

# MYCOTOXINS 101

An introduction to the  
must-know mycotoxin facts



## CHAPTER 1

## What Are Mycotoxins?

### Mycotoxin *my-ko-tok-sin (noun)*

A poisonous compound produced by a fungus. The term comes from the Greek words mykes, meaning “fungus,” and toxikon, meaning “poison.”

Mycotoxins are secondary metabolites produced by fungi (mold), meaning that they are not essential for the fungus’s survival. However, they can provide the fungus with a competitive advantage, such as by making the fungus more resistant to predators or pathogens.

**FUN FACT:** There are thousands of mycotoxins we are exposed to regularly, but only a few are toxic to humans.



## CHAPTER 1

## What Are Mycotoxins?

### Mold allergy vs Mycotoxin toxicity

Mycotoxin Toxicity is often confused with Mold IgE Allergy as both are caused by exposure to mold, however, they are two different conditions which may require different types of treatments.

#### MOLD IgE ALLERGY

Mold IgE Allergy is an immune response to mold spores, which results in symptoms such as hives, itchy eyes, runny nose, and anaphylaxis (severe, sometimes life-threatening allergic reaction which can cause swelling of the mouth and throat).

VS

#### MYCOTOXIN TOXICITY

Mycotoxin Toxicity is poisoning caused by exposure to high levels of mycotoxins produced by molds, or the inability to break down mycotoxins.



## CHAPTER 2

Types of  
Mycotoxins

## The 4 Main Types Of Mycotoxins

There are 4 main fungi families that are considered to be the most common toxic to humans:

ASPERGILLUS	PENICILLIUM	FUSARIUM	TACHYBOTRYS Also known as <b>Black Mold</b>
<ul style="list-style-type: none"> <li>• Tolerant of dry conditions, mold spores can thrive in low humidity.</li> <li>• Often found in decaying vegetation and stored grains.</li> </ul>	<ul style="list-style-type: none"> <li>• Tolerant of dry conditions, mold spores can thrive in low humidity.</li> <li>• Commonly found in decaying plant debris, grains, and dried/rotting fruits</li> </ul>	<ul style="list-style-type: none"> <li>• Must have moisture levels at or above .9 AW (Water activity), mold spores thrive in high humidity and wet environments.</li> <li>• Often found in soil and on plants but is also commonly found on water-damaged drywall, behind wallpaper, under flooring, and other humid spaces in homes.</li> </ul>	<ul style="list-style-type: none"> <li>• Must have moisture levels at or above .9 AW (Water activity), mold spores require a high humidity level and/or wet environment.</li> <li>• Commonly found in water-damaged homes where roofs and walls have leaked, or near a plumbing leak.</li> </ul>

With thousands of mold and mycotoxin species around the world, slight exposures are unavoidable. Luckily, many mold and mycotoxin families are not toxic to humans and will not cause harm.



## CHAPTER 2

Types of  
Mycotoxins

Many molds produce the same mycotoxins, which provides an opportunity to get information on the potential of over 300 common mold exposures by testing as little as 16 different mycotoxins. The chart below provides insights into mycotoxins produced by common mold species.

MOLD VARIETY	MYCOTOXIN PRODUCED:					
	Aflatoxin	Gliotoxin	Ochratoxin A	Zearalenone	Roridin E	Verrucaric Acid
Alternaria		✓				
Aspergillus Favus	✓					
A. Fumigatus		✓				
A. Niger			✓			
A. ochraceus			✓			
A. parasiticus	✓					
A. Veridictum			✓			
Cylindrocarpon					✓	
Dendrodochium					✓	✓
Fusarium avenaceum				✓		
F. cerealis				✓		
F. clumorum				✓		
F. equiseti				✓		
F. graminearum				✓		
F. incarnatum				✓		
F. moniliforme				✓		
F. verticilloides				✓		
M. verrucaria					✓	✓
Penicillium carbonarius		✓	✓			
P. nordicum		✓	✓			
P. stoloniferum		✓	✓			
P. verrucosum		✓	✓			
Stachybotrys					✓	✓
S. chartarum						
Trichoderma viride		✓				



## CHAPTER 3

# Common Places for Mycotoxin Exposure in the home

## 1 ROOF

Standing water combined with humid weather and defective shingles can lead to mold, the spores from this mold can travel down the walls into the home

## 2 WINDOWSILLS & DOORS

Broken insulation in windows can cause moisture to condense, allowing mold to grow and the wood around it to rot.

## 3 PLUMBING

Water damage from appliances, toilets, air conditioning units, or water pipes can form mold.

## 4 BATHROOMS

Trapped moisture from improper ventilation practices can cause mold to form.

## 5 CLOSETS

Storing damp clothing in poorly ventilated closets can lead to mold growth.

## 6 FIREPLACES & CHIMNEYS

Moisture can build up from the cover or cap, causing mold growth. This is especially true when the chimney is not regularly inspected.

## 7 LAUNDRY ROOMS

Trapped moisture from closing washing machine doors after use can create an environment for mold to grow.

## 8 FOOD

Improperly sealed shelf stable food items can gather moisture from the air, leading to mold growth.

## 9 REFRIGERATORS

Broken refrigerator seals and rotten food can cause mold growth.

## 10

## AIR CONDITIONING

Condensation within the machine combined with dust can generate an environment perfect for mold growth.

## 11

## BASEMENTS

Moisture from running water in rooms like bathrooms and kitchens can appear on the ceilings of rooms below. Moisture can also get trapped under cardboard or storage boxes left on the ground



## CHAPTER 4

## What Are the Health Effects of Mycotoxin Exposures

### Mycotoxin Exposure

Mycotoxin exposures can seriously impact a person's overall health and well-being. By being aware of the potential dangers of mycotoxin exposure, you can seek appropriate testing and treatment.

#### SYMPTOMS OF MYCOTOXIN EXPOSURES CAN INCLUDE:

- ▶ Mold IgE All
- ▶ Debilitating Fatigue
- ▶ Body Pain
- ▶ Brain Fog
- ▶ Headaches
- ▶ Respiratory Issues
- ▶ Sinusitis and Sinus Issues
- ▶ Immune suppression/Chronic Illness
- ▶ Depression & Anxiety
- ▶ Anemia
- ▶ General weakness
- ▶ Fluid Retention
- ▶ Chronic inflammation
- ▶ Osteoarthritis
- ▶ Various Cancers

Symptoms of mycotoxins are often nonspecific and vary from person to person, making toxic exposures challenging to pinpoint, which makes it important to maintain a high level of clinical suspicion, and test when appropriate.



## CHAPTER 5

## Testing for Mycotoxins

### The Two Types of Mycotoxin Testing

Testing for Mycotoxin exposure is a simple process utilizing a single urine sample. There are two main types of mycotoxin testing, Mass Spectrometry and ELISA (Enzyme-linked immunosorbent assay).

	BENEFIT	DISADVANTAGE
MASS SPECTROMETRY	Highly Sensitive	Only picks up on specific mycotoxins not modified within the body
ELISA	Picks up mycotoxins that have been modified within the body	Not as sensitive as mass spectrometry

At US BioTek, we believe that ELISA testing provides the most accurate clinical information for practitioners and patients regarding mycotoxin levels. This is because many mycotoxins are modified once they enter the body. This modification makes the ELISA method preferable, as it can provide more accurate information on what is currently present in and impacting the body. Because mass spectrometry cannot detect body-modified mycotoxins (metabolites) mass spectrometry results tend to be artificially low.





CHAPTER 5

# Testing for Mycotoxins

## Different Testing Methods


A helpful analogy to better understand the capabilities of the standard mycotoxin testing methods, especially in identifying modified mycotoxins within the body, consider how these methods would recognize and report on a person.

**WANTED**  
Myco Toxin




6ft tall, 180lbs, Blue Hair, last seen wearing ONLY glasses and a blue striped lab coat.

**\$500 Reward**

If Myco stays exactly how he is, both testing methods identify him.

✓	MASS SPEC
✓	ELISA

If Myco alters his appearance by **PUTTING A HAT ON** he will be now slightly different (taller + heavier) and will no longer be identified by the Mass Spec technology.

✗	MASS SPEC
✓	ELISA

## CHAPTER 6

## FAQ About High Mycotoxin Levels

### How can I tell if I have mold exposure or high Mycotoxin levels?

Testing for exposure is the only sure way. Mold symptoms may result from a mold allergy or from direct exposure to mycotoxins. Mycotoxin exposure can occur from ingestion (eating contaminated foods), inhalation (moldy environment), or through the skin.

*Your clinician can order the following tests for you:*

- ▶ The Mycotoxin Panel measures mycotoxin metabolites in urine.
- ▶ The Mold IgE Panel is a blood test that checks for allergic reactions to fifteen common environmental molds.

### I got tested and my levels were high! - how can I avoid further exposure?

Mycotoxins are found in grains, coffee, dairy products and dried fruits or nuts. Most mycotoxin exposures occur through food consumption. Certain molds are deliberately used in fermented foods (yogurt, soy) or cheese-making. Avoiding these foods and environments may help reduce mold/mycotoxin exposures.

- ▶ Use proper food storage techniques to prevent mold growth.
  - Dispose of foods that show signs of mold such as black spots, fuzzy growth, or a white film.
  - Keep foods such as grains, dried fruits, coffee, etc. in a cool dry place to prevent mold growth
  - Refrigerate or freeze foods to prevent mold growth and discard foods that have past their expiration date.
- ▶ Mycotoxins may be found in walls and cabinets in damp or moldy environments.
  - Mold growth on environmental surfaces can be reduced using commercial bleach products containing 2.4% sodium hypochlorite.
  - Moldy books or textiles should be discarded.



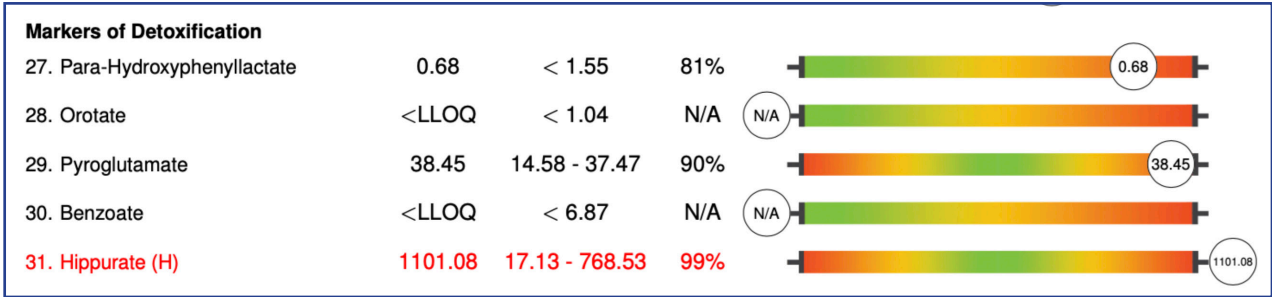
CHAPTER 6

# FAQ About High Mycotoxin Levels

## Is there any way to get the Mycotoxins in my system out quicker?

Humans and molds have co-evolved on the planet, but if mold/mycotoxin levels are high some individuals may need additional support after a significant mold/mycotoxin exposure. Treatment may vary if the mold reaction is an allergy rather than a high mycotoxin level, so testing is required before any attempt to treat. Allergy management is very different from detoxification (reducing mycotoxin burden).

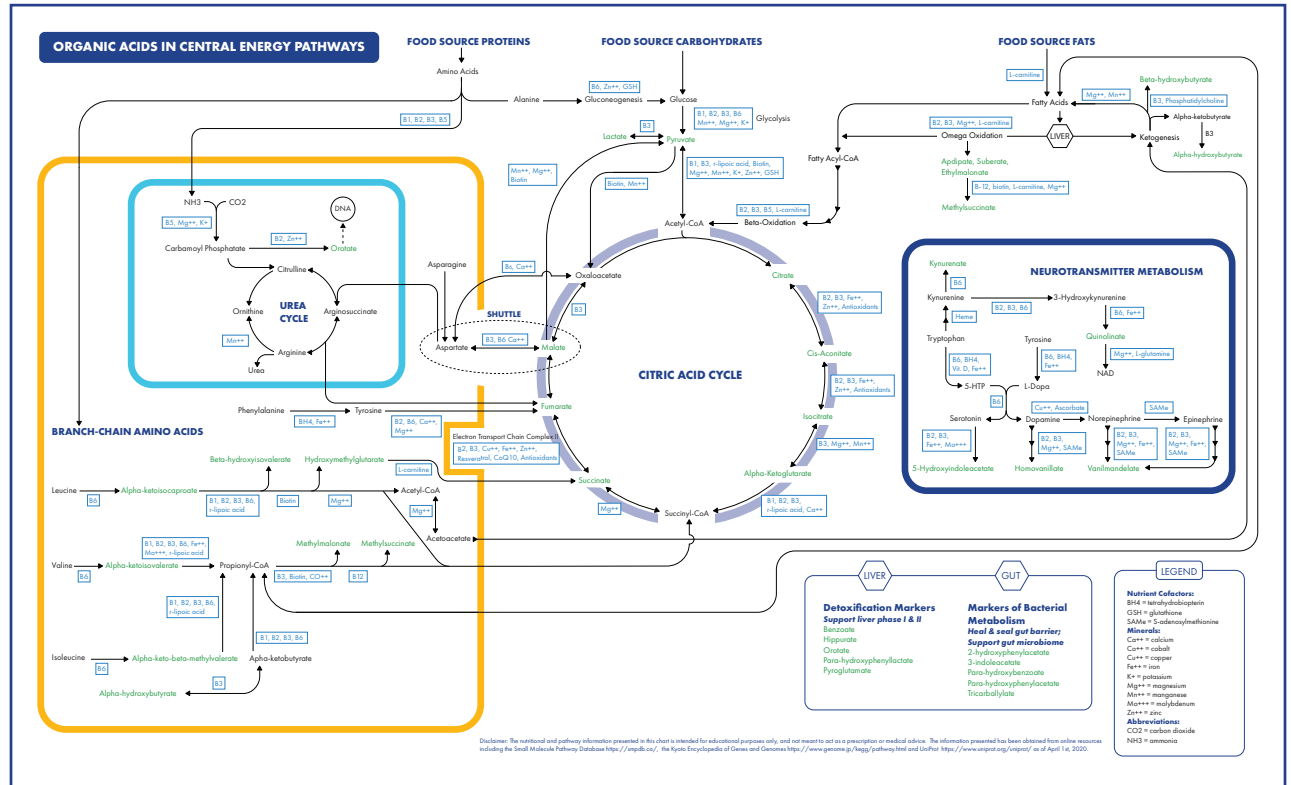
However, either type of exposure can increase inflammation, impair mitochondrial energy production, and increase oxidative stress, other types of toxic exposures such as chemical or metal exposure can cause similar problems. A dried urine Organic Acids Profile can detect evidence of impaired mitochondrial energy production, increased oxidative stress, or poor detoxification capacity. The nutrients used to correct these metabolic problems will also promote the detoxification of mycotoxins and can help decrease inflammation associated with allergic reactions.



CHAPTER 6

# FAQ About High Mycotoxin Levels

Understanding a person's specific capacity for detoxification will allow a practitioner to create a dietary and/or supplement plan to help support that individual's detoxification needs.



With testing profiles such as the MOE-Tox Complete Profile, which test Mycotoxins, Organic Acids, and Environmental Pollutants, individuals can not only understand their overall toxic burden but also how that burden is impacting their mitochondrial function as well as their ability to detoxify.



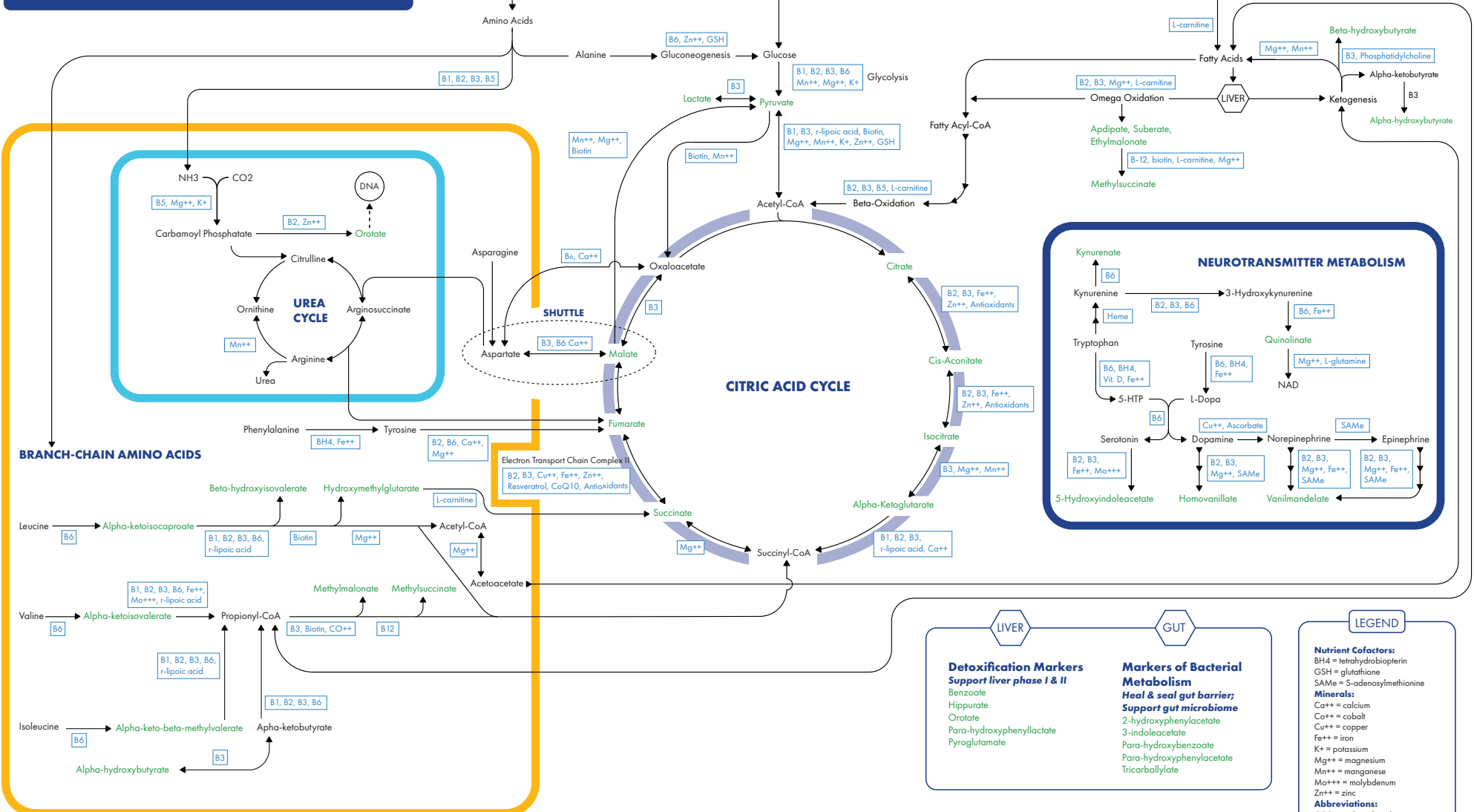
For more information on the MOE-Tox Complete Profile visit [usbiotek.com/tests/mycotoxin](https://usbiotek.com/tests/mycotoxin) or scan the QR code.

ORGANIC ACIDS IN CENTRAL ENERGY PATHWAYS

FOOD SOURCE PROTEINS

FOOD SOURCE CARBOHYDRATES

FOOD SOURCE FATS



**LIVER**

**Detoxification Markers**  
Support liver phase I & II

- Benzoate
- Hippurate
- Orotate
- Para-hydroxyphenyllactate
- Pyrogulamate

**GUT**

**Markers of Bacterial Metabolism**  
Heal & seal gut barrier;  
Support gut microbiome

- 2-hydroxyphenylacetate
- 3-indoleacetate
- Para-hydroxybenzoate
- Para-hydroxyphenylacetate
- Tricarballic acid

**LEGEND**

**Nutrient Cofactors:**  
BH4 = tetrahydrobiopterin  
GSH = glutathione  
SAmE = S-adenosylmethionine

**Minerals:**  
Ca++ = calcium  
Co++ = cobalt  
Cu++ = copper  
Fe++ = iron  
K+ = potassium  
Mg++ = magnesium  
Mn++ = manganese  
Mo+++ = molybdenum  
Zn++ = zinc

**Abbreviations:**  
CO2 = carbon dioxide  
NH3 = ammonia

Disclaimer: The nutritional and pathway information presented in this chart is intended for educational purposes only, and not meant to act as a prescription or medical advice. The information presented has been obtained from online resources including the Small Molecule Pathway Database <https://smpdb.ca/>, the Kyoto Encyclopedia of Genes and Genomes <https://www.genome.jp/kegg/pathway.html> and UniProt <https://www.uniprot.org/uniprot/> as of April 1st, 2020.

## References

- Awuchi CG, Ondari EN, Nwozo S, Odongo GA, Eseoghene IJ, Twinomuhwezi H, Ogbonna CU, Upadhyay AK, Adeleye AO, Okpala COR. Mycotoxins' Toxicological Mechanisms Involving Humans, Livestock and Their Associated Health Concerns: A Review. *Toxins* (Basel). 2022 Feb 24;14(3):167.
- Bush RK, Portnoy JM, Saxon A, Terr AI, Wood RA. The medical effects of mold exposure. *J Allergy Clin Immunol*. 2006 Feb;117(2):326-33. doi: 10.1016/j.jaci.2005.12.001. Erratum in: *J Allergy Clin Immunol*. 2006 Jun;117(6):1373. Erratum in: *J Allergy Clin Immunol*. 2014 Nov;134(5):1217.
- Dyląg M, Spychała K, Zielinski J, Łagowski D, Gnat S. Update on *Stachybotrys chartarum*-Black Mold Perceived as Toxigenic and Potentially Pathogenic to Humans. *Biology* (Basel). 2022 Feb 23;11(3):352.
- Hooper DG, Bolton VE, Guilford FT, Straus DC. Mycotoxin detection in human samples from patients exposed to environmental molds. *Int J Mol Sci*. 2009 Apr 1;10(4):1465-1475
- Hope J. A review of the mechanism of injury and treatment approaches for illness resulting from exposure to water-damaged buildings, mold, and mycotoxins. *ScientificWorldJournal*. 2013 Apr 18;2013:767482.
- Omotayo OP, Omotayo AO, Mwanza M, Babalola OO. Prevalence of Mycotoxins and Their Consequences on Human Health. *Toxicol Res*. 2019 Jan;35(1):1-7.
- Reynolds KA, Boone S, Bright KR, Gerba CP. Occurrence of household mold and efficacy of sodium hypochlorite disinfectant. *J Occup Environ Hyg*. 2012;9(11):663-9.
- Rodríguez-Andrade E, Stchigel AM, Cano-Lira JF. New Xerophilic Species of *Penicillium* from Soil. *J Fungi* (Basel). 2021 Feb 9;7(2):126.
- Rosenblum Lichtenstein JH, Hsu YH, Gavin IM, Donaghey TC, Molina RM, Thompson KJ, Chi CL, Gillis BS, Brain JD. Environmental mold and mycotoxin exposures elicit specific cytokine and chemokine responses. *PLoS One*. 2015 May 26;10(5):e0126926.
- Snyder AB, Worobo RW. Risk Mitigation for Immunocompromised Consumers of Mucormycete Spoiled and Fermented Foods: Germain Guidance and Remaining Needs. *Microorganisms*. 2018 May 18;6(2):45.
- Vojdani A, Campbell AW, Kashanian A, Vojdani E. Antibodies against molds and mycotoxins following exposure to toxigenic fungi in a water-damaged building. *Arch Environ Health*. 2003 Jun;58(6):324-36.