What We’ll Be Covering Today

Welcome to Module 10 Lesson 3 Today we will review the top seven most hazardous substances along with the heavy metals found within them. We’re going to discuss how they affect human health, how to detect them, and how to get rid of them.

Each Person is Unique

First we need to understand that each person is unique. There’s a high level of variability, sensitivity and tolerance associated with toxic metals. For example, you and I might have the same amount of toxic metals in our body but it may be too much for me but not for you.

This is known as our personal level of intolerance or the toxicant-induced loss of tolerance. It’s kind of like the bucket theory we discussed in an earlier lesson. When your bucket becomes too full you cannot tolerate additional toxic load.
Top 7 Hazardous Substances

This top 7 come directly from the Agency for Toxic Substances and Disease Registry. In order they are as follows: arsenic, which is a non-metal often found with other metals, lead, mercury, vinyl chloride; polychlorinated biphenyls, benzene, and cadmium. Out of this list we will review arsenic, lead, mercury, cadmium and we will also look at aluminum, which is not on this list.

Arsenic

More and more we are seeing high levels of arsenic contamination in our water, air, soil and many foods like rice, chicken fed with roxarsone, and well water. Prior to 2003, arsenic was used in the production of wood preservatives. Thankfully, they have been phased out for certain wood products. Sawing or sanding, wood-treated with arsenic preservatives will generate arsenic-contaminated sawdust. I am sure there are some old contaminated pieces still lingering around the world.

The fact that arsenic has become significantly high in our food and water supply is viewed as the largest current calamity of chemical poisoning in the world. This is what one of the researchers from the Journal of Environmental Chemistry said about this issue. Arsenic also crosses into the placenta and breast milk. Actually, this is true for most of the heavy metals we will cover.

Arsenic is also found in smog due to the combustion of fossil fuels. This picture shows smokestacks. Part of the residue coming out of those stacks is arsenic. The Canada main urban air arsenic levels are up to 17 ng/m3. USA is about 30 ng/m3. The level is generally highest in urban and industrial centers.
Health Effects

It’s tough to really quantify the affect environmental arsenic has on us as human so what I’m going to do is present the health effects of arsenic in general and then hopefully you’ll just avoid it as best you can.

First, we have to understand that it’s well-absorbed both oral and through inhalation. Inorganic arsenic undergoes methylation primarily in the liver, which as we learned last lesson, means it accumulates in skin, bone, hair, and nails. Organic arsenic is generally less toxic and excreted in the urine.

As you will see, there are different forms of metals like organic, inorganic, and different types of the compounds. I’ve broadly grouped them into one category, take arsenic for example; there are both organic and inorganic forms. Organic arsenic tends to be a little bit less toxic.

No matter what type the toxic metal is it will be detoxified primarily through the liver which can cause liver toxicity. Inhalation of arsenic may cause respiratory irritation, nausea, skin effects, and increased risk of lung cancer. Acute, high dose of oral exposure may cause nausea, vomiting, diarrhea, cardiovascular effects, night blindness, and encephalopathy, which is an inflammation of the brain.

Long-term oral exposure to low levels of inorganic arsenic may cause hyper-pigmentation and hyperkeratosis, which is shown in the pictures. Corns and warts can also be a side effect. Peripheral neuropathy; which is the
numbness and tingling advanced diabetics can experience, increased risk of skin cancer, bladder cancer, and lung cancer.

Measurement of urinary arsenic levels is generally accepted as the most reliable indicator of recent arsenic exposure and I'll tell you how you can get tested a little later in the lesson.

Arsenic also inhibits metal detoxification. This can become problem if you have been exposed to heavy metals and arsenic since it inhibits your body’s ability to get rid of those metals. It also has a high affinity for selenium. We know that selenium’s a very powerful antioxidant, arsenic literally disables it. It disrupts mitochondrial function, which inhibits the energy production our cells need. It inactivates cofactors in many metabolic and enzymatic processes. Zinc deficiency may also exacerbate arsenic toxicity which is a problem since many people are zinc deficient.
Mercury

You’ve probably heard more about mercury than any other heavy metal toxicity. Surprisingly there are still many industrial, commercial, and dental medicinal uses for it. Dental amalgams are probably the most prevalent form of methyl mercury. Amalgam is in silver-colored dental fillings, so if you have silver fillings, you’ve got some mercury in your teeth. It contains approximately 50% metallic mercury, 35% silver, 9% tin, 6% copper, and trace amounts of zinc. Estimates of the amount of mercury released from dental amalgams range from 3 to 17 mcg/day, contributing up to 75% of your total daily mercury exposure.

This would be, obviously, there’s a huge variance from 0% to 75%, but realize that if you chew on very hard-things like ice it can release mercury vapor from your fillings. You can’t even detect this through the naked eye, but we know that this is what’s happening. 78% of Americans have dental fillings, and 95% of people with disorders of the central nervous system, such as multiple sclerosis, epilepsy, paralysis, and migraines also have silver dental fillings. That’s a huge correlation.

Some vaccines, like the flu vaccination thimerosal, also contain mercury, and that’s why there’s been a big uproar about vaccines leading to problems with the central nervous system. Over-the-counter products such as antiseptics, laxatives, diaper-rash ointments, eye drops, nasal sprays, and cosmetics all contain varying degrees of mercury, generally in the form of methyl mercury.
Routes of Action

We can ingest mercury generally in the form of methyl mercury. This is the form most easily absorbed through the GI tract where 95% of it is absorbed, which is not good. For instance, after you foods that are contaminated with methyl mercury, it enters your bloodstream and goes rapidly into other parts of your body. If inhaled, about 80% of the vapors enter the bloodstream from the lungs and then onto other parts of the body, including the brain and kidneys.

Mercury can stay in your body for weeks or months. When it enters the brain, it’s readily converted to its inorganic form and can get trapped for a long period of time. Mercury in the blood of a pregnant woman can enter her developing child. Again, all this stuff can be transmitted through the fetus, many times through the breast milk, and it’s not good. The problem here is that it resides in the nervous tissue. Even though there’s debate as to whether toxicity is doing bad things or not we honestly don’t have enough long-term data to know. Most of the mercury will accumulate in your kidneys, though, but can also accumulate in the brain. It can lead to kidney disorders and detoxification, because kidneys are involved in detoxification.

When methyl mercury does leave your body after you’ve been exposed to it, it leaves slowly over a period of several months, mostly in the feces. This is another really important reason to take in a good amounts of fiber and to make sure you’re regular because if this stuff needs to be evacuated through feces. If you’re not going to the bathroom properly this stuff is just going to recirculate in your bloodstream.

Mercury in Food

You’ve probably heard of mercury being found in fish and seafood. Methyl mercury is produced by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methyl mercury that these small organisms make. Sharks, swordfish, large tuna, and sea bass have the highest levels of mercury due to bioaccumulation. They eat smaller fish which eat smaller fish which eat smaller fish. All of that bioaccumulates and if you eat these big fish, you’re going to be taking that in as well.
Lower levels in some medium to smaller fish, for instance, sardines and anchovies are probably the best—flounder, haddock, herring and salmon. Salmon is also a little bit on the lower side of methyl mercury, even though a lot of people talk about it being on the higher side. It’s actually kind of low to moderate, but, again, you don’t want to overdo this stuff. According to the FDA, pregnant women and small children under six should not eat more than two servings of fish each week and should only eat those fish with low mercury content. I would actually just recommend that for people in general. There’s no reason we need to be eating shark and swordfish.

**Health Effects in Mercury**

The Health effects of mercury depend on the form, dose, presence of synergistic metals, for instance, lead and cadmium; presence of deficiency of important sulfhydryl-bearing compounds, such as glutathione, which is a really important detoxifying antioxidant agent in ourselves, the amount of protective nutrients—zinc, selenium, vitamin E. Do we have any concurrent conditions, immunosuppressive diseases? Do we have an autoimmune condition? Or have we exceeded our toxic tolerance?

Having said that, here are the main effects with mercury. We know that the brain and nervous system are very sensitive to mercury. It’s a long list of neurological symptoms: speech impairments, motor-control problems, it goes on and on. Developmental issues: it passes through the breast milk and placenta, effecting the fetal and newborn development. It is also linked to autism. Gastrointestinal effects: it damages the stomach and the total intestinal tract. May lead to autoimmunity in susceptible individuals. Visual impairments, obviously in the eye area. Urinary system and kidneys; again, very susceptible to mercury accumulation here. We’ve seen that there’s an increased incidence of heart attacks in those with high levels of mercury in their bodies.
Mercury and Autism

There’s a lot, a lot of research; a lot of debate on this subject. A big review of the medical literature and U.S. government data suggest the following about this mercury and autism link. Many cases of autism are induced by early mercury exposure. This actually was looking specifically at flu vaccine thimerosal. What they found was that many cases were induced by early exposure to mercury an early inoculation with this vaccine. This type of autism represents an unrecognized mercurial syndrome at the time, and genetic and nongenetic factors established a predisposition, meaning thimerosal only affects some children. Again, there’s a huge amount of debate about this. You’ll find research that says yes, others that say no. You can find meta-analyses and reviews that say yes; others say no. I’m generally going to err on the side of caution in saying that if you have mercury sitting in your brain; it’s probably not a good thing.

Here’s a direct quote from the Journal of Developmental and Physical Disabilities in 2011: “Correlational data reveal that autism rates are higher in areas of greater pollution levels, and autistic individuals exhibit biological evidence of mercury toxicity. Further, oxidative stress and decreased antioxidant activities are manifested in individuals with autism. Taken together, available evidence supports a methyl mercury-induced oxidative stress model of the disorders for at least some sufferers.” We’re seeing that mercury somehow comprises glutathione levels making these individuals unable to deal with oxidative stress. This can lead to a host of issues, autism being one of them.
Lead

Major sources of lead include lead-based paint, which thankfully has been discontinued, leaded gasoline, which has been discontinued except for the airlines, which still use leaded gasoline; lead-contaminated water; manufacturing of lead batteries; rubber products; glass; and lead oxide fumes that result when demolishing industrial buildings.

The problem is that even discontinued sources of lead show up in the environment still. Leaded gasoline was discontinued more than a decade ago but what do you think happened to all the little drops of gas that accidentally dripped out of the nosal or spilled on the ground at the pumps? If you compound that by all the gas stations across the world that had leaded gasoline at the time, you get a runoff into the groundwater and that is a problem.

An estimated 64 million homes in the U.S. still contain lead paint. This can be ingested in flakes or inhaled as a microscopic dust without even knowing it. This picture is an example of lead paint peeling off the side of a house. It’s not that you’re going to go and eat this stuff but if it is peeling it could perhaps, fall into your food, and you don’t even know, you can’t even see it.

**Lead in the Body**

When inhaled, approximately 95% of deposited inorganic lead is absorbed. Inhalation of lead is the big one here. The problem in terms of exposure is really through inhalation.

The extent and rate of GI absorption of inorganic lead is influenced by the physiological state of and the species of lead compound. Generally, absorption rates in the GI tract are higher in children 40% to 50%, adults, 3% to 10% percent, and the presence of food decreases that further. You can see there’s a huge difference between inhalation and absorption through the GI tract. Inhalation, obviously, is much more problematic.
Health Effects

It leads to colic in children; elevated blood pressure; decreased glomerular filtration rate which affects the kidneys, encephalopathy, peripheral neuropathy; neural behavioral and neural psychological effects in adults; cognitive and neural behavioral effects in children; autism, ADHD possibly; and reduced fertility.

Tips to Reduce Lead Intake

First you need to make sure you are not adding lead to your food, do not store food in open cans, especially imported ones. It seems that imported cans contain lead while domestic ones don’t. So if you open up a can of chickpeas or tomatoes and you have some left over, put them in a Tupperware container or a glass jar, do not store them in the can, because the can oxidize and leach some lead into the food. Do not store food in pottery; it’s only for decorative use.

Do not eat or drink food or beverages in lead crystal. Fruits and vegetables that you’ve raised in your own harm garden may contain lead if you’ve grown them in lead-contaminated soil, so you want to check for that if you can. Lead may also be found in plants sprayed with insecticides containing lead. You want to test the soil if you can and be sure there’s no lead in there. If lead is found, find another location for the garden or replace the soil.

Do not raise or eat fruits and vegetables grown along roadways or near house foundations. The soil near roads and near the home can contain lead in high concentrations due to lead-based paint or leaded gasoline runoff. As a general rule of thumb, wash all fruits and vegetables carefully, thoroughly, remove all soil from it. Also, be sure that the soil is washed down the drain so that the lead does not contaminate other food in the kitchen. Capiche? Pretty simple stuff, right?

The sad part is we can’t avoid the fact that we live in a toxic world; we just have to do our best to reduce our intake and help our bodies detoxify naturally.
Aluminum

Small amounts of aluminum are released into the environment from coal-fired power plants and incinerators. That’s mainly how it gets out into our environment. As with other elements, aluminum is absorbed and accumulated in the body and has been linked to serious illnesses, including osteoporosis, extreme nervousness, anemia, headaches, decreased liver and kidney function, forgetfulness, speech disturbances, and memory loss. It has also been widely associated with Alzheimer’s disease. People who’ve died from Alzheimer’s have been to have four times the average amount of aluminum accumulated in the nerve cell sin the brain.

Common Sources

Common sources: foods, mainly flour, baking powder, coloring agents, anticaking agents, and additives. You’ll notice that all of these are very common in baked products, wheat-based products. Yet another reason to avoid that kind of garbage. The average adult in the U.S. eats about 7 to 9 mg of aluminum per day in their food. Whether that is problematic or not is debatable based on the source you read.

Another common source is water, antacids, astringents, buffered aspirin, antiperspirants, cosmetics, aluminum cookware, and aluminum foil. I wouldn’t recommend using aluminum cookware, really; there are better options, safer options. Again, it’s debatable. Authorities at the EPA and other agencies say that the levels of aluminum in aluminum cookware is far below the risk levels
for humans, but it’s better to avoid it if you can. That’s not to say that using Teflon is any better; Teflon is *definitely* not better. That’s a bad chemical that we haven’t even talked about either.

**Antiperspirants**

Antiperspirants, prevent perspiration, which is a totally unnatural thing to occur. People are more concerned about not having pit stains than they are about clogging their sweat glands or causing tumors or cancer in the breast area. The problem with these antiperspirants is that they contain aluminum, which is absorbed through the skin, into the blood. Deodorants aren’t as bad because they still allow you to perspire, but, again, if they contain some level of aluminum, I would stay away from them. What I would recommend is use a crystal instead. The crystal uses; I believe its potassium alum. Don’t quote me on that, but I believe that’s what it is. It’s a naturally occurring crystal, kind of rock, that doesn’t prevent your body from sweating. Sweat doesn’t normally smell; it’s just water and salt, pretty much.

The problem is that we have bacteria on our skin, which off of our sweat producing by-product that smell. What deodorants do is try to eliminate that bacteria, obviously not in a natural way. The crystal is naturally occurring antimicrobial agent which allows you to sweat, but you don’t smell because it’s taking care of the bacteria in your sweat glands.

**Health Effects**

Workers who breathe large amounts of aluminum dust can have lung problems. The use of breathing masks can be obviously a beneficial thing in factories. Some studies show that people exposed to high levels of aluminum may develop Alzheimer’s disease; other studies show that this not necessarily true. I generally err on the side of caution, and I’m kind of the opinion that this stuff does cause problems, whether it’s Alzheimer’s or something else with the central nervous system.
Again, there are a lot of studies to show that, here’s exactly what aluminum does at the cellular level in the brain, so there obviously are some effects. Any toxin that resides in your brain will have an effect, so anything that cross the blood-brain barrier, not a good thing. You definitely want to minimize it.

**How to Avoid**

You really can’t avoid aluminum because it’s so common and widespread in our environment. Exposure levels of aluminum that are naturally present in food and water and the forms of aluminum that are present in dirt and aluminum pans are *supposedly* not considered to be harmful. I stress *supposedly*. Is there really a safe form of poison?

Eating large amounts of processed food containing additives or frequently cooking acidic foods in aluminum pots may expose a person to higher levels than consuming unprocessed foods and using pots made from other materials, like stainless steel or glass. Also limit your intake of large quantities of aluminum-containing antacids and buffered aspirin.
Cadmium

I put these pictures of batteries here because they are one of the major uses of cadmium. It’s a naturally occurring metal that can be found in food: lettuce, spinach, potatoes, grains, peanuts, soybeans, and sunflower seeds are the most highest-containing ones. It’s also present in water and cigarette smoke.

The previous metals that we looked at are classified as not-known carcinogens. It means that they have not been shown to cause cancer in humans. Cadmium has been shown to cause cancer in humans. It harms DNA directly and it disturbs a DNA repair system that helps to prevent cancer. I would argue that it probably has something to do with the methylation pathways as well, hence this DNA repair system, which methylation is part of.

Cadmium is used in mainly batteries, 83%, pigments, coatings, and platings, and stabilizers for plastics. This accumulates in aquatic organisms and agricultural crops. As you can see, all this stuff we’re talking about here is the result of an industrialized world. All the exposure that we’re now experiencing is coming as a result of really industrial uses of this stuff. It’s not like we’re just injecting it into our food; it’s the result of being present in the smog or runoff into groundwater from plants and the way things are burned. It’s all a result of the industrialized world we live in. We can’t avoid this stuff.
Again, as I just said, it’s released into the air from mining industries, burning coal, household waste, where then it binds the soil particles, dissolves in water; fish, plants, and animals then accumulate this. Highest levels are found in shellfish, liver, and kidney meats. If you eat organ meats like pate, liver, stuff like that, just be aware of this.

We’re not only exposed to cadmium through food, but also through drinking contaminated water and breathing cadmium-contaminated air, such as near burning waste, battery manufacturing; metal soldering; or welding. Like other metals, it stays in the body for a long time and accumulates after long-term exposure to even low levels.

**Cadmium and Smoking**

Don’t do what this guy’s doing. Don’t bust out a wheel of cigarettes and try to smoke ’em all at once. Although, if your kids smoke, I would maybe encourage them to do that, because they’d probably be turned off in a second. Tobacco leaves accumulate high levels of cadmium from the soil. On average, smokers have four to five times higher blood cadmium levels and two to three time’s higher kidney cadmium concentrations than nonsmokers. If you smoke, you’re doubling your risk of cancer more or less, whether it is from the tobacco or something in there or the cadmium itself.

**Health Effects**

Breathing air with high levels of cadmium can severely damage the lungs, build up in the kidneys, and may cause death. Ingesting it in high levels can severely irritate the stomach, leading to vomiting, diarrhea, and sometimes even death. Lower levels over a prolonged period of time can lead to buildup
in the kidneys and can also cause bones to become fragile and break easily. As I mentioned, the U.S. Department of Health and Human Services and the EPA have determined that cadmium is a human carcinogen.

**How to Avoid It**

First of all, don’t smoke; that’s a pretty simple one. Second, check into any local fishing advisories before consuming fish or shellfish from local waterways. Avoid hazardous waste sites; dispose of nickel cadmium batteries properly; recycle old batteries whenever possible; good occupational hygiene for those who work in cadmium-emitting industries, for instance, bathing and changing clothes before returning home may help reduce cadmium transported from the job to the home. It reminds me of *The Simpsons* cartoon where Homer, in the introduction kind of thing they have on the show, he’s leaving the power plant, the uranium or plutonium ends up in his back pocket and he goes home. It’s still in his back pocket, I think, or it falls out of his car. Just take care of it before you come home to everything.
Getting Tested for Heavy Metals

We’ve talked about five common heavy metals and some problems. The easiest way to test your levels is a hair element analysis which is generally a good indicator of excessive exposure to toxic metals and/or elements over the past 2 to 4 months. Remember, your hair takes time to grow, and it’s going to bioaccumulate elements, minerals, stuff like that in the hair, so as the hair follicle grows, the closest to the scalp will be the newest, and the farthest away...
will be the oldest. You can get a general read of what’s happened over time. And you can also screen for physiological excess deficiencies or maldistribution of certain other elements, minerals, stuff like that.

Here’s an example of a hair-element analysis readout from an individual who lived under a flight path in New Zealand. You can see that living under airplanes landing is probably not the best idea based on the chemicals that they’re emitting. Aluminum, in the 100th percentile; all of these very elevated. Mercury very elevated. Barium we haven’t talked about. Just very, very high levels of all this stuff.

And then looking at some deficiencies down here in the magnesium area, zinc, that’s a big one. This is generally what a readout would look like of a hair-element analysis. You could also do a fecal-element analysis. Most acutely ingested or inhaled metals end up in stool via direct pass-through. The bile binds to them in the small intestine and then kind of excrete them through the large intestinal tract.

Unprovoked urine toxic metals analysis. There’s also the provoked urine toxic metals analysis. You can just ask your doctor about this, unprovoked versus provoked. Provoked basically means that you just kind of test your system with a specific agent to provoke a response. This is an excellent tool to assess for acute exposure, again, to toxic metals such as arsenic, cadmium, mercury, and lead, as well as essential elements like copper, zinc, and selenium.

**Removing Heavy Metals**

How do you remove them from your body? If you’re seeing a naturopathic doctor, I’m sure they will assign various supplements to you which contain various compounds to assist in this. Chelation therapy is often used by naturopathic doctors. Medical research shows that there’s really no validity for using chelation therapy; however, there’s a lot of support for it, so you may want to check with your naturopathic doctor about that if you want to do that.

Supplementation with L glycine at about 40 mg/kg/day helps to release metals into the urine. If you weight 80 kg, you’re looking at 80 mg of L glycine. Glutathione via aerosol or IV. Since metal exposure depletes glutathione
which doesn’t really get absorbed; that’s why aerosol or intravenous has been shown to be effective. Oral N-acetylcysteine at about 1200 mg/day. This helps to indirectly raise glutathione levels. And detoxification is a *must*.

We’ve seen that we live in this polluted world. We live in smog, chemicals, and all this stuff. We can’t escape it; all we can do is fortify our defenses and clean our bodies out regularly.
Some glutathione precursors are, cruciferous veggies, asparagus, avocado, walnuts, oranges, tomatoes. Again, a whole-foods diet is going to give you all this good stuff. Whey protein, has shown to be a very powerful precursor to glutathione. Garlic and MSM are very high in sulfur, which assists in detoxification.

Selenium and zinc, because they’re obviously important antioxidants: Brazil nuts for selenium, pumpkin seeds, oysters for zinc, or supplementally you could take either one or both. Cilantro either as an herb or supplementally. Supplementally in a tincture form, which obviously would be a lot more powerful and concentrated, specifically helps remove mercury, so cilantro’s really, really powerful.

Eat lots of fruits and veggies, even if they are contaminated or not organic, you’re going to be getting compounds assist your body’s ability to detoxify metals and pesticides.

Heavy metals tend to stick around when there is a higher viral or bacterial load in the body. When you have more bacteria, more viral stuff hanging around in your body, those tend to hold on to heavy metals inside your body. Supplementing with probiotics or eating fermented foods is a great way to counteract that and reseat, reestablish a healthy gut flora.
Conclusions

We don’t know the full extent to which heavy metals impact our health, but it’s mostly negative. Be a smart consumer and view cleansing as a daily practice that can be achieved by eating clean. Do the things you can to avoid these heavy metals—don’t smoke, you’ll avoid cadmium; recycle your batteries properly; you’re going to help yourself, as well as the rest of the world not have to deal with cadmium runoff from poorly recycled batteries—stuff like that. Choosing foods that are clean, that are detoxifying are going to help your body out dramatically. Those are some things that you want to think about as you move forward.
Coming in Lesson 4

In Lesson 4, we will discuss fasting, fat loss, and life extension. This whole module has been about cleansing, detoxification. We’re going to be talking about fasting, intermittent fasting specifically, we’ll touch upon as long-term well, and we’ll look at how that impacts your ability to lose weight and we’ll spend a little bit more time on life extension, being able to live longer by eating less. I’ll see you then.