

Toxic Chemicals: A Major Cause of Developmental Disorders and Chronic Illnesses

Every day, we are exposed to hundreds of toxic chemicals through products like pharmaceuticals, pesticides, packaged foods, household products, and environmental pollution. As we have become more accustomed to chemical-laden products, and as our environment has become more contaminated, we have been confronted with an accelerating rate of chronic illnesses like cancer, heart disease, chronic fatigue syndrome, chemical sensitivity, autism spectrum disorders, ADD/AD(H)D, autoimmune disorders, Parkinson's disease, and Alzheimer's disease.

Because exposure to environmental pollutants has been linked to many chronic diseases, The Great Plains Laboratory has created GPL-TOX, a toxic organic exposure profile that screens for the presence of 168 different toxic chemicals including organophosphate pesticides, phthalates, benzene, xylene, vinyl chloride, pyrethrin insecticides, and others. This profile also includes Tiglyglycine (TG), a marker for mitochondrial disorders resulting from mutations of mitochondrial DNA. These mutations can be caused by exposure to toxic chemicals, infections, inflammation, and nutritional deficiencies.

Advantages of the GPL-TOX Profile

- William Shaw, Ph.D., Lab Director for The Great Plains Laboratory, Inc. is one of a handful of individuals in the world who is board-certified in both clinical chemistry and toxicology by The American Board of Clinical Chemistry. In addition, he has extensive experience in directing organic acid testing for genetic disorders at a major pediatric hospital.
- GPL-TOX directly tests for 11 unique compounds. Indirect screening provides an evaluation of 168 different toxic chemicals by testing specific metabolites. All of the information is assessed from a single urine sample.
- GPL-TOX revolutionizes the development of testing by expanding the scope to include both the environmental pollutants and mitochondrial function metabolites. The Great Plains Laboratory, Inc. suggests that the comprehensive GPL-TOX profile be used as the initial screening test for patients with severe or chronic illnesses.
- GPL-TOX uses the power of advanced mass spectrometry (MS/MS) and the specificity of multiple reaction ion monitoring. Conventional mass spectrometry is adequate for substances present in urine at high concentrations, but is inadequate for testing substances such as certain genetic, mitochondrial, and toxic chemical markers. These markers found at very low concentrations in urine disappear in baseline noise with conventional mass spectrometry. Typically, many different individual tests are necessary to determine the levels of each pollutant, but the new GPL-TOX technology makes it possible in one single test by measuring urinary metabolites.

Environmental Pollutants Tested by GPL-TOX

Phthalates

Perhaps the most widespread group of toxic chemicals found in our environment. Phthalates are commonly found in after shave lotions, aspirin, cosmetics, detergents, foods microwaved with plastic covers, oral pharmaceutical drugs, intravenous products prepared in plastic bags, hair sprays, insecticides, insect repellents, nail polish, nail polish remover, skin care products, adhesives, explosives, lacquer, janitorial products, perfumes, paper coatings, printing inks, safety glass, and varnishes. Phthalates have been implicated in reproductive damage, depressed leukocyte function, and cancer. Phthalates have also been found to impede blood coagulation, lower testosterone, and alter sexual development in children. Low levels of phthalates can feminize the male brain of the fetus, while high levels can hyper-masculinize the developing male brain.

Vinyl Chloride

Vinyl chloride is an intermediate in the synthesis of several commercial chemicals, including polyvinyl chloride (PVC). Exposure to vinyl chloride may cause central nervous system depression, nausea, headache, dizziness, liver damage, degenerative bone changes, thrombocytopenia, enlargement of the spleen, and death.

Benzene

Benzene is an organic solvent that is widespread in the environment. Benzene is a by-product of all sources of combustion, including cigarette smoke, and is released by outgassing from synthetic materials, and is a pollutant released by numerous industrial processes. Benzene is an extremely toxic chemical that is mutagenic and carcinogenic. High exposures to benzene cause symptoms of nausea, vomiting, dizziness, lack of coordination, central nervous system depression, and death. It can also cause hematological abnormalities.

Pyrethrins

Pyrethrins are widely used as insecticides. Exposure during pregnancy doubles the likelihood of autism. Pyrethrins may affect neurological development, disrupt hormones, induce cancer, and suppress the immune system.

Xylenes

Xylenes (dimethylbenzenes) are solvents found not only in common products such as paints, lacquers, pesticides, cleaning fluids, fuel and exhaust fumes, but also in perfumes and insect repellents. Xylenes are oxidized in the liver and bound to glycine before eliminated in urine. High xylene levels may be due to the use of certain perfumes and insect repellents. High exposures to xylene create an increase in oxidative stress, causing symptoms such as nausea, vomiting, dizziness, central nervous system depression, and death. Occupational exposure is often found in pathology laboratories where xylene is used for tissue processing.

Styrene

Styrene is used in the manufacturing of plastics, in building materials, and is found in car exhaust fumes. Polystyrene and its copolymers are widely used as food-packaging materials. The ability of styrene monomer to leach from polystyrene packaging to food has been reported. Occupational exposure due to inhalation of large amounts of styrene adversely impacts the central nervous system, causes concentration problems, muscle weakness, tiredness and nausea, and irritates the mucous membranes of the eyes, nose, and throat.

Organophosphates

Organophosphates are one of the most toxic groups of substances used throughout the world. They are often used as biochemical weapons and terrorist agents, but are most commonly used in pesticide formulations. Organophosphates are inhibitors of cholinesterase enzymes, leading to overstimulation of nerve cells, causing sweating, salivation, diarrhea, abnormal behavior, including aggression and depression. Children exposed to organophosphates have more than twice the risk of developing pervasive developmental disorder (PDD), an autism spectrum disorder. A study done in the San Francisco Bay area found that in California agricultural areas, children born to mothers living within 500 meters of fields where organochlorine pesticides were used were more than 6 times more likely to develop autism than children whose mothers did not live near such fields. ASD risk increased with the poundage of organochlorines applied and decreased with distance from field sites. Maternal organophosphate exposure has been associated with various adverse outcomes including having shorter pregnancies and children with impaired reflexes.

MTBE and ETBE

MTBE and ETBE are gasoline additives used to improve octane ratings. Exposure to these compounds is most likely due to groundwater contamination, and inhalation or skin exposure to gasoline or its vapors and exhaust fumes. MTBE has been demonstrated to cause hepatic, kidney, and central nervous system toxicity, peripheral neurotoxicity, and cancer in animals. Since the metabolites of these compounds are the same, ETBE may be similarly toxic.

2,4-Dichlorophenoxyacetic Acid (2,4-D)

A very common herbicide that was a part of Agent Orange, used by the United States during the Vietnam War to increase visibility for war planes, by destroying plant undergrowth and crops. It is most commonly used in agriculture on genetically modified foods, and as a weed killer for lawns. Exposure to 2, 4-D via skin or oral ingestion is associated with neuritis, weakness, nausea, abdominal pain, headache, dizziness, peripheral neuropathy, stupor, seizures, brain damage, and impaired reflexes. 2, 4-D is a known endocrine disruptor, and can block hormone distribution and cause glandular breakdown.