

The Impact of Chronic Infections and Toxic Heavy Metals on Detoxification, and What You Can Do To Help Your Body Get Well



If you've experienced a health condition without a known etiology that has left you with vague and troubling symptoms of chronic fatigue, pain, difficulty thinking, headaches, or general malaise, you are not alone. The cause of many of these chronic health conditions is often elusive, but that does not mean it does not exist. Chronic infections, environmental toxin exposures, and heavy metal toxicity each can have a deleterious and cumulative effect on our health, yet many individuals aren't aware of their impact.

Often, a chronic infection or imbalances of ordinary bacteria and yeast that are considered normal flora, particularly in the gastrointestinal tract, can contribute to the development of these vague symptoms. Lyme disease and other tick, animal, or food-borne pathogens are massively underdiagnosed (the CDC estimates that 300,000 Americans are infected annually with Lyme Disease—ten times what was previously suggested). Some tests, in particular those for Lyme disease, have poor diagnostic accuracy, while many other microbes are not even assessed for in typical screening panels physicians use.¹ An example is Powassan virus, a tick-transmitted flavivirus, which once was extremely rare with only 75 cases reported in the US in the past 10 years,² yet more recently, 8 cases of Powassan-associated encephalitis (inflammation of the brain) were reported in Massachusetts and New Hampshire alone in 2013 - 2015.³ There also is a high rate of transmission of this virus with *Borrelia burgdorferi*, the spirochete bacteria that causes Lyme disease.^{4,5} In fact, ticks carrying more than one pathogen may now be the norm, not the exception.^{6,7,8} Although we hope that screening will improve, there still will be many who suffer with multiple, undiagnosed tickborne infections.

Unfortunately, we live in an increasingly toxic world, and with population growth, deforestation and loss of natural green spaces, the situation isn't getting any better. Improper disposal and removal of waste products from decades long past, as well as bioaccumulation of toxic molecules up the food chain, can expose us to multiple types of toxins. There are three main routes of exposure to environmental toxins: through the air, contaminated drinking water, and food. And this kind of exposure to a wide range of environmental toxins and toxic heavy metals may be associated with the development of many types of cancer, respiratory disease, cardiovascular disease, diabetes, infertility, allergies, autoimmune disease, and many other conditions.^{9, 10, 11, 12}

Mercury, of course, is also a huge issue, and many of us are exposed to it on a routine basis, particularly if we have dental amalgams (mercury-based fillings) or consume high levels of seafood, particularly larger predatory fish like shark, swordfish, marlin, tuna, and tilefish¹³. In the United States, 1 in 6 women of childbearing age has blood mercury levels that exceed those considered safe by the EPA for a developing baby¹⁴, which is particularly concerning for the fetus as mercury concentration is increased in the fetal blood supply and breast milk.¹⁵

Clearly, we all have reason for deep concern about the impacts that undiagnosed chronic infections and environmental toxicities may have on our health. Unfortunately, the story gets worse before it gets better.

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How chronic infections and mercury exposure impact inflammation and detoxification

Lipopolysaccharide (LPS) is the major component of the outer membrane of gram-negative bacteria, contributing to the structural integrity of the bacteria, and protecting the membrane from chemical assault. LPS is critical to the survival of gram-negative bacteria, whose death results if it is mutated or removed. LPS plays a role in immune system activation and response as well, and for this reason is known as endotoxin. In vivo, gram-negative bacteria probably release minute amounts of endotoxin¹⁶ while growing, as studies in vitro have shown.¹⁷ But for the most part, endotoxins remain associated with the cell wall until destruction of the organism. Not surprisingly, some of our immune cells contain a lipopolysaccharide receptor complex, which recognizes these endotoxins. LPS binds to this receptor complex and activates many immune cell types, especially monocytes, dendritic cells, macrophages and B cells.¹⁸ This leads to secretion of many pro-inflammatory cytokines, nitric oxide, and eicosanoids. These pro-inflammatory cytokines are a critical part of the immune response.

However, this signaling cascade can go awry. For instance, damage to the intestinal barrier, aka “leaky gut” allows LPS from gut pathogens to be released into the bloodstream. Increased translocation of LPS from gram-negative bacteria in the gut into circulation may play a role in a variety of diseases including depression, chronic fatigue syndrome, liver disease, heart disease, autoimmunity, obesity, fertility, and many other common conditions.^{19, 20, 21, 22}

Damage to the intestinal barrier is not uncommon in this day and age. Many things including infection, stress, celiac disease, food allergies, non-steroidal anti-inflammatory drugs (NSAIDs), and alcohol can damage the intestinal barrier.^{23, 24} With exposure to mercury, inflammation and increased intestinal permeability can occur due to oxidative stress and glutathione depletion.²⁵ Unfortunately, in addition to being a problem in and of itself, the additional intestinal inflammation has an adverse impact on the body’s natural detoxification pathways. Exposure to endotoxin has suppressive effects on detoxification, downregulating expression of some of the important CYP enzymes and Phase III transporters.^{26, 27} Negative feedback from the downregulation of Phase III inhibits Phase II detoxification. However, Phase I is relatively unaffected by this and continues to create activated toxins.

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Supporting the body in detoxification

Despite our daily exposures to toxins, there are many actions we can take to support the body in detoxification. Although the process of detoxification occurs in every cell of the body, organs in which detoxification occurs at a higher level are the liver and kidneys. It is well known that in individuals with compromised liver or kidney function, dosages of many medications must be altered. The mucosal lining of the small intestine also plays an important role in detoxification, and proteins important for all phases of detoxification are expressed at a high level here.^{28, 29} When any of these systems are impaired, a backup in processing of toxins will occur, with a greater burden being placed on other organ systems. It is easy to see the importance of an integrated process where the intestine, liver, and kidneys are all functioning in an optimal fashion simultaneously.

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Keep the pathways of detoxification open!

Some activities which support the body's detoxification are: lymphatic massage, topical application of castor oil to the skin of the abdomen and region of the liver, dry skin brushing, drinking adequate amounts of water from a clean source, and engaging in activities such as exercise or using a sauna to promote sweating. These activities gently help the body eliminate toxic substances via the pores of the skin, liver, gastrointestinal tract, and urine. These modalities can be paced by the individual to minimize adverse reactions, and they can be implemented before undertaking an oral detoxification program, or as additional support with an oral detoxification protocol. These low cost simple tools help the body achieve balance and eliminate toxic substances at a well-tolerated rate.



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The skin, lungs, kidneys, liver, and gastrointestinal tract each play an important role in the process of detoxification. Some strategies for supporting these organs are detailed below:

01 Skin



The skin serves as an organ of detoxification, and a substantial amount of toxins are excreted in our sweat and the oily/waxy matrix that from the sebaceous glands. In fact, the dermal excretion of some toxic metals has been shown to exceed urinary elimination.³⁰ A variety of other toxic substances including bisphenol A and organochlorinated pesticides are also excreted through the skin--again, some at higher levels than in the urine.^{31,32} Activities such as saunas or exercise which promote sweating enhance the dermal elimination of toxins, so it is important to shower soon afterwards to remove toxin-laden sweat. Additionally, spa treatments that involve the topical applications of clay, known as Pelotherapy, may support detoxification. These treatments enhance skin³³ heating, perspiration, blood circulation, and excretion and elimination of toxins from the skin. Toxins are taken up and bound into the clay and drawn from the body.

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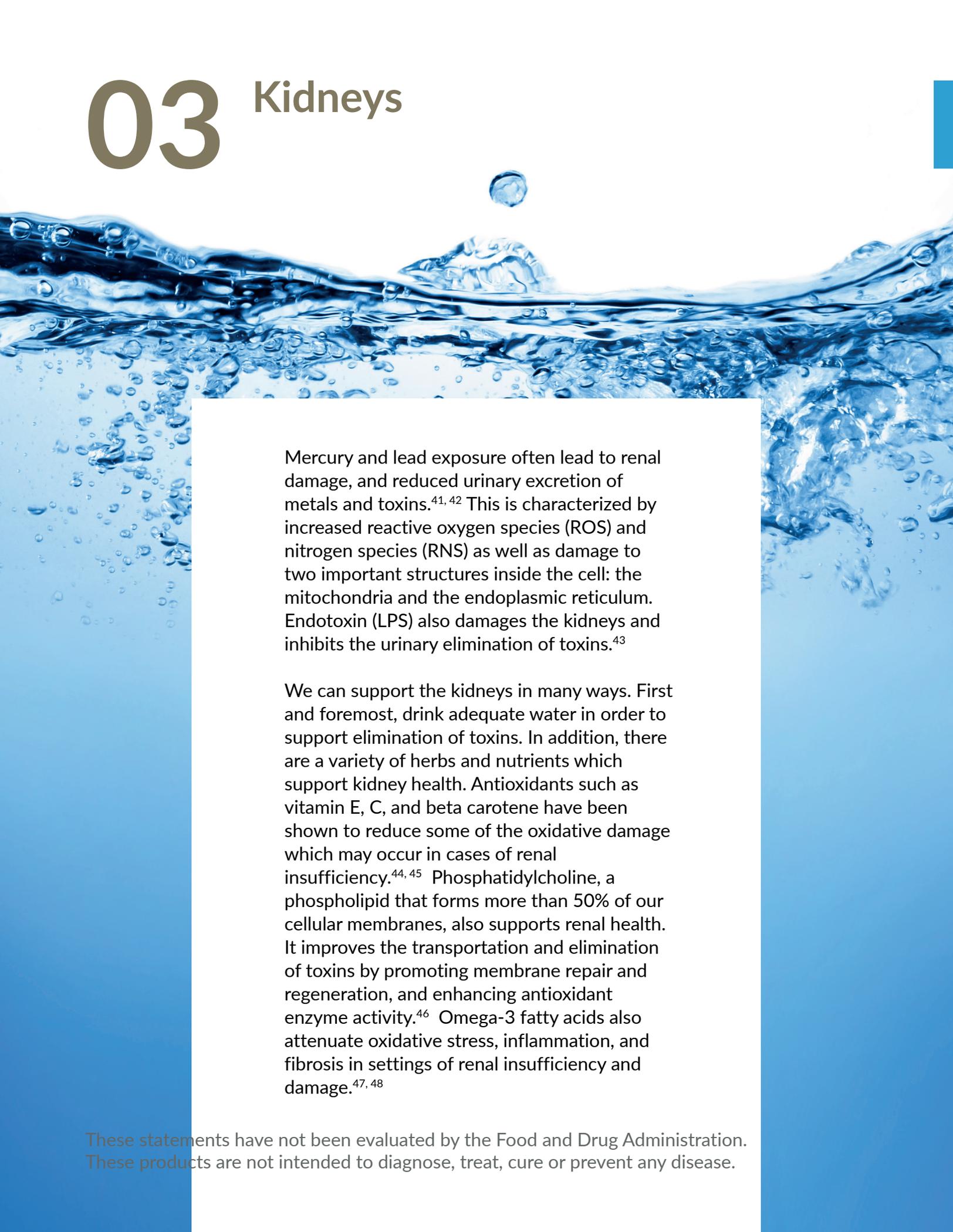
02 Lungs

It is our very nature to breathe without even noticing our breath. However, how and where we breathe matters. We now have evidence that controlled breathing techniques positively impact our health.^{34, 35} Additionally, we also can thank science for showing us that breathing in natural settings is more restorative than breathing in an urban environment.^{36, 37} Getting outside to take these deep healing breaths in nature, in a location where the air is fresh, and one is surrounded by trees and able to listen to nature sounds, plays an important and overlooked role in supporting detoxification. Exposure to nature has been shown to increase parasympathetic nervous system balance, improving mood and attention.^{38, 39} Nature exposure affects the immune system, blood glucose, blood pressure and more, according to a recent review on nature-related studies in Japan.⁴⁰



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03 Kidneys



Mercury and lead exposure often lead to renal damage, and reduced urinary excretion of metals and toxins.^{41, 42} This is characterized by increased reactive oxygen species (ROS) and nitrogen species (RNS) as well as damage to two important structures inside the cell: the mitochondria and the endoplasmic reticulum. Endotoxin (LPS) also damages the kidneys and inhibits the urinary elimination of toxins.⁴³

We can support the kidneys in many ways. First and foremost, drink adequate water in order to support elimination of toxins. In addition, there are a variety of herbs and nutrients which support kidney health. Antioxidants such as vitamin E, C, and beta carotene have been shown to reduce some of the oxidative damage which may occur in cases of renal insufficiency.^{44, 45} Phosphatidylcholine, a phospholipid that forms more than 50% of our cellular membranes, also supports renal health. It improves the transportation and elimination of toxins by promoting membrane repair and regeneration, and enhancing antioxidant enzyme activity.⁴⁶ Omega-3 fatty acids also attenuate oxidative stress, inflammation, and fibrosis in settings of renal insufficiency and damage.^{47, 48}

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Chronic kidney insufficiency can lead to increased homocysteine levels due to decreased renal removal and impaired metabolism.⁴⁹ Homocysteine elevations are associated with an increased risk for ischemic heart disease, deep vein thrombosis, stroke, depression, and cognitive impairment.^{50, 51, 52} Supporting the body with B complex vitamins, in particular B6 with folate and B12 in their active, methylated forms, supports the reduction of homocysteine as deficiencies of these vitamins are another common cause of homocysteine elevation.⁵³

Solidago, commonly known as goldenrod, is a botanical known for its action on the urinary tract. It is classically used for urinary tract conditions including infections, inflammation, and prevention of kidney stones.⁵⁴ Solidago is rich in health-promoting compounds including flavonoids, phenolic acids, sesquiterpenes, diterpenes, saponins, and several caffeoylquinic acids.^{55, 56} Solidago acts as an anti-inflammatory, antimicrobial, diuretic, antispasmodic, analgesic due to these many compounds found within it.⁵⁷ Research has also shown that the flavonoids from solidago help activate GSH S-transferase, a critical enzyme in phase II detoxification, and that they do so in a dose-dependent fashion.⁵⁸

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04 Liver/Gallbladder



Topical castor oil to the abdomen and right upper quadrant of the liver, as previously mentioned, is very supportive for lymphatic drainage and detoxification support. One can easily perform a simplified castor oil pack by massaging castor oil into this region, applying an organic cotton cloth to protect other garments from the oil, and using the body heat to draw the oil internally. A warm water pack can also be applied for 15 – 20 minutes. However, heat is not recommended in the case of uterine fibroids, pregnancy, or excessive menstrual bleeding. Castor oil packs can be done daily.

Many molecules support the liver, including antioxidants such as vitamin C and E, phosphatidylcholine, lipoic acid, glutathione. Liver function is also enhanced by factors which support glutathione, such as selenium and N-acetylcysteine (NAC), which provides cysteine, the rate limiting amino acid in glutathione formation.^{59, 60} As with the kidneys, the liver relies on phosphatidylcholine, which assists the transfer of waste products out, nutrients in, and helps repair cellular membranes, protecting against fibrosis and cirrhosis.⁶¹ Botanicals such as turmeric, milk thistle, dandelion, and burdock root also have a hepatoprotective effect and support the liver's antioxidant status as well as glutathione and glutathione-S-transferase levels, which are critical for detoxification.^{62, 63, 64, 65}

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05 Gastrointestinal tract

In the gut there are a variety of issues which may need to be addressed to support detoxification. First and foremost: keep things moving. Digestive bitters are an excellent way to resolve constipation, as they stimulate gallbladder ejection, which promotes motility. Supplemental magnesium is a gentle and useful tool to promote elimination, and supports parasympathetic nervous system tone--which can be poor with the stress that toxicity and detoxification places on the body.

Because of the impact that gastrointestinal pathogens or gut dysbiosis can have on inflammation, immune activation, and detoxification, it is important to consider testing for the presence of pathogens or flora imbalances and overgrowth. There are a wide variety of tests which many companies offer that are capable of assessing for pathogens, flora balance, small intestinal bacteria overgrowth (SIBO), intestinal permeability, pancreatic function, and many other markers of health and inflammation.

There are many levels of intervention for poor gastrointestinal function and health. Cleaning up the diet, improving mealtime rituals (sitting to eat, avoiding electronics, chewing food thoroughly), and bringing in bitter foods and herbs is a great place to start. Include dietary sources of probiotics via fermented foods, fiber to support healthy short chain fatty acid (SCFA) levels (in particular colon-protective butyrate), and broad-spectrum antimicrobials if indicated. Support for the healing of the gastrointestinal mucosal barrier helps to get the gut back on track and thus detoxification as well.

Gentian is one of the strongest herbal bitters and is most often utilized in digestive bitter formulations. By stimulating bitter taste receptors, it stimulates a variety of digestive secretions including saliva and bile flow. It is a digestive toner and modulator of stomach acid secretion, improving function in a state of deficiency but also having a protective effect in settings of gastritis or gastric ulcers (possibly through prostaglandin pathways).⁶⁶ Gentian also acts beyond the digestive system. Gentian contains compounds that exhibit hypoglycemic, hepatoprotective, anti-inflammatory, antioxidant, antimicrobial, immunomodulatory, and adaptogenic properties.^{67, 68} As a liver protective agent, gentian has been shown to increase glutathione, glutathione peroxidase, and superoxide dismutase levels that were reduced by alcohol or acetaminophen-induced oxidative damage.^{69, 70}

Artemisia annua, also known as sweet wormwood, or Qinghao, has a long history of use against malaria and other parasites such as *Leishmania*, *Babesia*, and *Schistosoma*.^{71, 72, 73, 74} The primary active moiety found in *Artemisia annua* is known as artemisinin, or Qinghaosu in Chinese medical traditions.

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Artemisia annua has also been shown to have broad antibacterial, antifungal, and antiviral action. The essential oil of *Artemisia annua* has been shown to inhibit *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli*, *Escherichia coli* UPEC, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Candida albicans*, and *Candida krusei*.⁷⁵ Extracts from *Artemisia annua* have been shown to have antibacterial action against *Campylobacter jejuni* and *Clostridium perfringens*, two bacterium which are common causes of foodborne enteritis.^{76,77} Viral action has been demonstrated against cytomegalovirus, herpes simplex virus type 1, Epstein-Barr virus, and hepatitis B and C virus.⁷⁸

A biofilm is a matrix of extracellular polymeric substances (also known as exopolysaccharides) produced by microorganisms such as bacteria or yeast. This film serves to help the organisms adhere to surfaces, protect them as a unit, and is used as a network of communication, enabling the microorganisms within to sense the stress-state of their surroundings and shift gene activity to alter their phenotype and growth.^{79,80} The biofilm increases resistance of the microbial species to antibiotics, and to detergents in food-related or hospital settings.⁸¹ Nattokinase, a fibrinolytic enzyme, also has been shown to disrupt biofilms.⁸² Artemisinin derivatives also have been shown to impact biofilms which make infections such as *Candida albicans* resistant to treatment.⁸³

Terminalia chebula, also known as Haritaki, is widely used in Ayurvedic medicine and is part of the famous blend of three herbs known as Triphala, having a long history of use for a variety of digestive complaints. *Terminalia*, as a part of this combination, has been shown to play a role in healing the brush border membrane of intestine, as well as supporting the recovery of the intestinal phospholipid and glutathione content after medication-induced damage.⁸⁴ *Terminalia* also has been shown to protect the gastric mucosa, reducing the formation of gastric ulcers in various settings.⁸⁵

Removal of debris and toxins is always important when restoring microbial balance to the gastrointestinal tract. Drawing agents such as charcoal and pyrophyllite or bentonite clay (when taken internally) support the natural elimination of debris and toxins including endotoxin (LPS), metals, and unwanted microbial by-products through the intestines. However, because charcoal and clay may limit absorption of other nutrients, they ideally should be taken at least 1 hour away from other meals or other supplements and also must be taken with adequate water to prevent constipation. The internal use of charcoal and clay decreases Herxheimer reactions (also known as “die-off”), which may occur when taking microbial-balancing botanicals. Overall, this will support a well-tolerated cleansing regime.

If mercury is an issue, oral supplementation with thiol-functionalized silica will support the gastrointestinal tract and reduction of systemic mercury burden by removing this harmful metal. This highly purified silica has covalently attached thiolic metal-binding groups and is not absorbed in the gastrointestinal tract. Instead, it binds and eliminates mercury and other heavy metals accumulated in the intestines while simultaneously quenching free radicals. This also enhances Phase III detoxification--the critical system of transporters that ship toxins out of the cells and the body

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In closing

Finding the right balance of support from supplements is important, particularly for sensitive or toxicity-laden people. For these and a great many other reasons it is important that one work with an experienced practitioner and utilize well developed protocols and testing to guide effective detoxification. Quicksilver Scientific was founded for this very purpose: supporting you to achieve optimal health and function. These core values are what motivate each and every one of the supplements and protocols we develop, as well as the educational tools we provide for both consumers and practitioners.

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