

ENVIRONMENTAL MEDICINE, PART II, NEUROLOGY

David G. Schwartz, M.D.

August 27, 2020

In Part I, I gave an overview of some environmental toxicants, their sources, and consequent health problems. This issue focuses on some specific illnesses, the role of toxicants in their development, and strategies for avoiding and removing toxicants to promote healing. Please refer to the previous article for abbreviations and acronyms.

The nervous system seems to be the most delicate and complex of all systems, and diseases of the nervous system seem most devastating to our well being and self concept and consciousness, and we feel most vulnerable in relation to injury to our nervous system. The textbook states: “Multiple neurotoxic compounds are present in all persons.” To me, that is particularly astounding, that we are swimming in such a neurotoxic chemical soup.

Some of the conditions most affected by toxicants are cognitive decline, Alzheimer’s Disease, Attention Deficit Hyperactive Disorder, Autism Spectrum Disorder, Parkinson’s Disease, and Depression. Nearly everyone knows people with one or more of these disorders, which in previous centuries were uncommon.

The nervous system is a unique target for toxic agents for several reasons. 1. Once neurons are killed by toxin exposure, they are not replaced. 2. The blood-brain barrier does not stop solvents, chlorinated pesticides, and other fat-soluble compounds from entry. 3. The normal function of the nervous system requires a complex integrated network of many specialized types of cells, so that damage to even a small part of this system can bring down major functions. 4. Neurological systems have a limited supply of antioxidant compounds, especially glutathione, that can be rapidly depleted. 5. Because of the high lipid content of the brain, lipophilic xenobiotics are stored and accumulated. These compounds generally increase in people’s bodies over the years, if the usual exposure continues. 6. Neurons have large surface areas for exposure to toxins. 7. Neuroinflammation is easy to be started by toxins, but it is difficult to calm it down.

Chlorinated, organophosphate, and pyrethroid pesticides are ubiquitous in the US population. They block transmission of nerve impulses. This results in inhibition of the whole central nervous system. Long term exposure to solvents results in memory impairment, personality changes, and chronic neurological diseases. These are direct assaults on the nerve cells.

The indirect toxicity comes from oxidative damage and neuroinflammation. All environmental pollutants have pro-oxidant effects, deplete glutathione, and inhibit antioxidant enzymes. They damage DNA, protein, and lipids, causing neurodegeneration. The oxidative stress activates the microglial cells that provide surveillance against invaders, whether microbial or chemical. The microglia produce a variety of pro-inflammatory cytokines intended to attack whatever the invader is, thereby producing unintended neuroinflammation. This is a key component in headaches, chronic pain, Alzheimer’s, ALS (Amyotrophic Lateral Sclerosis), ADHD, Autism, MS, Bipolar Disease, and seizures.

Neuroinflammation can be triggered by traumatic brain injury, high blood sugar, stress, and a variety of toxicants, including heavy metals, vehicular exhaust, and other air pollutants.

The main contributors to cognitive and executive function decline are vehicular exhaust, phthalates, organophosphate pesticides, heavy metals, and PCB's. It is estimated that the IQ of the general population has dropped 14 points since the 1850's. Between 1950 and 2000, the average world IQ dropped 0.86 points, and a further drop of 1.28 points is predicted by 2050.

Exposure to organophosphates, phthalates, methyl mercury, or PCB's in pregnant women, each reduced IQ and cognitive function in the offspring. Maternal levels of phthalates (from personal care products, including nail polish) were correlated with a 7 point drop in IQ in their children. Women with higher exposures to combustion-related air pollution during pregnancy were 3 times more likely to have children with reduced verbal IQ at age 7. Prenatal exposure to PCB's (mainly sardines and farmed salmon) result in lower IQ, impulsivity, anxiety, and poor motor function and memory.

Postnatal exposure by children and adults of all ages to vehicular exhaust in multiple studies show neuroinflammation, cognitive decline, in direct correlation to the amount of exposure. Vehicular exhaust with $P_{2.5}$ is the greatest threat to cognitive function. The second greatest factor is toxic metals. Blood lead levels in children of over 5 micrograms/dL resulted in loss of 1.37 IQ points for every one microgram/dL increase, and the cognitive deficiencies persisted into adulthood. Cognitive decline is also correlated with bone lead burden. Though lead is no longer in vehicular exhaust, municipal drinking water is a significant source of lead exposure. Flint, Michigan is not the only city, (my comment).

Cadmium exposure in children is associated with several neurological disorders. Mercury in dental workers result in poorer neuropsychiatric performance, and methyl mercury from eating high-mercury fish also is associated with poorer memory and visuospatial processing. Also ground water arsenic exposure resulted in poorer verbal fluency, memory, and other cognitive skills.

A variety of neurological health problems is associated with solvents, phthalates, PM's, PCB's, organophosphates, organochlorine pesticides, Cadmium, Lead and Mercury.

Depression, a common worldwide health problem, is directly linked with neuroinflammation. Exposure by previously healthy individuals to $PM_{2.5}$ resulted in development of major depressive disorder (MDD). The greater the exposure, the greater the risk. NO_2 and ozone were also associated with depression.

Increased levels of total PM, CO, NO_2 , and SO_2 in the air on any particular day were all followed by increased suicide attempts on the following day. Cumulative exposure to a variety of pesticides and herbicides are also linked with depression. Phthalates in liquid personal care products are also linked to depression. People with higher lead and Cadmium levels had higher risk of depression and panic disorder.

Increased risk for ADHD results from prenatal exposures to PCB's, methyl mercury, air pollutants, and phthalates (from personal care products), and from post natal exposure to lead, pesticides, and vehicular exhaust. Autism spectrum disorder is more likely to occur in offspring of mothers exposed to solvents, ozone, $PM_{2.5}$, PBDE flame retardants, PCB's, BPA, dioxins, ozone, $PM_{2.5}$, canned food, plastics, phthalates, mercury, manganese, lead and nickel.

Alzheimer's Disease is the dreaded condition for which conventional medicine has no effective treatments. This condition, like Parkinson's, has a lot of oxidative stress, mitochondrial dysfunction, persistent activation of glial cells, and neuroinflammation.

Air pollution, especially PM_{2.5}, correlates highly with tau proteins and beta amyloid. Pesticide use and exposure confers higher risk for AD. Organophosphates (OP's) are especially associated with a 62% increase in AD, and chlorinate pesticides correlated with 49% increased risk.

Parkinson's Disease (PD) was first found to be immediately and irreversibly induced by MPTP, a contaminant of synthetic heroin, after a single intravenous administration, in 1976. Pesticides, farming, and well water use have been repeatedly connected with PD. Many studies (104) confirmed the correlation with herbicides, solvents, and any type of pesticide. Any household use of pesticides increase the risk by 47%. Cumulative lead burden doubles the risk.

Some of the methods of testing the effects on neurological function are neuropsychological testing, balance testing, visual contrast sensitivity (VCS), mini-mental state examination, and Beck's depression index.

The best defense against the pollutants and the neurological disease they cause is avoidance. Many of the pollutants are not persistent in the body, so that levels fall when exposure is reduced. Buildings that comply with green building practices have office workers with better cognitive function than those in conventional offices. High efficiency air purifiers can reduce pollutants indoors, including those from outdoor vehicular exhaust. Lifestyle choices can markedly reduce exposure to phthalates. Pesticide exposure can decrease with stopping residential use, and with smart food choices. PCB's, chlorinated pesticides, and heavy metals are persistent and accumulate with time, and can be passed from mother to child. Reducing exposure can keep the levels from rising further. Chlorophyll, green tea, and rice bran extract can help expel them, acting through the gut to reduce cyclic re-absorption.

Dietary choices can counteract or ameliorate the deleterious effects of pollutants. Cognitive decline and depression are associated with the inflammatory markers IL-6 and hsCRP. These markers can decrease, mood can improve, and the risk of AD can decrease, with the Mediterranean diet. Olive oil (extra virgin) itself is anti-inflammatory, and whole foods provide carotenoids, Vitamin E, and tocotrienols, which protect against PD and AD. The high intake of vegetables and fruits provides many kinds of polyphenol compounds, which provide antioxidant and anti-inflammatory support. The resveratrol from grapes and red wine protect neurons from effects of traumatic brain injury. Grape skins' and grape seeds' anthocyanins protect neurons and reduce neurotoxicity from methyl mercury and cadmium. Blueberries, though not in the Mediterranean Diet, have some of the most powerful anthocyanins and polyphenols for reversing age-related cognitive decline, and for reducing ischemia-induced brain damage, through reducing oxidative stress and inflammation. Walnuts and fish oil, also abundant in the Mediterranean Diet, reduce neuroinflammation and cognitive decline.

Supplements can also help. Milk thistle not only protects the liver from toxins but also protects the brain against PD by suppressing the glial cell activation and consequent inflammation, stabilizes mitochondria, prevents loss of dopaminergic neurons, and reduces oxidative stress in the brain caused by exposure to excess manganese chloride. Green tea helps to prevent development of PD and reduces risk of cognitive decline in older adults by 75%. Turmeric reduces lead levels, increases glutathione, reverses oxidative stress caused by lead, and reverses cognitive defects in lead-poisoned animals. Turmeric also reduces levels of mercury.

The combination of these dietary and supplement components, avoidance, and exercise have improved function in people with AD. Fuller discussion of these methods and other factors is in the

article on The End of Alzheimer's, by Dr. Dale Bredesen. Also in the Archives, find a fuller description of general detoxification in the article, "Detoxification, A Vital Imperative."

Dr. Crinnion's book, Clean, Green, and Lean summarizes the whole spectrum of avoidance, detoxification, and nutrition, regarding multiple health problems. My report is in the Archives.

The textbook gives detailed detoxification pathways in many organ systems, including biotransformation of compounds, excretion, elimination, and how we can assist the body with nutritional supplements, exercise, saunas, colon hydrotherapy, chelation, etc. A future article will discuss the immune system and its many disorders caused by toxicants.

In summary, if anyone is considering preventing neurological disorders (including preconception and prenatal consideration of offspring), or reversing or ameliorating brain disorders, it is prudent to do the following: Reduce exposure to toxicants by eating organic foods, especially avoiding the non-organic "dirty dozen," as listed by the Environmental Working Group (EWG). Avoid plastic near food as much as possible and avoid processed and packaged food. Especially don't heat food in plastic. Filter your drinking water (and the shower if the water is chlorinated). Purify indoor air if living near heavy traffic, industrial sites, or agricultural areas. Live in a house with green building design. Check for mold in the house, and remediate if necessary. Take off shoes indoors. Avoid wall to wall carpet. Clean HVAC filters in a timely fashion. Avoid most personal care products except organic.

Protect against oxidative stress and inflammation from toxicants already in the body, with food choices and supplements. Assist the removal of toxicants from the body with exercise, saunas, food choices, and supplements.

Do your part to stop the wanton release of toxic chemicals into the environment and the negligence of the EPA. Become a political and consumer activist. Buy things that pollute the environment less in the manufacture and transport. Buy locally. Buy less stuff.

Now, much of the data in this textbook shows correlation, and does not prove causation. To prove causation would require randomized placebo controlled human studies, which in most cases, would not be ethical. Nonetheless, the correlations are so striking, and they are corroborated by multiple studies and parallel studies, so that the probability of causation is very high, in my view. Also, some of the data is about animal studies, but if toxicants cause disease in animals, who would want to be exposed to those same substances?

Some countries require the precautionary principle, that is, before any new human-made substance is released for use, safety for humans has to be proven. In contrast, in this country, thousands of these chemicals are in put into use without adequate studies. For the consumer, or patient, or general citizen, the personal "precautionary principle" is to steer clear of these chemicals when at all possible. The potential cost of exposure is so high that it is worth it to take avoidance measures.

We can do a lot to protect our brains and those of our offspring, and we may be able to reverse many chronic neurological conditions if we pay attention to our exposures, take measures to expel toxicants from our bodies, give good nutritional support to our nervous systems, and take action as consumers and citizens to clean up our planet. To me, this pollution is unacceptable. We must stop it. It is also irresponsible for the medical profession to ignore the evidence for the environmental causes of many of these conditions considered to be "idiopathic," that is, without known cause. To ignore or to remain silent promotes the problem. If more doctors would read this textbook, we may have a chance.