

# Change

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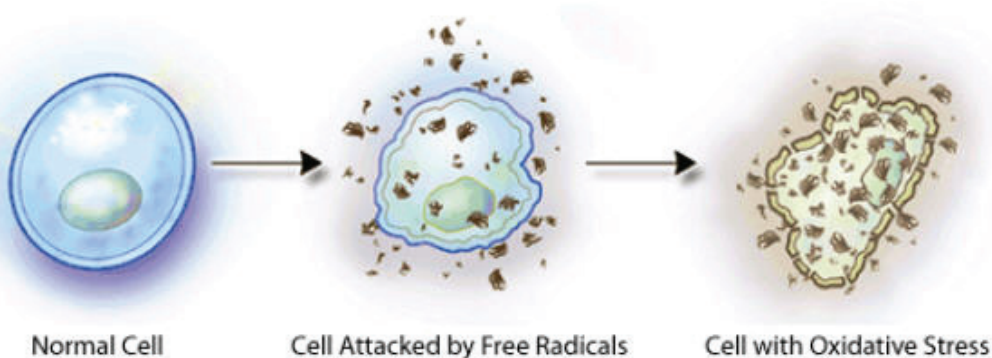
## How Toxins Affect Our Health

### Several Chronic Conditions Linked to Toxicity

It has finally happened. I have become one of those people who talks incessantly about toxins. I used to think "those people" who spoke about, lectured about, and went "on and on" about toxins were boring drones, or at least too esoteric for me to relate to. But underneath these more defensive emotions lurked fear and repulsion. Quite honestly, I didn't want to know about toxins. I am an optimist to the core, and I would prefer to ignore ugly topics. However, the more I read, learn, and understand about toxicity, the more I feel compelled to talk about it. Now I find myself talking about toxicity with every patient that I see, even every friend that I meet, all day long, every day of the week. Sigh.

It's not my fault, really. I am a doctor and I went in to medicine to help people. The saying among my colleagues when I was a resident was that we went into medicine "to stamp out disease and pestilence." If that is true, then it certainly makes sense to start with the leading causes of death and disability in the United States - and guess what? Several of them are chronic conditions that can be linked to toxicity. According to the Center for Disease Control, the top ten list includes heart disease, diabetes, cancer, obesity, and arthritis. If I truly want to help people become well and stay healthy, of course I need to talk about diet and lifestyle, but I also need to talk about toxins. And it is not just that I have become an "out there" doctor. For this topic I am fully able to turn to some of the most conservative pillars of knowledge in the world of

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healthcare. For example, the New England Journal of Medicine, one of the most prestigious journals in the medical field, published an article in October of 2004 linking traffic-related air pollution to an increased risk of heart attacks. The authors state, "An association was found between exposure to traffic and the onset of myocardial infarction within one hour afterwards." The National Centers for Biotechnology Information, the American Heart Association, the Center for Disease Control, and the National Center for Health Statistics

have all issued statements regarding the increased risk of heart disease with pollution. With so many heavy hitters putting their weight into the ring, it boggles my mind that it doesn't feel like there is a fight going on.

### How Toxins Affect Our Health

To truly understand how toxins affect our health we must first take a closer look at

what makes us healthy on a cellular level. Our health on a molecular level comes down to the ability of our cells to fight free radicals and oxidative stress. But what exactly does that mean? As with people, electrons like to be paired. Free radicals are unpaired electrons that are looking for a partner and often find one by stealing an electron from the atoms that make up the cells of our bodies, such as the atoms in proteins or in fats. This leaves the body's electrons unpaired, which damages the protein or the fat that the electron was stolen from. Essentially free radicals punch holes in our proteins and in our cells, making them leaky and structurally unsound. This process is called oxidative stress. The worse kind of oxidative stress is free radical damage to DNA, because damaged DNA leads to producing cancer cells rather than healthy cells. If the body has antioxidants on board such as vitamin C or Coenzyme Q10, the damage can be repaired because the antioxidant will donate an electron to the atom in the cells and the cell will now be whole again. The most powerful of all of the antioxidants is glutathione.

*Continued on Page 2*

Continued from Page 1

## How Toxins Affect Our Health

thione. Glutathione is needed by every cell in the body to clean up the damage caused by free radicals. As we age and as we are exposed to toxins, less glutathione is available to the cells which accelerates the wearing down of the body.

### Free Radicals

Reactive oxygen species, or ROS, are compounds that contain oxygen and have free radicals in them. Oxygen is an example of a molecule that can become a free radical when an extra electron is attached. It typically has four electrons, but if a fifth electron comes along it is turned into superoxide, which is a ROS. Our bodies are

designed to handle ROS because ROS are produced as our cells make energy. They are like factories, producing both product, in the form of ATP, and waste, in the form of ROS. Our bodies clean up this waste with antioxidants like glutathione. ROS are also used in the body by the immune cell to fight off foreign invaders. An example of this is hydrogen peroxide (essentially bleach), which is spit out by the cells of the immune system onto either bacteria or cancer cells in order to punch holes in their cells walls and destroy them.

### Heavy Metals

Reactive oxygen species can also be produced by toxins in the environment. Lead, for example, produces ROS that particularly damages the lining of the arteries. This essentially makes the arteries less compliant and less able to relax as they pump blood through the body, which leads to the stiffness and tightening of the arteries – the fundamental problem that

causes hypertension. A study published in Current Hypertension Report in 2004 showed that chronic low lead exposure caused hypertension in both humans and animals through several different mechanisms, not only by increasing ROS. Lead exposure also increased norepinephrine, one of the body's stress hormones, and decreased several other hormones

that helped to keep the arteries relaxed and compliant. Additionally, an article published in the journal Environmental Health Perspectives in 2006, found a significant association between blood levels of lead and elevated homocysteine. Homocysteine is an amino acid that increases when the body is not able to properly clear toxins. It damages arteries as it travels through the body, and elevated homocysteine levels have been closely linked not

only to an increased risk for heart disease but also dementia.

Finally, elevated lead has also been linked to an increase in the metabolic syndrome – the triad of hypertension, diabetes, and high cholesterol - in the Veterans Administration's normative aging study. In this study men with the metabolic syndrome were found to have higher levels of lead in their bones, which was statistically significant because all other major differences in the men were accounted for. It is understood that because lead depletes glutathione levels through the formation of ROS, it will produce an inflammatory response. As many of you have read in my past newsletters, inflammation is the cause of all of our modern-day diseases, including diabetes and hypertension. ROS also damage cholesterol, leading to oxidized LDL – the very worst kind of LDL to have in that it has been most closely linked to heart disease.

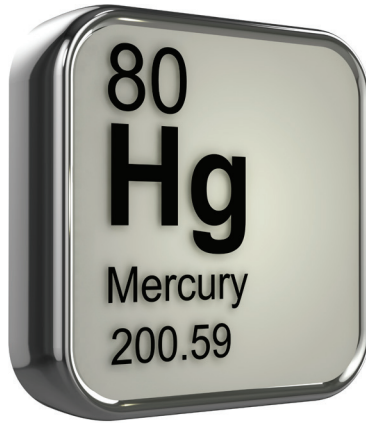
The other heavy metals that have been linked

to the metabolic syndrome are arsenic and mercury. Arsenic, interestingly enough, actually interferes with the expression of genes in the cells in the pancreas that produce insulin, thereby increasing the risk for type 2 diabetes. Arsenic also disrupts cellular energy production. It prevents the mitochondria, which are the "powerhouses of the cells," from making those molecules of energy called ATP. Essentially, arsenic prevents the factories of our cells from making energy and increases how much waste is produced. Since arsenic will also increase free radical production, it causes our cells to have factories that make waste, not energy, and be unable to even clean up the waste. Arsenic interferes with sugar and fat metabolism, increasing the likelihood of fatty liver. Arsenic also increases the stickiness of platelets in the blood, which increases the risk for heart disease and stroke.

### The Role of Mercury and Heart Disease

Mercury has also been linked with heart disease. Several studies demonstrate the role of mercury in the development of heart disease, hardening of the arteries, and heart attacks. Mercury has also been shown to also play a role in the development of oxidized LDL. Oxidized LDL is LDL that has been damaged by free radicals. We now know that it is not our native LDL that causes arterial plaque, but oxidized LDL that is truly linked to heart disease. Mercury has also been linked to hypertension. The National Health and Nutrition Examination Survey found that for each 1.3 mcg/L of mercury in blood, blood pressure increased by 1.8 mmHg. That is almost two points increase in blood pressure for every 1.3 micrograms of mercury. Yikes.

Mercury is particularly devastating to the



Continued on Page 3

Continued from Page 2

## How Toxins Affect Our Health

body because it irreversibly binds to a class of enzymes called selenoenzymes. These enzymes are needed to make glutathione – that all-important antioxidant. Any tissues that use a lot of oxygen during metabolism will be particularly damaged by mercury. This of course includes not only the heart but also the brain. Mercury is also a neurotoxin and has been linked with Alzheimer’s, Parkinson’s, and autism. Mercury interferes with the microtubule structure of the brain, increasing the release of neurotransmitters such as acetylcholine, serotonin, dopamine, and norepinephrine, making us feel irritable and anxious. Sound familiar?

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If all of that is not bad enough, perhaps the most insidious role of mercury is prenatally. Babies who have been exposed to mercury in utero have difficulty making neurons so that they can’t form healthy brain matter. Several studies have linked maternal exposure to mercury to cognitive and motor deficits in children that last into adulthood. Children in the Faroe Islands who were exposed to mercury in the prenatal period had defects in attention, memory, language, and motor function. Changes caused by mercury poisoning result in significant clinical deficit in motor skills, coordination, and general activity rate of cognitive and psychological disorders. With all of this information about the damaging effects of mercury, why on earth do we still use thimersol (ethylmercury) as a preservative in flu shots and recommend them to pregnant women and small children?

This is perhaps the scariest part of toxic-

ity – that it is generational. I certainly feel outraged that toxicity is linked to diabetes, hypertension, heart disease, and the metabolic syndrome, but I feel utter horror that the effects of toxins are not just seen in adults who have been exposed to toxins, but they are seen in the offspring of women who have been exposed. This is true for heavy metals and also for PCBs – polychlorinated biphenyls. We all know that production of PCBs in the United States has been banned since 1979; however, PCBs belong to a group of toxins called “persistent organic pollut-

ants (POPs),” meaning that they last in the environment for 20 years or more. POPs are stored in fat and act as endocrine disruptors, affecting our hormones in a few different ways. They act as “xenoestrogens” meaning they mimic estrogen in the body, and they suppress thyroid hormone. These actions lead to increased inflammation, which of course leads to heart disease, diabetes, and cancer, but also lead to the other top causes of disease and mortality – arthritis and obesity. In the setting of prenatal exposure, PCBs have been shown to cause behavioral problems in children and reduced

scores in all areas of cognitive testing. This one will hit close to home – in a study of in utero PCB exposure in the Great Lakes area, cognitive deficits were seen as early as seven months and followed as long as eleven years. At the age of four cognitive speed was slower and at the age of eleven children exposed to PCBs had lower IQ scores, poorer reading skills, memory problems, and attention deficit. Sadly, the levels of PCBs in the mother’s blood was not much higher than what is considered to be normal background levels.

And that is if a woman can conceive at all with toxins in her body. Study after study of women exposed to toxins of all classes show higher rates of infertility, higher preterm delivery rates, higher birth defect rates, lower birth rates, higher rates of spontaneous abortions, and higher rates of stillbirth. This is true for heavy metals,

Continued on Page 4



Continued from Page 3

## How Toxins Affect Our Health

PCBs, industrial agents such as solvents and petroleum products, and pesticides and insecticides. There are also numerous studies showing that lead and cadmium toxicity reduce sperm counts. PCBs have been linked to male sterility. Phthalates, commonly found in plastics, have been shown to damage DNA in sperm, reduce sperm motility and decrease the concentration of sperm. Higher levels of phthalates in sperm were found in samples from men at an infertility clinic, and the higher the phthalate concentration, the more abnormally shaped sperm there were.

### How Do We Avoid the Toxic Soup We Live In?

So what do we do about this toxic soup we live in? Avoidance, avoidance, avoidance! Buying organic really does make a difference. Studies show that children who were fed an organic diet had dramatic reductions in toxins, especially pesticides, after just one day, and after two weeks the levels were virtually non-detectable. Buying organic can be pricey, but the long-term health consequences of non-organic, to me, seem even more expensive. Still, one can turn to the environmental working group's (EWG) list of the least toxic ("clean fifteen") or the most toxic ("dirty dozen") fruits and vegetables to have a better sense of how to make one's dollars count the most. While we all know that there are no absolutes, and that even the "clean fifteen" will have toxins, at least it is a place to start if you are on a tight budget. Sadly, the number of pesticides allowed in organic foods has just risen to twenty-eight from seventeen, thanks to the lobbying efforts of big business. They know that organic foods are now so popular that the organic market is a big money maker.

Another study in Beijing showed that blood levels of common air pollutants from traffic decreased ninety-five percent

by just wearing one of those 3M face masks. I always thought the people I saw wearing face masks were a little goofy and paranoid, but now I know they are brilliant! Air and water filters in the home can also be helpful to avoid toxins. However, they both have their challenges. Most common air filters are so leaky that they don't effectively remove all toxin particles from the air. Air filters that can do this are fairly costly, such as the IQ air filter which costs about \$1000. If you can afford this, having one at least in your bedroom where you spend the most amount of time in the house is beneficial. With regards to water filters, there are so many levels of water filters that one can get a little crazy trying to sort it all out. At the very least you can have a simple PURE water filter on the kitchen faucet, and at the very most you can install a whole house water filtration system. Any step in the right direction is a good one. Finally, watching what you put your food in can affect toxin levels as well. We all know about using glass rather than plastic for drinking bottles and storage containers to avoid plastics. Cooking on stainless steel or cast iron rather than Teflon or other artificial coatings is important as well, and especially avoiding cling wrap and minimizing aluminum foil.

### Clearing Toxins from the Body

On the other side of avoiding toxins is maximizing the body's ability to clear them. The liver needs an abundance of B vitamins to help clear toxins, so taking a B-100 complex with additional B12 will help lay the foundation for liver support. The liver also needs to be able to make glutathione which requires not only the active form of B6, called pyridoxal 5 phosphate, but also B2, folate, B12, magnesium, and the precursor of glutathione, N-acetyl cysteine (NAC). NAC is typically the rate-limiting step in the formation of glutathione, so taking 600mg twice a day gives the body a boost in its ability to detoxify. NAC has been shown to reduce inflammation in arteries as well, so that it helps with hypertension, heart



disease, and even dementia because it is able to cross the blood-brain barrier and clear inflammation in the brain. Magnesium is something that virtually no one has enough of. Supplementing with 400 to 800mg of magnesium citrate daily not only helps with detoxification, it also helps the body make more ATP. Finally, load up with anti-oxidants! Vitamin C, CoQ10, Vitamin E, along with lots of green leafy vegetables will support the body's ability to nullify those free radicals.

I think that the reason I didn't used to like "those people" who talked incessantly about toxins is because it is such an overwhelming topic. Sadly, environmental toxins are here to stay. They are waging a full-out war on our bodies and if we are truly going to change the top ten causes of disease we must give as much consideration to toxins as to diet and lifestyle.