

Mold

For Health Care Providers

This information presented here pertains to environmental exposure to mold (fungi) and may not apply to all fungal infections.

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Mold growth

Fungal spores are always present in the air, even if there is no visible growth.

Three factors are necessary for growth:

Moisture

- Different fungal species will grow with different amounts of moisture (damp windows versus leaking pipe versus flood waters in house), usually on material with a moisture content above 16%.
 - For example, *Aspergillus* and *Penicillium* tend to grow with damp conditions (minor moisture/condensate), while *Stachybotrys*, *Fusarium* and *Acremonium* are hydrophilic molds and will only grow with higher amounts of moisture present.
- Moisture indoors may also provide a climate for bacteria, cockroaches and dust mites (all may be a problem for people).

Nutrients

- Almost anything can be a food source for mold, including dirt, dust, wood, paper, paint, glue, textiles, insulation and other common materials.
 - For example, *Stachybotrys* will grow on cellulose-containing materials, such as wallpaper, paper, gypsum of wallboard, ceiling tiles, carpets and insulation (e.g., ureaformaldehyde foam).

Temperature

- If the right moisture and nutrients are present, fungi will grow at any temperature between 32°F and 130°F.



What mold structure and chemicals have been linked to health effects?

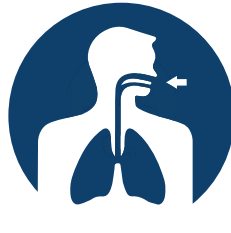
Exposure, in general, may be from:



Ingestion



Dermal Contact



Inhalation



People may be exposed to three different mold products:



Spores

Most mold spores are between 2 to 10 μm and are small enough to reach the lungs.

- However, spores over 10 μm may only reach the bronchi and bronchioles.

Fungal fragments

Many fungal fragments have structural chemicals that may cause allergic or irritant reactions:

- Glucans (structural component present in cell walls).
- Ergosterol (structural component present in the cell membrane).

Chemicals produced by fungal species

Mold growing indoors can degrade the surrounding materials and add chemicals and bioaerosols to indoor air.

- The musty smell often present with mold growth is from volatile organic compounds produced by mold (mVOCs).
 - mVOCs include alcohols, esters, aldehydes, hydrocarbons and aromatic compounds.
 - mVOCs are irritating in higher concentrations (may cause temporary eye irritation, conjunctivitis, skin rashes, rhinitis, laryngitis, hoarseness, cough and chest tightness).
- When conditions are appropriate, fungal species may produce mycotoxins (secondary metabolites) that are toxic to humans and animals.
 - Mycotoxins may be present in spores and fungal fragments.
 - Amount of mycotoxins can vary with specific isolate and prevailing growth conditions (temperature, nutritive status, light level and growth phase).

Mycotoxins can also be present in food, water and dietary supplements (e.g., aflatoxin, trichothecenes, patulin, ochratoxin and fumonisins). Clinically, mycotoxin exposure typically occurs through its presence in food (i.e., diet is the most important source of mycotoxin exposure as natural contaminants in various foods and liquids).

The U.S. Food and Drug Administration (FDA) regulates mycotoxins in food.

Note: Exposure to any of these three mold products (spores, fungal fragments and chemicals produced by fungal species) may not necessarily cause health issues. Additionally, exposure to mycotoxins versus exposure to fungi capable of producing mycotoxins are independent from one another and are dependent on the environment.

Symptoms and health conditions linked to mold and its chemicals:



Symptoms associated with exposure to indoor mold:

- Upper respiratory tract symptoms, including nasal congestion, sneezing, runny or itchy nose and throat irritation.
- Exacerbation of asthma.
- Wheeze.
- Cough.
- Hypersensitivity pneumonitis related to occupational settings in susceptible persons.
- Fungal colonization or opportunistic infections in immune-compromised persons.



Health conditions associated with agricultural/gardening products and dusts:

- Organic dust toxic syndrome, or “farmer’s fever,” due to acute inhalation of dust containing organic material (mold/bacteria) primarily in, but not limited to, agricultural and demolition settings.
- Hypersensitivity pneumonitis, from exposure to moldy straw, hay, compost and mulches.



Damp environments in general have been linked to:

- Respiratory symptoms.
- Headache.
- Fatigue.
- Recurrent infections.

Note: The suspected causes of these symptoms are not limited to mold. Other organisms such as dust mites and bacteria may also be responsible. Bacteria can also grow indoors and may produce endotoxins and bacterial VOCs.

Health conditions and symptoms *not* associated with mold:

Certain health conditions are commonly thought of as associated with mold. However, these do not have sufficient evidence to be associated with indoor mold.

These health conditions and symptoms are:

- Acute idiopathic pulmonary hemorrhage in infants.
- Cancer.
- Development of asthma.¹
- Gastrointestinal tract problems.²
- Lower respiratory illness in otherwise healthy adults.
- Mucous membrane irritation syndrome.
- Neuropsychiatric symptoms (including loss of intellectual ability and sleepiness).
- Rheumatologic and other immune diseases.
- Airflow obstruction in an otherwise healthy person.
- Chronic obstructive pulmonary disease.
- Fatigue.
- Inhalation fevers not related to occupational exposures (hypersensitivity pneumonitis symptoms).
- Reproductive effects.
- Shortness of breath.
- Skin symptoms.

¹ Mold exposure may trigger or exacerbate pre-existing asthma (Mazur et al. 2006).

² Ingestion of mycotoxins through food has been linked to gastrointestinal problems and direct contact with specific mycotoxins or VOCs may irritate the skin (Mazur et al. 2009).

Should I recommend mold testing?

No.

The genus or species of the mold does not matter in most environmental exposures. Also, there are no regulatory or health-based levels available to compare to results. “Safe” or “dangerous” levels of mold have not been set.



It is not a problem for mold *spores* to be present in indoor environments; however, mold *growth* indoors is a problem.

As outside air enters a house, so will mold spores (amount and type of spores would be similar). The patient's focus should be on both stopping the cause of the mold growth and removing the mold itself, not identification or presence of mold spores.

Refer patients to [Michigan.gov/Mold](https://www.michigan.gov/Mold) to view mold education fact sheets, including:

- All About Mold.
- Steps for Cleaning Mold.
- Mold & Your Health.
- Mold & Homeowners.

Note: Testing to determine if a person is infected with a fungal species is beyond the scope of this fact sheet.

What if my patients already tested their blood or home for mold and have results?

There are no standards for levels of mold/mold spores in an indoor environment. If mold can be detected, either visually or by odor, it should be addressed. Action is not dependent on amount of spores present.

If a patient has mold testing results, here are a few considerations to review with them:



Did the testing company use an industrial hygienist?

- Industrial hygienists have the background to deal with indoor air situations. The individuals should have accreditation such as Certified Industrial Hygienist (CIH) or Certified Associate Industrial Hygienist (CAIH) from the American Board of Industrial Hygiene (ABIH). Many other “certifications” are available, but not all require the same level of technical expertise.

Air sample results:

- Number of colony forming units per cubic meter of air (CFU/m³) indicate the number of colonies that grew on media from air in a specific location.
- The results should have both indoor and outdoor (reference area) samples for comparison. If the outdoor levels are greater than the indoor levels, there may not be an indoor mold problem.

Human blood testing results:

- The companies that test blood for mold and mycotoxins typically use testing for antibodies against mold or mycotoxins (RAST, ELISA) instead of direct biomonitoring of mycotoxins. This has all the limitations of typical allergy testing and the American College of Medical Toxicologists states that it “is not an accepted method to assess human exposure.”
- Results from the testing are not able to assess human exposure as the testing is based on encountered antigen (extract); the antibodies an individual has, which is not diagnostic of disease; and there is no connection between mold in the home and presence of antibodies to either mycotoxins or mold (a variety of mycotoxins are present in food and people can be exposed to mold through a variety of activities).
- Companies do not appear to test for infections with fungal species or the presence of mycotoxins. These items may not be clear due to the wording used to report out the test results.

What about “toxic black mold?”

According to the U.S. Centers for Disease Control and Prevention (CDC), the term “toxic mold” is not correct. While certain molds are toxigenic, meaning they can produce toxins (called mycotoxins), the molds themselves are not toxic or poisonous. The “toxic black mold” often linked to issues in popular media reports is *Stachybotrys chartarum*.

Facts:

- Many molds are black in appearance; color does not indicate species (some fungal species will have different colors under different growth conditions).
- Even if *Stachybotrys* is growing in a person’s house that does not mean it is producing dangerous levels of mycotoxins.
- Presence and amount of mycotoxins can vary with specific isolated and prevailing growth conditions (temperature, nutritive status, light level and growth phase).

For more information on mold and health, call the Michigan Department of Health and Human Services at 800-648-6942 or visit Michigan.gov/Mold.



Additional references on mold exposure

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