevent the sick person from being bitten. The common practice is to give every healthy person a mosquito net or to reduce the number of mosquitoes, but the most effective way to possible eliminate malaria altogether would be to make certain that every person with malaria would be prevented from getting bitten. Without a human host, the malaria could not survive. The malaria that non-human primates get are several species which are different from the ones that cause human malaria.

Water-borne diarrheal diseases can also be deadly, because an immobile host can still pass it on through fecal contamination of water. Thus cholera, typhoid, and dysentery can be deadly. A diarrheal disease that is not so easily passed on and requires the mobility of the person to aid the transmission, will be selected naturally to cause less severe disease, so that the mobile host can spread it.

Hospital acquired infections are increasingly becoming antibiotic resistant, and many are termed "super bugs." Infections within hospitals that are antibiotic-resistant are no more deadly than antibiotic sensitive ones, providing there is an antibiotic or herb that works. Infections that regularly circulate in hospitals though, are more deadly, whether antibiotic-sensitive or not. I would presume that this is because the infection that brought the patient to the hospital was more lethal than an infection that was mild enough to be cured outside the hospital. It would also make sense that bacteria that are easily

spread from host to host quickly in the hospital has the evolutionary advantage of contagion, and can cause severe disease, and those strains will not be out competed by milder strains that require mobile hosts for transmission. Natural selection makes the more serious infections not to have to worry about causing immobility or death of the host because it can still get spread by hospital staff. This is all the more reason for hospitals to have strict protocols for hand washing and other cleanliness procedures to stop the promotion of "super bugs."

Pathogens that can live for a long time outside the host in the external environment can also be more deadly, such as smallpox, tuberculosis, diphtheria, and pneumococcal pneumonia, because they don't require mobile hosts to transmit them.

Sexually transmitted microbes would not live long enough to get transmitted to other people if they behaved like the common cold. They would be destroyed in a matter of days by the person's immune system. Since people don't usually change sex partners frequently, the pathogens wouldn't have a chance. So they cleverly employ sneaky tricks. The bacteria that cause syphilis strips off many external molecules to avoid recognition by the immune system, like criminals who sand off their finger prints. HIV impersonates a "police officer", using the crime metaphor, by living inside the immune cell itself, and it frequently mutates to avoid detection, like plastic surgery for a fugitive from the law. The bacteria that cause gonorrhea are quick-change artists, changing external molecules daily to avoid detection. Herpes Simplex avoids detection by hiding in nerve cells. Then under stressful conditions, it comes out to the skin so it can spread to other people quickly before the host is disabled or killed by the stressful situation. The papilloma virus enlists the cervical cells to hide them inside the cells, and they induce the cervical cells to divide more prolifically, and before the cells become cancer, the virus has time to have infected someone new.

Some sexual behaviors select for more aggressive variants or more benign variants. For people who have sex less frequently, the more benign variants are favored, because they have to behave well enough to stay around long enough to get transmitted by the next sexual encounters. For people who change sexual partners frequently, the more lethal variants can easily be transmitted soon again after infection, so they don't have to take care to behave more benignly. They don't give a hoot whether the host dies or becomes handicapped soon, because they've already soon been transmitted to another promiscuous partner that is likely to pass it on again. Thus, the more dangerous papilloma virii that lead to cancer are more prevalent among people who change partners frequently. These make the cervical cells multiply more rapidly. The HIV epidemic got its debut among people with multiple sex partners and those who shared needles with many people. So among people who change partners frequently, natural selection favors those STD's that cause more severe infections.

Another issue complicating the control of mosquito borne infections, diarrheal disease, and STD's is that contact tracing is more difficult. If someone has a cold, "How are you?" "Oh, I have a cold!" You don't usually say, "I have diarrhea," and even less likely, "Oh, I have gonorrhea," or "I have malaria. Help me kill those mosquitoes that just bit me so they don't give this to someone else."

One of the reasons more severe infections don't spread so widely, is that people take actions against them. We influence the evolution of pathogens with better hygiene, facial coverings, social distancing, safe drinking water, mosquito control, selective use of anti-microbials (pharmaceuticals and herbs), and vaccines against the most harmful of the pathogens. Then the more benign ones can out compete the more dangerous ones. For example, the papilloma virus vaccine targets the more dangerous strains, giving the more harmless ones opportunity to take over. Likewise the Hemophilus influenza vaccine has eliminated many of the more dangerous strains that cause meningitis, and the less dangerous ones

have become more common. Better hygiene and safe drinking water have controlled cholera and typhoid, and the milder diarrheal outbreaks are not targeted so carefully, and they have become more prevalent. So the evolutionary lesson is, control the most severe pathogens, and the milder ones take over.

Another aspect of letting milder pathogens replace the more severe ones, is to introduce a milder form before people get exposed to the severe form, so not only does the milder form get first chance at the slot, but it also primes the immune system to be prepared better to fight the severe form. This was the case when cowpox was given to people as the first vaccine, so that they could better fight off smallpox.

Other vaccines following that for smallpox have had decreasing returns on investment. Smallpox fortunately lacked the ability to mutate. Influenza and SARS Cov-2 mutate a lot, and HIV even worse, which is one main reason it has been so hard to make an HIV vaccine. Antibiotics likewise have had decreasing returns on investment, with resistance growing every day. We can no longer count so much on these rescue measures, and we need to emphasize healthful lifestyle, hygiene, safe water, food, herbs, and other natural things that support a healthy, balanced, resilient immune system. And if we want to have better management of infectious disease, we need to plan better strategies, and this means having a better understanding of the behavior of these organisms.

The author proposes that many chronic diseases are caused in part by "stealth infections," in which a virus or bacteria causes no acute infection, or a very minor ailment, and evades detection by the immune system, or encounters very little resistance by the immune system, and it smolders along with chronic inflammation. He suggests that atherosclerosis, breast cancer, Alzheimer's dementia, schizophrenia, infertility, and chronic fatigue syndrome are in part caused by stealth microbes. Evidence for correlation is pretty convincing, but in the ensuing decades since the book was written, causation has not been proven although the correlations have been confirmed.

We already know of proven causation by microbes for gastric ulcer, cervical cancer, Kaposi's sarcoma, Burkitt's lymphoma, adult T-cell leukemia, and liver cancer. For many of these, the evidence either was not clear, or it was not accepted for decades. Causality cannot be proven by Koch's Postulates, an orthodox requirement for proof of causation, which would not be ethical or even practical to do. Correlation has to be depended upon for sufficient proof to act on it.

This theory has been corroborated by many other sources. Periodontal disease has long been correlated with cardiovascular disease. For multiple sclerosis, many pathogens have been implicated, such as EBV (Epstein Barr Virus), HHV-6, coronaviri, and chlamydia. Dr. Jacob Teitelbaum, expert on chronic fatigue syndrome and fibromyalgia, considers candida and many virii such as EBV, Cytomegalovirus, and coxsackie as playing a role in these conditions. Dr. David L. Hahn, MD, MS, wrote a whole book about Chlamydia pneunoniae as implicated in hard-to-control asthma, the same bacteria that Paul Ewald connects with atherosclerosis. Dr. Hahn has had some success with antibiotic treatment. His book is A Cure For Asthma. Dr. Aristo Vojdani, PhD, pioneer in laboratory testing for many antibodies associated with many chronic conditions, contends that these microbes are associated with Alzheimer's disease: Porphyromonas gingivalis, E. Coli, Salmonella typhosa, Borrelia burgdorferi, chlamydophilia pneumoniae, CMV, H. Pylori, and HSV-1. Noted in JAMA, RA (rheumatoid arthritis) is associated with porphyromonas gingivalis, prevotella copri, and EBV. Autoantibodies can cross react with bacteria and the joints. RA is correlated with decreased gut bacteria diversity. Dr. Rawls connects Borrelia with Alzheimer's disease and ALS, chlamydia with MS, and mycoplasma with RA.

In Dr. William Rawls' book, Unlocking Lyme, he explains some of the dynamics of how microbes live in a spectrum between normal flora and deadly pathogens, and many of the bacteria that are not normal flora, may be "normal flora wannabe's," living in this range, not deadly, but not completely benign, in which they can cause stealth infections that most of the time don't cause symptoms. These may be borrelia, mycoplasma, bartonella, etc. For some people with compromised or imbalanced immune symptoms, they can cause severe symptoms, but rarely death. He models a pyramid, with normal flora on the bottom, the common cold the next step up with smaller numbers, then farther up, these stealth infections, then up to others less frequent and more virulent such as influenza, then at the very top, ebola, quite rare, but deadly. These are prototypes or examples of organisms, but many other microbes fit into these categories. When a virus jumps species, from bats or birds to humans, most of them are not so dangerous, but these are the situations where deadly virii can come, as with ebola, or the 1918 flu, which came from birds, and SARS-1 and MERS virii, which also had jumped species. The virii don't mean to cause harm, they just want to use us as food, but they are not proficient at living with humans, so they cause damage from being clumsy. Humans also, not having previously encountered them, do not have immune systems that can handle them well. In contrast Dr. Rawls says the Lyme spirochete, Borrelia burgdorfori has been with humans for millions of years and it has learned how to live in the body, shielded from the immune system, growing slowly as to make antibiotic treatment difficult, and are widespread among humans, mostly causing no symptoms except for people with imbalanced immune systems. Modern immune systems are more vulnerable than those 100 years ago, and more people are getting sick from Lyme. Modern life with unnatural food, toxin overload, chronic emotional stress, physical inactivity, EMF's, microbiome imbalance, etc., makes people more more susceptible to stealth microbes causing more symptoms.

Paul Ewald is more confident than I about the causation of chronic disease by microbes, but this does deserve serious consideration and more research. Besides antibiotics and vaccines, we have many more things in our repertoire, such as herbs and nutritional therapies. These are not accepted by conventional medicine because of "inadequate proof." Well, that kind of proof will never come if it depends on expensive research on the caliber of what is necessary for drugs, which are more risky and require a higher standard of research. The financial return in investment is too low for someone to fund the research, if it depends on the capitalistic system to make it work. A more social, cooperative funding system could support research on the level appropriate for herbs and supplements. Stephen Harrod Buhner has written several books, including Herbal Antivirals and Herbal Antibiotics, the latter for which I wrote an article, in the archives. He quotes an abundance of research done in many parts of the world outside the USA, showing benefit from many herbal medicines against these pathogens.

Above all, we need to keep healthy, balanced immune systems with healthful lifestyle, and we need to become familiar with and grow and use more herbs, so we are better prepared for the next pandemic for which we have no drugs or vaccines, and also so we can better reduce chronic disease from stealth pathogens, with the use of herbal medicine and other natural treatments.