PARASITES: THE GOOD AND THE BAD

by HEALTHMEANS

CONTENTS

INTRODUCTION

Parasites conjure unsettling feelings of squirming worms and sucking bugs, but the relationship between humans and parasites encompasses more than what you might imagine. These creatures are widely found in humans and can create severe health issues. But they can also contribute to optimal immune function.

Ectoparasites, helminths, protozoa and viruses can all act as human parasites. Effects range from a simple stomachache to the development of autoimmunity. However, some evidence also shows surprising and unique beneficial interactions between parasites and our immune system. These ancient pathogens produce toxins, create infections, manipulate our behavior and spread to those around us to ensure their survival, but they're not always harmful!

In this eBook, we'll outline the most common and the most impactful parasites that humans encounter. We'll explore how these organisms can contribute to or explicitly cause some modern maladies along with how they might benefit us. Finally, we'll discuss how each organism is uniquely transmitted while learning how to avoid and support ourselves from parasitic infections.

ECTOPARASITES

Ectoparasites are the physically largest parasites. They also have the most considerable impact on a host's health out of all the parasites discussed in this eBook. These bloodsuckers include arthropods, like mosquitoes, as well as creatures that attach or burrow into the skin, such as ticks, fleas, lice and mites. Why are these parasites the most impactful? Not only do they create direct physiological disturbances, but they also carry and transmit other parasites, viruses and bacteria. In this way, they are doubly troublesome!

ECTOPARASITES AND YOU

Arguably, some of the most infamous and threatening chronic modern maladies come from ectoparasitic ticks. Ticks are arachnids much like spiders, but they are known for their bloodsucking capabilities. Hiking in the woods, doing yard work or simply lying in the grass can bring you into contact with a tick.

The blacklegged tick of North America (also known as the deer tick), the American dog tick and the lone star tick are well known for carrying and infecting hosts with a plethora of other parasites and bacteria. The protozoan parasite Babesia, the bacteria Bartonella, Rickettsia, Ehrlichia and Anaplasma, viruses like Colorado tick fever, and multiple other coinfections are all known to be spread by various tick species [1]. Because of this, we often refer to one or a combination of these infections as a tick-borne illness. These pathogens are challenging to eradicate and often prey on a weakened immune system.

While the well-known bull's-eye rash can appear with a tick bite, it is not always a tell-tale sign that someone has been bitten. Other symptoms of these infections can include fatigue, joint pain, fibromyalgia, food reactions, such as alpha-gal syndrome (tick bite meat allergy) and remitting fevers. Tick-borne illnesses can be hard to identify as the symptoms are similar to those of several autoimmune diseases, or may even contribute to the development of autoimmunity. For instance, because bacteria like Bartonella, Rickettsia and Ehrlichia affect the nervous system, signs of their presence often mirror multiple sclerosis. Some studies have shown that individuals presenting with symptoms of scleroderma, rheumatoid arthritis or lupus may have some degree of tick-borne illness activity [2].

While tick-borne illnesses are undoubtedly threatening, other ectoparasites like mites can also be harmful to human health. Much like ticks, mites can spread the bacterium Rickettsia, which can cause Rocky Mountain spotted fever. Rickettsia can cause fever, myalgia, headache and rash [3]. In addition, a dark scab often appears at the site of the bite. Like ticks, the presence of mites and the diseases they carry can also mimic autoimmune disorders.

Additionally, mites may contribute to rosacea. For example, the Demodex folliculorum mite lives on the human skin and is known to carry bacteria like Bacillus oleronius and Staphylococcus epidermis. These bacteria are known to contribute to symptoms of rosacea and respond to antibiotics. Allergic reactions to the feces and proteins of mites themselves have also been documented [4]. Bed bugs are similar in this regard [5].

Head and body lice are troublesome ectoparasites commonly associated with school children. However, these parasites are not as innocent as the hosts they infect! Body and head lice are most known for the itching and scratching they cause. However, body lice can indirectly cause conditions like epidemic typhus, trench fever and louse-borne relapsing fever by carrying parasites that contaminate their hosts [6].

Fleas are ectoparasites often associated with dogs. But they're also readily found on mice, cats and other wild animals. Fleas are widely known for spreading Yersinia pestis, more commonly known as the bubonic plague [7]. Fleas also can transfer tapeworms, a common parasite we'll discuss in more detail later in the eBook.

TRANSMISSION

The transmission of ectoparasites is relatively straightforward: They seek warm, damp areas of our bodies and thrive in similar climates. They spread from person to person, environment to person, or sometimes animal to person. Poor hygiene increases the chances of ectoparasitic transmission, particularly lice. Head and body lice spread via infected bedding, brushes and clothing. Pubic lice are generally transmitted through sexual contact.

It's advantageous to be aware that cutaneous myiasis, an ectoparasitic infestation of the skin with the larvae of specific flies, can occur while traveling in tropical locales. Ticks thrive in countless numbers in the Northeastern United States during the summer months. Fleas are quickly passed from cats and dogs to their human roommates, while scabies (itch mites) results from skin-to-skin contact. Transmission of Cimex lectularius, the common bedbug, is true to its name [8].

PREVENTION AND SOLUTIONS

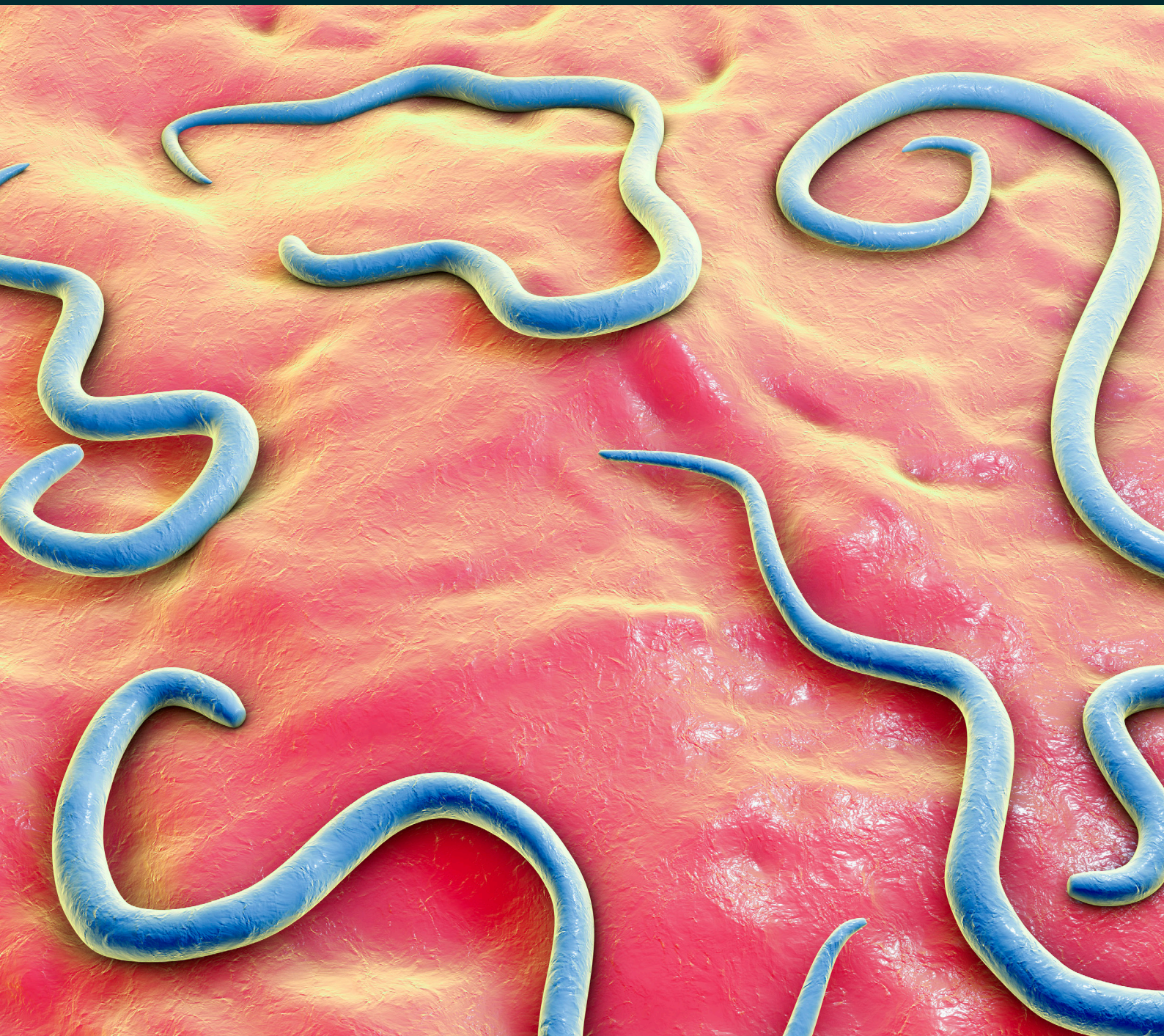
While the size, type and severity of an ectoparasitic infection can differ drastically, all have similar processes for prevention. First, hygiene is of the utmost importance. This aspect of prevention is not limited to washing hands after using the restroom — although it remains a priority! Creating a clean home and ensuring your pets are well groomed goes a long way, too. Do not share hygiene or body care products like hairbrushes or combs, and always thoroughly check yourself and your family members for ticks when coming in from a day outside. Ticks like to hide in hair, behind ears and in hard-to-reach areas. Additionally, they can spread through unchecked laundry and carpets.

Tick-borne illnesses seem to present a particularly detrimental problem in the United States. If you get bit by a tick, remove it as quickly as possible without puncturing, crushing, squeezing, burning (or using heat to make it pull out) or the use of petroleum jelly. These methods cause the tick to regurgitate and increase the chance of infectious spread. Instead, grasp the tick as close to the skin as possible and gently pull it out at a 45-degree angle. Some sources recommend saving the tick to be tested for pathogens. Specialized doctors called Lyme-literate doctors specifically treat people who have been infected with Lyme disease.

Multiple protocols exist for the holistic treatment of Lyme disease. Stephen Buhner is a clinical herbalist and author who has written numerous books on the use of herbs and nutrition to support those with Lyme and coinfections. Tailored treatments, stress management, a nutrient-dense diet and avoidance of processed foods will help keep the immune system resilient against ectoparasites and their pathogens [9].

HELMINTHS

Helminths are probably what your mind jumps to when you hear the word “parasite”! These are large, worm-shaped, multicellular organisms you can see. Species of helminths include flatworms, roundworms and thorny-headed worms. Helminths are not restricted to the digestive tract; they also infect the blood, lymph and body tissues. Both direct and indirect damage occurs due to helminth infection. Direct damage refers to the harm done by the worm itself, while indirect damage occurs due to the host’s immune response — a situation of biological friendly fire.



HELMINTHS AND YOU

Flatworms

One of the larger subsets of helminths found in humans is flatworms. Probably the most famous flatworms are the tapeworms. There are tapeworms specific to pork, beef and fish — Taenia solium, Taenia saginata and Diphyllobothrium latum. These parasites are often acquired by eating raw or undercooked meat. Few people know they have a tapeworm as symptoms begin with an upset stomach and weight loss. However, more serious issues can occur in an immunocompromised individual. Diphyllobothrium latum, for instance, can grow up to 30 feet long and cause vitamin B12 deficiency, intestinal obstruction and gallbladder disease. Pork tapeworms can lead to cysticercosis, a severe illness that results from tapeworms reproducing in the muscles, organs and brain that can cause muscle and eye damage [10].

Schistosomes (liver flukes) are carried by freshwater snails and mainly affect the urinary tract, bladder, intestines and liver. They lead to rash, itchy skin, cough, fever, chills and other flu-like symptoms. In more advanced cases, granulomas (swollen areas of inflammation) may form around schistosome eggs and contribute to gallbladder and liver dysfunction. Amazingly, the symptoms of schistosomiasis are an example of indirect parasitic damage; symptoms are due to the immune system's reaction to the eggs — not the eggs or flatworms themselves [11].

Filarial worms such as Wuchereria bancrofti spread through mosquito bites. These flatworms can lead to a disease known as lymphatic filariasis, as the worms live in the human lymphatic system. Once in the lymphatic system, the worms mate and migrate into the blood. These parasites are linked to elephantiasis in developing countries [12].

Roundworms

Ascaris lumbricoides is the most common worm infection in humans, while Trichuris trichiura is the infamous human whipworm. Both are characterized as roundworms and affect the gastrointestinal tract. However, as with most parasitic infections, ascariasis generally goes unnoticed. Most people are asymptomatic or have only light feelings of nausea, loss of appetite or weight loss.

Severe infestation, however, can create extremely detrimental effects in the intestines and lungs, small intestine obstruction, twisted bowels, appendicitis, inflammation of the gallbladder and pancreas, shortness of breath, and chest pain. In addition, Ascaris-associated mucosal bleeding and inflammation may lead to anemia.

T. trichiura is the second most common human helminth infection. It invades the intestinal mucosa and may lead to bleeding and anemia, specifically in pregnant women.

Ancylostoma and Necator are hookworms that burrow into the inner layers of the GI tract and damage the capillaries and arterioles deep within. Due to their secretion of anticoagulants, infections with these parasites may lead to prolonged bleeding, blood loss and anemia [13].

While all worms lead to some detriments, often due to nutrient leaching from the host and eventual malnutrition, they can also cause indirect harm. The immune system operates by recognizing a pathogen and reacting to initiate a response to expel it from the body. Because worms are relatively large, it can be difficult for the immune system to address them.

Additionally, parasites can emit immune-altering chemicals that allow for evasion. As a result, this can leave the immune system chronically activated like a security guard that cannot find a hiding intruder. Thus, conditions like asthma, airborne allergies, food reactions and autoimmune disorders have been linked to chronic parasitic presences [14].

Even with the horrible effects that helminths create in some humans, it's interesting to consider that we may benefit from infestation with these "old friends." This terminology is not arbitrary. Accompanying and perhaps even overturning the hygiene hypothesis — the proposition that exposure to germs, infections and other immune-stimulating substances create a more balanced and less reactive immune system — is the "old friends" hypothesis.

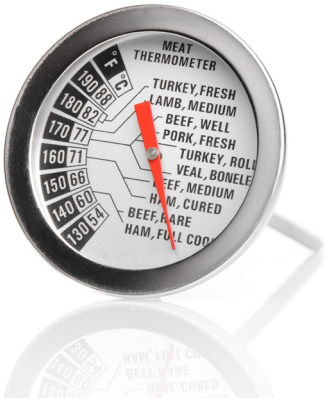
This hypothesis was proposed in 2003 by professor Graham Hook, MD. He believes that the hygiene hypothesis is faulty for two main reasons. First, he points to the hygiene hypothesis' blanket claim that all exposures can lead to benefit. He suggests that some diseases, such as measles, for instance, are crowd infections. These pathogens did not evolve with humans and do not have the same immunological effects as inputs that have interacted with humans for millions of years.

Second, he believes hygiene is confused with toxic cleaning and building materials often present in our homes. Hygiene in and of itself is not problematic to immune regulation; Hook states it's one of the most valuable and essential achievements of medical research! Toxic materials and the environments they create, however, are highly problematic [15].

Parasites, along with non-pathogenic environmental bacteria, mud, untreated water and feces, fall neatly into the "old friends" hypothesis. They are compounds with which humans coevolved and that directly and indirectly support immune function [16]. Moreover, evidence displaying benefits to such exposures has been shown in research on multiple sclerosis and celiac disease, for example [17].

PREVENTION AND SOLUTIONS

The prevention of helminth infection includes well-funded public health measures, proper hygiene, a focus on nutrient-dense diet and digestive health support. These efforts are often overlooked but can make a significant impact. Cooking meat to recommended temperatures (especially pork and fish) is also highly recommended.



If you suspect some sort of helminth presence, it may be helpful to speak to your healthcare practitioner and order an in-depth stool analysis. Such a test will check for worms, protozoa and viruses, as well as inappropriate bacteria and fungi.

Some speculate that parasites like helminths have increased activity during full moons. Their reproductive cycles are known to synchronize with the lunar cycle, and studies have shown higher instances of gastrointestinal disturbances during this time to support the theory [18]. If you routinely notice an increase in symptoms around the full moon, it might be worthwhile to explore if helminths are a problem for you.

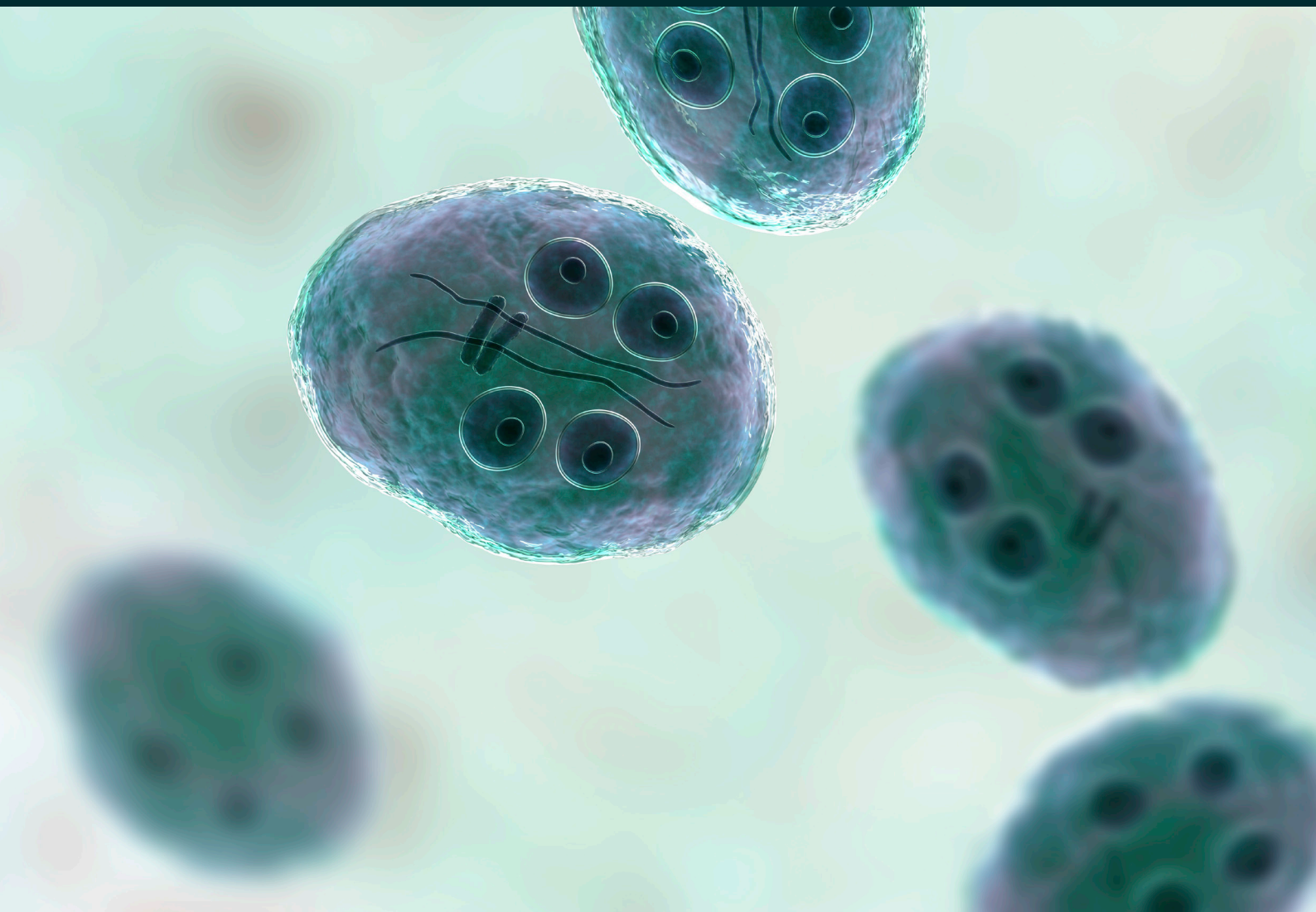
Some relatively common foods and herbs may be supportive. For example, pumpkin seeds and their extracts have shown efficacy in reducing helminth infestation in in vitro and animal studies [19, 20]. Thus, intermittently consuming these foods can also help with prevention.

Herbs such as sweet wormwood, turmeric, Chinese rhubarb, epazote, pomegranate seed and husk, and thyme have anti-helminthic properties. However, the use of these foods and herbs comes with a critical caveat: They may be harmful to the parasites and the host. Use these herbs with caution and with the supervision of both your doctor and an experienced herbalist. This recommendation is especially true for people with complex medical histories or those taking prescription medications. Do not underestimate the potency of antiparasitic plants [21, 22].

During an active infestation, it may be wise to decrease the amount of inulin in the diet. Insulin is present in otherwise gut-supportive foods like leeks, Jerusalem artichokes, asparagus, garlic and bananas. These foods are ordinarily fantastic for microbial gut health. But in animal models of helminth infection, inulin has been shown to increase infection persistence and gut disturbance [23].

PROTOZOA

Though not as tiny as viruses, protozoa are microscopic. They are unicellular (one-celled) creatures that can live independently or as parasites. In humans, protozoa are generally found in the intestines via the fecal-oral route or in the blood and tissues via vectors such as mosquitoes or sandflies [24]. Because protozoa can multiply inside the human body (as opposed to other parasites, such as worms that cannot reproduce in humans), they can multiply quickly and cause severe infection.



PROTOZOA AND YOU

Giardia (giardiasis or beaver fever) is a well-known protozoan known to infect humans by ingestion of cysts from an infected host or contaminated drinking water. The parasite lives in the intestines and makes its presence known by symptoms of abdominal cramps, nausea, foul-smelling stool, acute or chronic diarrhea, malabsorption, characteristic burps that smell and taste like rotten eggs, and the failure to thrive in children [25]. Giardiasis is the most common protozoal infection in humans, with worldwide incidence ranging from 20% to 60%. While we often think of giardiasis as a rare occurrence, the robustness of the Giardia lamblia species and the immunity of the host can allow it to linger.

The body protects itself from Giardia with an antibody called secretory immunoglobulin A. This antibody is protective of mucous membranes and is found in the digestive tract. It serves as the "cushion" that repels inflammatory agents from destroying the intestinal epithelium [26]. When immunity and secretory IgA production are altered from stressors such as an inflammatory diet, Giardia may be harder to fend off and eliminate. It can then cause this protective barrier of the immune system to break down further, contributing to intestinal permeability, aka leaky gut [27]. Additionally, the chronic presence of this pest can mirror symptoms of autoimmune disorders like lupus and ulcerative colitis [28, 29].

Earlier, we mentioned the protozoa Babesia, but it's important to explore this infection a bit further. Babesia microti is a tick-borne parasite that infects red blood cells and can lead to babesiosis. This illness is commonly found alongside other tick-borne illnesses and is known as a Lyme disease coinfection. Those with babesiosis can develop respiratory distress and pulmonary edema due to the abnormal clumping and rigidity of infected red blood cells. Further complications involve capillary blockage and an enlarged spleen [30, 31]. Unfortunately, these symptoms are infrequently tied to the bite of a tick. For this reason, it's crucial to explore underlying influences that may be contributing to these issues.

Cryptosporidium is also a protozoan. Both the parasite and the disease it causes are known as "Crypto," and it is responsible for most water-borne diseases in the United States. The main symptoms are diarrhea, stomach cramps and dehydration [32]. This parasite can create atrophy of the villi within the small intestine — the tiny hair-like projections that facilitate nutrient absorption and increase the surface area of the gastrointestinal system. Crypto can resultantly cause weight loss and malabsorption [33].

Toxoplasma gondii is a protozoan that leads to the associated disease toxoplasmosis. Estimates show that 11% or more of the population of the United States are infected with T. gondii [22]. Toxoplasmosis can have severe effects on people who are immunocompromised, including brain abscesses or blindness. In addition, studies show that this parasite may subtly affect humans neurochemistry by increasing impulsiveness and risk behaviors. T. gondii is also linked to psychological illnesses like schizophrenia based on an individual's genetics [34].

TRANSMISSION

Protozoan transmission includes the fecal-oral route from contaminated food or water and a vector route from the bite of a tick, mosquito or tsetse fly. Their presence can only be determined through symptoms or specific testing, such as stool or blood tests, as they are not visible to the naked eye.

A 2018 CDC infectious disease report detailed a previously unknown transmission route for protozoan parasites — sexual transmission via seminal fluid. Five parasitic species were found in the seminal fluid of humans. Infection may lead to decreased sperm quality or damage to the reproductive organs [35].

PREVENTION AND SOLUTIONS

As with ectoparasites, it's most important to keep a strong immune system to ward off protozoan pathogens. A nutrient-rich diet and rest are genuinely the best tools. Aside from that, consuming safe water is a significant priority. Installation of a premium water filter at home while avoiding unfiltered water when traveling or camping can help protect against common water-borne protozoa like Cryptosporidium and Giardia.

Checking the body for ticks, as described previously, can be helpful for the prevention of babesiosis and other tick-borne illnesses. Maintaining the hygiene of yourself, your family and your pets can also prevent protozoan infections. Because protozoa can spread via the fecal route, always ensure you thoroughly wash your hands following the use of any private or public restroom. Consider wearing a mask while changing the kitty litter.

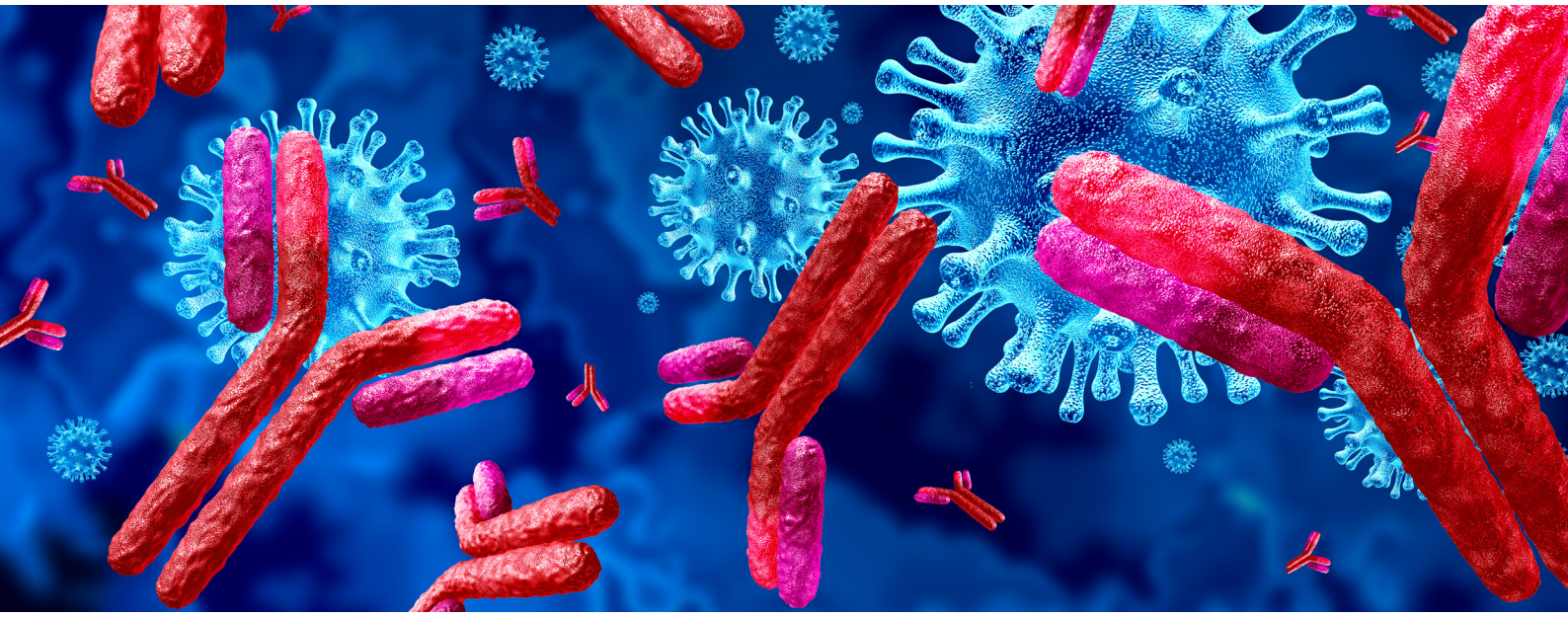
Finally, it's helpful to know specific giardiasis solutions due to its widespread incidence. More people are now aware of these over-the-counter remedies, thanks to the comprehensive research and teaching of Dr. Jason Hawrelak. The addition of wheat germ, blueberries, blueberry juice, garlic and propolis all support the eradication of Giardia. Increases in dietary fibers and flavonoid-rich foods, along with the reduction of fats and simple sugars, may also inhibit Giardia's growth, reproduction and uncomfortable symptoms. Additionally, Florastor brand probiotics may help both eradicate Giardia and the overall health of the GI tract (36).

VIRUSES

The word “virus” comes from the Latin word for “slimy liquid” or “poison.” Though not technically alive, all viruses are classified as obligate parasites, meaning they must exploit a host to reproduce. Viruses do not fall under one of the CDC’s three major parasite classifications: protozoa, helminths and ectoparasites. Still, they fulfill the classical definition of a parasite: an organism that lives in or on an organism of another species (its host) and benefits by deriving nutrients at the other’s expense. They rely on a host to grow and meet their needs, such as energy production and reproduction. And they most certainly cause infectious disease [37]. Some viruses may also work in tandem with other parasites to increase or decrease their detrimental effects on human hosts; this is known as hyper- or hypovirulence [38].

VIRUSES AND YOU

Thankfully, viruses do not usually cause disease; most viral infections are asymptomatic. Our immune system creates chemicals called interferons that strengthen cellular resistance and limit viral spread. Antibodies then kill and clear the virus from the body while also providing immunological memory for the possibility of future infections [39].



However, some viruses do cause illness. Virus-host interactions lead to acute diseases, such as seasonal colds and flus (rhinovirus and influenza). In contrast, others trigger much more severe chronic issues, such as cervical cancer (associated with human papillomavirus type 16). Thankfully, most viruses are efficiently cleared from the body via our immune system, and we develop life-long immunity. However, people with compromised immune systems are more at risk of overwhelm by viral replication or viruses that are inaccessible due to depressed immune function.

Viral latency can also be problematic. Herpes viruses, for instance, cause infections only at times of lowered immunity. They lay dormant in the body until they have a chance to replicate and cause symptoms. Shingles and chickenpox are both diseases caused by the herpes virus, varicella-zoster. In the next section, we'll learn more about varicella-zoster along with other common viruses.

Epstein Barr

Epstein Barr (EBV) is a virus that may be familiar to you, as it's the cause of infectious mononucleosis and may underlie chronic fatigue syndrome. It's infamously spread by exchanging salivary secretions with an infected individual — kissing and sharing food or drink are the most common transmission routes. Epstein Barr belongs to the herpes virus family and works by injecting its DNA material into immune cells. In this way, it can reproduce very quickly. It's currently estimated to infect over 90% of the population [40].

After an acute EBV infection, a person can either be asymptomatic or experience headache, malaise, fever and sore throat, possibly including enlarged lymph nodes or spleen. In a healthy host, the body will overcome EBV, and it will become dormant. However, in chronic reactivated Epstein Barr, the virus will prey on periods of host weakness during times of immunosuppression. In addition, chronic infections elsewhere in the body, psychological stress, poor diet or a culmination of these factors lessen the immune system's ability to suppress the virus.

Epstein Barr may contribute to conditions like fibromyalgia and chronic fatigue syndrome. It is also linked to rheumatoid arthritis, lupus, Hashimoto's thyroiditis and multiple sclerosis [41]. Further, it may contribute to neurodegenerative conditions like Alzheimer's disease by contributing to the formation of beta-amyloid plaques [42].

Cytomegalovirus

Cytomegalovirus (CMV) is another herpes virus. Much like Epstein Barr, CMV is known to infect many people in developed nations, with estimates of up to 70%. In addition, almost 100% of people in developing countries are thought to have CMV. It spreads perinatally and via the blood, breastfeeding, viral shedding in close-contact settings and sexual transmission [43]. Its contraction can cause everything from organ failure in severely compromised patients to being completely asymptomatic.

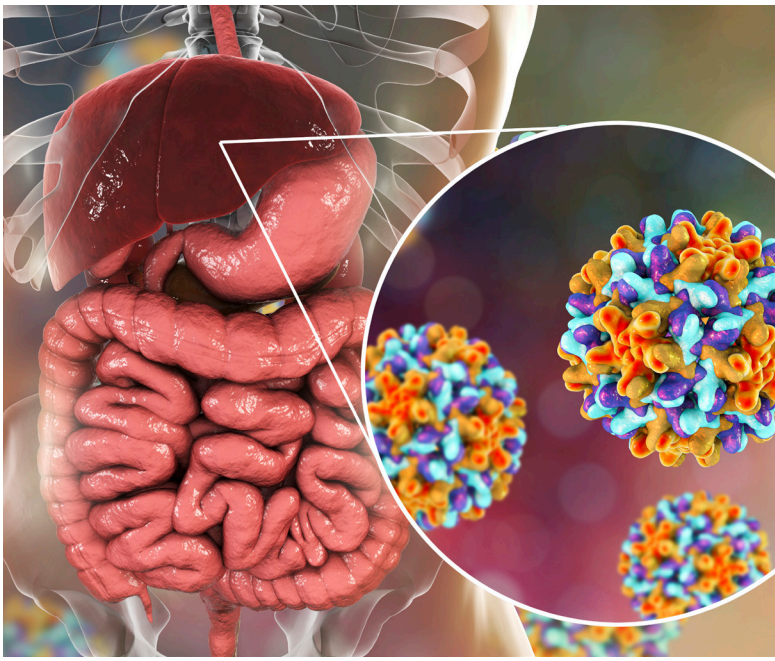
CMV is known to target the salivary glands specifically. Studies show that its presence is linked to autoimmune disorders that also target these glands, such as Sjogren's disease [44]. Like EBV, activated CMV can cause anemia, abnormal liver function tests, low blood platelets and tests indicative of an autoimmune diagnosis. For this reason, it has also contributed to diagnoses of other common rheumatic diseases like rheumatoid arthritis and lupus [45].

Herpes Zoster

Herpes zoster is a herpes family virus that we often see in childhood as chickenpox. While most people think that chickenpox is a one-time occurrence, this is only partially true. During times of immunosuppression in adulthood, herpes zoster may return in the form of shingles. This disease is characterized by fever, malaise and sometimes excruciating burning pain followed by the outbreak of blisters that appear over three to five days [46].

Hepatitis B

Hepatitis B is a member of the Hepadnaviridae family. A vaccination exists for hepatitis B, but contraction still occurs because of its limited availability in developing countries. Hepatitis B is transmitted by exposure to blood or body fluids containing the virus. Once the infection is established, it can remain persistent and challenging to eliminate, as hepatitis B is known to become resistant to drugs. Additionally, some individuals are unresponsive to treatment, while many are entirely unaware that they carry the virus [47]. Hepatitis B is also known to contribute to liver dysfunctions like cirrhosis and non-alcoholic fatty liver disease.



Hepatitis C

Hepatitis C is almost exclusively spread from blood-to-blood contact, making it contractible from intravenous drug use, tattoos and sharing razors and toothbrushes. Like hepatitis B, hepatitis C can be difficult to manage and is sometimes unknown to the host. As a result, treatments can lose their efficacy, and the virus can lead to cirrhosis, end-stage liver failure and non-alcoholic liver disease and associated conditions [48].

PREVENTION AND SOLUTIONS

The most effective and available solution to stopping the spread of viruses is proper hygiene. Frequent hand washing, covering the mouth while sneezing or coughing, and general personal discretion deter viral transmission [49]. Avoidance of sharing food and drink with an infected person is also helpful in preventing contraction.

Our nutritional status also affects our response to these microscopic parasites. If we lack certain immune-supporting and anti-oxidative nutrients, we are more susceptible to viral disease — even slight malnutrition can result in increased severity and duration of symptoms. It's also interesting to learn that some nutritional deficits in a host may make normally non-dangerous viruses much more dangerous and damaging!

Essentially, virulence — the virus's ability to do harm — is increased due to changes in the viral genome triggered by the low nutrient status of the host [50]. Deficiency in selenium and vitamin E has been explicitly found to induce viral genetic changes. These antioxidants can be found in Brazil nuts, beef, turkey, sunflower seeds, and many nuts and whole grains.

A sufficient amount of the amino acid lysine is also necessary when supporting the body against viruses. For example, lysine acts as an antiviral against herpes simplex virus, the parasite behind cold sores. Lysine is present in many beans, quinoa, meat, poultry, dairy products and potatoes [51]. Eating too many foods high in arginine — coffee, nightshades, tobacco, chocolate, spinach, nuts, grains and seeds — can deplete lysine levels during an outbreak.

Monolaurin is readily found in coconut oil and may help contain viral outbreaks of the Epstein Barr virus. Herbs like milk thistle and turmeric are also wonderfully antiviral and can be enjoyed as teas [52].

Altered nutritional levels resulting from obesity or malnourishment may also lead to harmful viral mutations and microbiome/virus interactions. If the immune system cannot properly fight off a viral invasion, the virus can more easily genetically diversify (i.e., mutate). Imbalances in the gut and respiratory microbiome also can negatively affect the immune system's ability to fend off viruses [53].

Finally, living in a chemically, psychologically and physically stressful environment can compromise the immune system to allow for viral activity. For example, chronic exposure to pesticides, chemicals, heavy metals and household mold is known to alter and lower immunity. These factors can give viruses — and all other parasites — the opportunity to overtake you, the host!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