A Brand New Urine Test for Mycotoxin Exposure

Mycotoxins: A Major Cause of Many Chronic Illnesses

Mycotoxins are some of the most prevalent toxins in the environment. Mycotoxins are metabolites produced by fungi like mold, which can infest buildings, vehicles, and foodstuffs. A majority of mycotoxin exposures are through food ingestion or airborne exposure. In the European Union, 20% of all grains harvested have been found to be contaminated with mycotoxins. Unfortunately, mycotoxins are resistant to heat and many processing procedures.

Fungi are able to grow on almost any surface, especially if the environment is warm and wet. Inner wall materials of buildings, wall paper, fiber glass insulation, ceiling tiles, and gypsum support are all good surfaces for fungi to colonize. These fungi then release mycotoxins into the environment causing symptoms of many different chronic diseases. Diseases and symptoms linked to mycotoxin exposure include fever, pneumonia-like symptoms, heart disease, rheumatic disease, asthma, sinusitis, cancer, memory loss, vision loss, chronic fatigue, skin rashes, depression, ADHD, anxiety, and liver damage. With our new MycoTOX Profile, we can identify mycotoxin exposures and make recommendations for detoxification treatments that have been effective.

Advantages of the MycoTOX Profile

- The MycoTOX Profile screens for 10 different mycotoxins, from 40 species of mold, in one urine sample.
- The MycoTOX Profile is the most comprehensive and competitively priced mycotoxin test available.
- The MycoTOX Profile uses the power of advanced mass spectrometry (MS/MS), which is necessary to detect lower levels of these fungal toxins. This test is optimal for follow up testing to ensure that detoxification therapies have been successful.
- The MycoTOX Profile pairs perfectly with the Organic Acids Test (OAT), GPL-TOX (Toxic Non-Metal Chemical Profile), Phospholipase A_2 Activity Test, and the Glyphosate Test. This gives you comprehensive testing to assess exposure to common environmental toxins and the damage that can be caused by this exposure, all at a great value, and all from one urine sample.

Markers in the MycoTOX Profile

Aflatoxin M1 (AFM1)

Aflatoxin M1 (AFM1) is the main metabolite of aflatoxin B1, which is a mycotoxin produced by the mold species Aspergillus. Aflatoxins are some of the most carcinogenic substances in the environment. Aflatoxin susceptibility is dependent on multiple different factors such as age, sex, and diet. Aflatoxin can be found in beans, corn, rice, tree nuts, wheat, milk, eggs, and meat. In cases of lung aspergilloma, aflatoxin has been found in human tissue specimens. Aflatoxin can cause liver damage, cancer, mental impairment, abdominal pain, hemorrhaging, coma, and death. Aflatoxin has been shown to inhibit leucocyte proliferation. Clinical signs of aflatoxicosis are non-pruritic macular rash, headache, gastrointestinal dysfunction (often extreme), lower extremity edema, anemia, and jaundice. The toxicity of Aflatoxin is increased in the presence of Ochratoxin and Zearalenone.

Ochratoxin A (OTA)

Ochratoxin A (OTA) is a nephrotoxic, immunotoxic, and carcinogenic mycotoxin. This chemical is produced by molds in the Aspergillus and Penicillium families. Exposure is primarily through contaminated foods such as cereals, grape juices, dairy, spices, wine, dried vine fruit, and coffee. Exposure to OTA can also come from inhalation exposure in water-damaged buildings. OTA can lead to kidney disease and adverse neurological effects. Studies have shown that OTA can cause significant oxidative damage to multiple brain regions and the kidneys. Dopamine levels in the brain of mice have been shown to be decreased after exposure to OTA.

Sterigmatocystin (STG)

Sterigmatocystin (STG) is a mycotoxin that is closely related to aflatoxin. STG is produced from several species of mold such as Aspergillus, Penicillium, and Bipolaris. It is considered to be carcinogenic, particularly in the cells of the GI tract and liver. STG has been found in the dust from damp carpets. It is also a contaminant of many foods including grains, corn, bread, cheese, spices, coffee beans, soybeans, pistachio nuts, and animal feed. In cases of lung aspergilloma, STG has been found in human tissue specimens. The toxicity of STG affects the liver, kidneys, and immune system. Tumors have been found in the lungs of rodents that were exposed to STG. Oxidative stress becomes measurably elevated during STG exposure, which causes a depletion of antioxidants such as glutathione, particularly in the liver.

Mycotoxins and human disease: a largely ignored global health issue

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Aflatoxins and fumonisins (FB) are mycotoxins contaminating a large fraction of the world's food, including maize, cereals, groundnuts and tree nuts. The toxins frequently co-occur in maize. Where these commodities are dietary staples, for example, in parts of Africa, Asia and Latin America, the contamination translates to high-level chronic exposure. This is particularly true in subsistence farming communities where regulations to control exposure are either non-existent or practically unenforceable. Aflatoxins are hepatocarcinogenic in humans, particularly in conjunction with chronic hepatitis B virus infection, and cause aflatoxicosis in episodic poisoning outbreaks. In animals, these toxins also impair growth and are immunosuppressive; the latter effects are of increasing interest in human populations. FB have been reported to induce liver and kidney tumours in rodents and are

adverse health effects is incomplete and the known risks are poorly communicated to policy markers in regions where the contamination is greatest. Second, in comparison, for example, to vaccination programmes, malaria control or improved sanitation, the perceived value of interventions to reduce mycotoxin contamination in low-income countries may be relatively low. Third, the approaches needed to control mycotoxin contamination, although potentially simple, are multifaceted, requiring consideration at numerous points pre- and post-harvest. Fourth, the highest exposures occur in communities that produce and consume their own food and thus regulatory measures to control exposure are largely ineffective. Fifth, the mycotoxin problem sits at the interface of agriculture, health and economics. In order to appreciate, the full burden to a country of contamination of its food by mycotoxins requires an inter-sectoral approach at government level, something that is often absent.

We remain therefore in the unusual and surely unacceptable position of being aware from a research perspective that a large proportion of the world's population has its staple food contaminated by known toxins, including the most potent naturally occurring hepatocarcinogens yet identified, but have relatively little coordinated action to combat the problem at a public health level. The World Health Organization has started to respond and highlight the need for action (5).

Roridin E

Roridin E is a macrocyclic trichothecene produced by the mold species Fusarium, Myrothecium, and Stachybotrys (i.e. black mold). Trichothecenes are frequently found in buildings with water damage but can also be found in contaminated grain. This is a very toxic compound, which inhibits protein biosynthesis by preventing peptidyl transferase activity. Trichothecenes are considered extremely toxic and have been used as biological warfare agents. Even low levels of exposure to macrocyclic trichothecenes can cause severe neurological damage, immunosuppression, endocrine disruption, cardiovascular problems, and gastrointestinal distress.

Verrucarin A

Verrucarin A (VRA) is a macrocyclic trichothecene mycotoxin produced from Stachybotrys, Fusarium, and Myrothecium. Trichothecenes are frequently found in buildings with water damage but can also be found in contaminated grain. VRA is a small, amphipathic molecule that can move passively across cell membranes. The primary tissues affected by VRA are intestinal and gastric mucosa, bone marrow, and spleen. VRA causes damage to human cells by inhibiting protein and DNA synthesis, disrupting mitochondrial functions, and by producing oxidative stress (due to generation of free radicals). Exposure to VRA can cause immunological problems, vomiting, skin dermatitis, and hemorrhagic lesions.

Enniatin B1

Enniatin B1 is a fungal metabolite categorized as cyclohexa depsipeptides toxin produced by the fungus Fusarium. This strain of fungus is one of the most common cereal contaminants. Grains in many different countries have recently been contaminated with high levels of enniatin. The toxic effects of enniatin are caused by the inhibition of the acyl-CoA cholesterol acyltransferase, depolarization of mitochondria, and inhibition of osteoclastic bone resorption. Enniatin has antibiotic properties and chronic exposure may lead to weight loss, fatigue, and liver disease.

Zearalenone (ZEA)

Zearalenone (ZEA) is a mycotoxin that is produced by the mold species Fusarium, and has been shown to be hepatotoxic, haematotoxic, immunotoxic, and genotoxic. ZEA is commonly found in several foods in the US, Europe, Asia, and Africa including wheat, barley, rice, and maize. ZEA has estrogenic activity and exposure to ZEA can lead to reproductive changes. ZEA's estrogenic activity is higher than that of other non-steroidal isoflavones (compounds that have estrogen-like effects) such as soy and clover. ZEA exposure can result in thymus atrophy and alter spleen lymphocyte production as well as impaired lymphocyte immune response, which leads to patients being susceptible to disease.

Aflatoxins as a Cause of Hepatocellular Carcinoma

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Aflatoxins, metabolites of the fungi *Aspergillus flavus* and *Aspergillus parasiticus*, are frequent contaminants of a number of staple foods, particularly maize and ground nuts, in subsistence farming communities in tropical and sub-tropical climates in sub-Saharan Africa, Eastern Asia and parts of South America. Contamination of foods occurs during growth and as a result of storage in deficient or inappropriate facilities. These toxins pose serious public health hazards, including the causation of hepatocellular carcinoma by aflatoxin B1. Exposure begins in utero and is life-long. The innocuous parent molecule of the fungus is converted by members of the cytochrome p450 family into mutagenic and carcinogenic intermediates. Aflatoxin-B1 is converted into aflatoxin B1-8,9 exo-epoxide, which is in turn converted into 8,9-dihydroxy-8-(N7) guanyl-9-hydroxy aflatoxin B1 adduct. This adduct is metabolized into aflatoxin B1 formaminopyrimidine adduct. These adducts are mutagenic and carcinogenic. In addition, an arginine to serine mutation at codon 249 of the p53 tumor suppressor gene is produced, abrogating the function of the tumor suppressor gene, and contributing to hepatocarcinogenesis. Aflatoxin B1 acts synergistically with hepatitis B virus in causing hepatocellular

Common Genera of Mold Tested by MycoTOX

Aspergillus

Aspergillus is the most prevalent mold group in the environment. It has caused billions of dollars of in damage to crops and livestock. Two of the most common *Aspergillus* mycotoxins are aflatoxin and ochratoxin. The main target of these toxins is the liver. These toxins have been found in all major cereal crops including peanuts, corn, cotton, millet, rice, sorghum, sunflower seeds, wheat, and a variety of spices. They are also found in eggs, milk, and meat from animals fed contaminated grains. Diseases caused by *Aspergillus* are called aspergillosis. The most common route of infection is through the respiratory system. *Aspergillus* can cause severe asthma when the mold colonizes the lung, forming a granulomatous disease.

Penicillum

There are over 200 species of *Penicillium* that have been discovered. *Penicillium chrysogenum* is the most common of these species. It is often found in indoor environments and is responsible for many allergic reactions. *Penicillium* is also a known contaminant in many different food items. Many different types of citrus fruits can become contaminated with *Penicillium*, but it can also contaminate seeds and grains. One reason that *Penicillium* is such a common infestation is because of its ability to thrive in low humidity. In the home, *Penicillium* can be found in wallpaper, carpet, furniture, and fiberglass insulation. The most common mycotoxin produced by *Penicillium* is ochratoxin (OTA). Ochratoxin is nephrotoxic, which means that it damages the kidneys. It is also carcinogenic.

Stachybotrys

Stachybotrys is a greenish-black mold. This mold can grow on materials with high cellulose and low nitrogen content such as gypsum board, paper, fiberboard, and ceiling tiles. *Stachybotrys* is known for its production of the highly toxic macrocyclic trichothecene mycotoxins. Two of the more common mycotoxins produced by *Stachybotrys* are roridin E and verrucarin. In addition to these mycotoxins, the fungus produces nine phenylspirodrimanes, as well as cyclosporine, which are potent immunosuppressors. These immunosupressors along with the mycotoxin trichothecenes may be responsible for the high toxicity of *Stachybotrys*.

Fusarium

Fusarium's major mycotoxins are zearalenone (ZEN) and fumonisin. *Fusarium* fungi grow best in temperate climate conditions. They require lower temperatures for growth than *Aspergillus*. *Fusarium* grows worldwide on many different types of grains including corn and wheat. Exposure to mycotoxins from *Fusarium* can lead to both acute and chronic effects. These symptoms can include abdominal distress, malaise, diarrhea, emesis, and death. ZEN possesses estrogenic effects and has been implicated in reproductive disorders.

The 40 Species of Mold and 10 Mycotoxins They Produce

	Aflatoxin	Gliotoxin	Ochratoxin	Sterigmatocystin	Zearalenone	Roridin E	Verrucarin A	Enniatin B	Mycophenolic Acid	Citrinin
Species:										
Acremonium sp.				Present						Present
Alternaria		Present								
A. flavipes				Present						Present
Aspergillus flavus	Present									Present
A. fumigatus		Present								Present
A. niger			Present							Present
A. ochraceus			Present	Present						Present
A. parasiticus	Present									Present
A. sydowii				Present						Present
A. versicolor				Present						Present
A. viridictum			Present	Present						Present
Aureobasidium				Present						
Chaetomium				Present						
Cladosporium				Present						
Cunninghamella				Present						
Cylindrocarpon						Present				
Dendrodochium						Present	Present			
Exophiala				Present						Present
Fusarium avenaceum				Present	Present			Present		Present
F. cerealis				Present	Present					Present
F. clumonrum				Present	Present					Present
F. equiseti				Present	Present					Present
F. graminearum				Present	Present					Present
F. incarnatum				Present	Present					Present
F. moniliforme				Present	Present			Present		Present
F. solani								Present		
F. verticillioides				Present	Present					Present
Myrothecium roridum						Present				
M. verrucaria						Present	Present			
Penicillium carbonarius		Present	Present	Present					Present	Present
P. nordicum		Present	Present	Present					Present	Present
P. stoloniferum		Present	Present	Present					Present	Prsent
P. verrucosum		Present	Present	Present					Present	Present
Phoma sp.				Present						Present
Rhodotorula				Present						Present
Scopulariopsis				Present						Present
Stachybotrys				Present		Present	Present			Present
S. chartarum				Present						
Trichoderma viride		Present		Present						
Ulocaldium										
Verticillium				Present						Present

Common Sources of Mold Exposure in the Home

Mycotoxin exposure can happen easily in the home. Mold can grow as a result of water damage or condensation build-up in many places in the home. It can also grow on foods stored at home and foods your purchase may already be contaminated with mold when you buy them. Here are the common sources of mold growth in the home:

- **Window Sills and Doors**
- **Plumbing**
- **Bathrooms**
- **Closets**
- **Fireplaces and Chimneys**
- **Laundry Rooms**
- **Basements**
- **Air Conditioning Systems**
- **Roofs**
- **Refrigerators**
- **Foods**

Recommendations for Treatment of Mycotoxins

If you or a patient has done a MycoTOX Profile and the results show moderate to high levels of mycotoxins there are things you can do to help the body eliminate the toxins and prevent future exposures. The first step is to eliminate or reduce exposure to mold. The majority of exposures result from contaminated food, skin contact, and inhalation of spore-borne toxins, which is often caused by water-damaged buildings. Inhalation of spore-borne toxins can be limited by detecting and eliminating damp and moldy environments, both indoor and outdoor.

Mold can enter homes through open windows, vents, doorways, and heating and air conditioning systems. Mold grows well on organic products such as paper, wood, cardboard, and ceiling tiles. Mold can also grow on insulation, drywall, wallpaper, carpet, fabric, and upholstery. Mold can be controlled by cleaning and drying after water intrusion; having proper ventilation for showers, laundry, and cooking areas; making sure that windows, roofs, and pipes are free of leaks; and by controlling humidity levels. After moisture problems are alleviated it is recommended that mold removal be performed by a licensed contractor. Attempts to remove mold may cause mold spores to scatter and spread to other areas. In addition, treating mold without proper ventilation could result in health problems caused by the release of mycotoxins from the mold spores.

Treatment for mold exposure should include fluid support to prevent dehydration. The drug Oltipraz can increase glutathione conjugation of mold toxins while inhibiting the toxic effect of P450 oxidation, reducing liver toxicity and promoting safer elimination. A diet of carrots, parsnips, celery, and parsley may reduce the carcinogenic effects of mold. Bentonite clay and zeolite clay are reported to reduce the absorption of mold found in food. Supplementation with chlorophyllin, zinc, A, E, C, NAC, rosmarinic acid, and liposomal glutathione alone or in combination have been shown to mitigate the oxidative effects of mold toxins.

Disorders and Symptoms Associated with Exposure to Mycotoxins

Liver disease	Dizziness
Dermatitis	Confusion
Fever	Irritability
Vomiting	Difficulty concentrating
Anorexia	Allergic rhinitis
Jaundice	Asthma
Headaches	Legionnaires ' disease
Nausea	Fibromyalgia
Sore throat	Irritable Bowel Syndrome
Diarrhea	Food allergies
Fatigue	Thyroid irregularities
Blurred vision	Balance problems
Difficulty breathing	Infertility
Vertigo	Seizures

Testing that Pairs Well with the MycoTOX Profile

When you order the MycoTOX Profile, we recommend adding any of the following tests that will provide additional information about markers correlated with mycotoxin exposure, most of which can be added to the same urine sample:

- Organic Acids Test
- GPL-TOX (Toxic Non-Metal Chemical Profile)
- Phospholipase A_2 Activity Test
- Glyphosate Test

Specimen Requirements for the MycoTOX Profile

10 mL of the first morning urine before food or drink is suggested. Fasting for 12 hours may increase the excretion of mycotoxins from the adipose tissue. However, fasting is not recommended if running this test in combination with other urine tests.

Sample Report and Interpretations

Metabolite	Results (ng/g creatinine)	Common Range of Positive Results
Ochratoxin A	7.32	1.2 - 7.5

Ochratoxin A (OTA) is a nephrotoxic, immunotoxic, and carcinogenic mycotoxin. This chemical is produced by molds in the Aspergillus and Penicillium families. Exposure is primarily through contaminated foods such as cereals, grape juices, dairy, spices, wine, dried vine fruit, and coffee. Exposure to OTA can also come from inhalation exposure in water-damaged buildings. OTA can lead to kidney disease and adverse neurological effects. Studies have shown that OTA can lead to significant oxidative damage to multiple brain regions and is highly nephrotoxic. Dopamine levels in the brain of mice have been shown to be decreased after exposure to OTA. Some studies have hypothesized that OTA may contribute to the development of neurodegenerative diseases such as Alzheimer's and Parkinson's. Treatment should be aimed at removing the source of exposure. Agents such as oral cholestyramine, charcoal, and phenylalanine can help prevent the absorption of these toxins from food. Antioxidants such as vitamins A, E, C, NAC, rosmarinic acid, and liposomal glutathione alone or in combination have been shown to mitigate the oxidative effects of the toxin. Bentonite or zeolite clay is reported to reduce the absorption of multiple mycotoxins found in food, including OTA. Studies have also shown that OTA is present in sweat, which supports the use of sauna as a treatment to increase the excretion of OTA. (PMID 17195275, 16621780, 16293235, 27521635, 22069626, 24792326, 22253638, 16140385, 2467220, 16844142, 19148691, 22069658, 16019795, 18286403, 15781206, 11439224, 17092826, 32710148)

Sterigmatocystin	0	0.1 - 2.25

Sterigmatocystin (STC) is a mycotoxin that is closely related to aflatoxin. STC is produced from several species of mold such as Aspergillus, Penicillium, and Bipolaris. STC is considered to be carcinogenic, particularly in the cells of the GI tract and liver. STC has been found in the dust from damp carpets. It is also a contaminant of many foods including grains, corn, bread, cheese, spices, coffee beans, soybeans, pistachio nuts, and animal feed. In cases of lung aspergilloma, STC has been found in human tissue specimens. The toxicity of STC affects the liver, kidneys, and immune system. Tumors have been found in the lungs of rodents that were exposed to STC. Oxidative stress becomes measurably elevated during STC exposure which causes a depletion of antioxidants such as glutathione, particularly in the liver. Because STC is structurally similarity to Aflatoxin, many of the same therapies will be effective. The drug Oltipraz can increase glutathione conjugation of aflatoxin while inhibiting the toxic effect of P450 oxidation, reducing liver toxicity and promoting safer elimination. A diet of carrots, parsnips, celery, and parsley may reduce the carcinogenic effects of aflatoxin. Bentonite or zeolite clay is reported to reduce the absorption of multiple mycotoxins found in food, including STC. Supplementation with chlorophyllin, zinc, and vitamins A,E, and C has been used to treat exposure to STC. (PMID: 10855723, 19998385, 21287681, 23705030, 24514428, 12147486, 15027811, 12244755, 11727790, 12725069, 18286403, 10050868, 7585637, 16762476, 16019795,

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