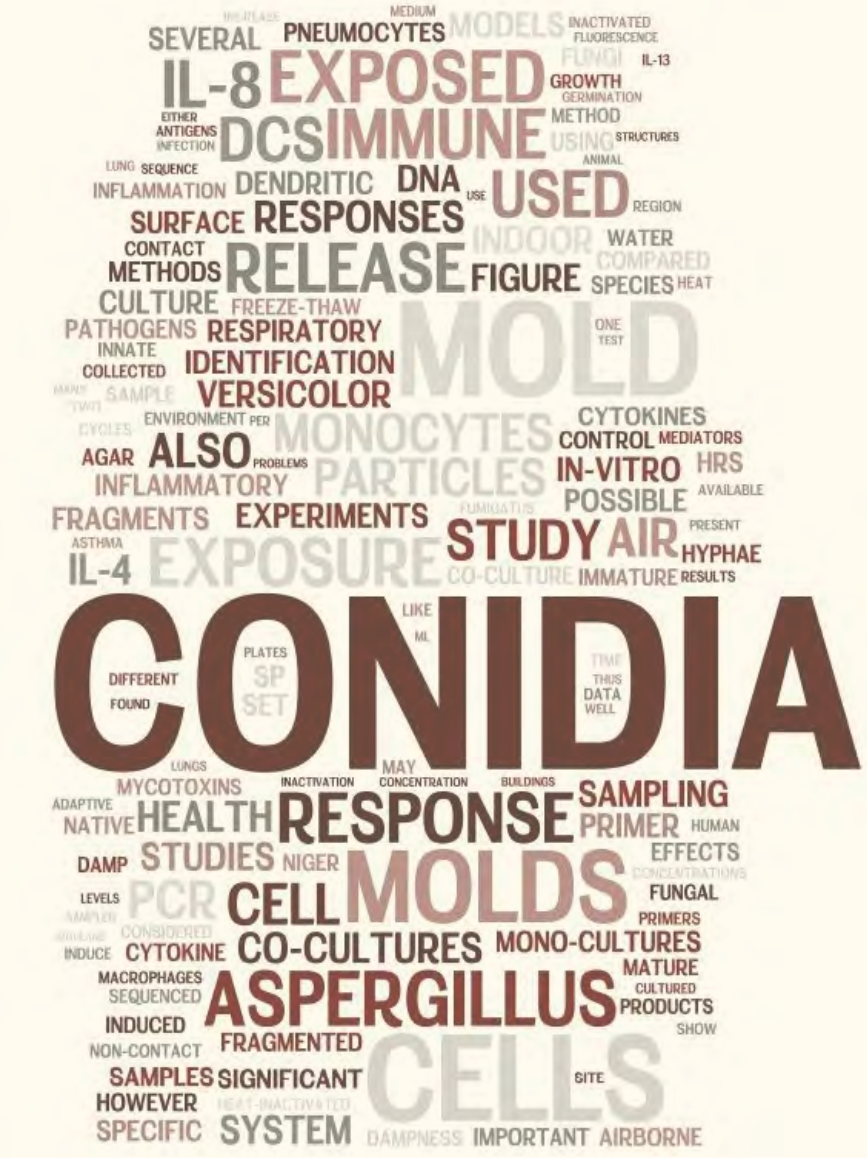
Mold Toxins & Related Illness — Cause & Effect

Implications for Mold Sensitive Adults and Children

by Gary Rosen, Ph.D.



This report will provide convincing science that:

1. **Most inhaled mold spores are quickly cleared from the upper respiratory system before reaching the lungs. They are then deposited into the gut for later excretion in the stool. Most inhaled mold spores are effectively eaten. As a result, *mold toxin exposure in the indoor environment is predominantly through the digestive tract and not respiratory system*.**

2. **Since mold toxin exposure in the indoor environment is predominantly through the digestive tract and not respiratory system, the thousands of studies on illnesses caused by ingesting mold toxins (mycotoxins) are applicable to indoor environmental exposure to mold. There is a great deal of accepted, non-controversial medical science on mycotoxin exposure via the digestive tract including concrete proof of *cancer*, *immune suppression; neurological impairment*; and *harm to intestinal lining & gut microflora* and other serious ailments.**

3. **Historically it has been claimed that it is not possible to establish thresholds for exposure levels of indoor mold. It has been claimed that it is not possible to prove an indoor environment is problematic. We will show otherwise.**

4. **Toxin producing molds are *always present* in water damaged homes and are *always producing toxins.***

5. **Indoor mold exposure is hazardous, especially to children.**

Section 1

Most inhaled mold spores are quickly cleared from the upper respiratory system before reaching the lungs. They are then deposited into the gut for later excretion in the stool.

Most inhaled mold spores are *effectively eaten*. As a result, mold exposure in the indoor environment is predominantly through the *digestive tract* and *not respiratory system*.

ASPERGILLUS ochraceous

ALLERGENICITY:	Allergenic.
MYCOTOXINS PRODUCED:	Ochratoxin, Penicillic acid.
HUMAN PATHOGENICITY:	Antromycosis; mycotoxin-induced tubulonephritis; chronic interstitial nephropathy.

You Are Not Feeling Quite Right — But There is No Visible Mold

Individual responses to mold exposure vary based on genetic makeup, duration and severity of mold (allergen and/or mycotoxin) exposure, and the individual's underlying health and nutritional status.

Evaluation of the amount of exposure speaks to the concept first articulated in the 16th century by Swiss-German alchemist Paracelsus that "dose makes the poison" i.e. that the amount of exposure as well as the potency of the poison (toxin) determines whether ill effect will occur. In the 21st century we know "the dose and the host" make the poison because susceptibility among those exposed varies extensively.

Indoor mold even at moderately high concentrations does not typically result in illness or even irritation to those not mold sensitive, which is the majority of people. However, breathing even very low concentrations of indoor mold can affect the sensitive (atopic), especially the young, the aged, those suffering from allergies or asthma and those with other illnesses or sensitivities that challenge or compromise their immune systems.

Illness promoting indoor mold problems are typically subtle and not visible; otherwise they are quickly fixed. So, the affected individual sees what appears to be a clean environment with perhaps a whiff of mustiness (odor from growing mold) but feels *for some reason* worse in the indoor environment than out. Chronic exposure to low levels of indoor mold toxins, mold allergens, and/or mold gases (mVOCs) are almost always involved and what started out as feeling "not quite right" can turn into something quite serious with continued exposure.

Mold hidden inside of walls even if extensive, if there is no active water source so the mold is no longer active, does not generally result in illness or irritation because mold exposure (see Mold Basics) is limited. Exposure to indoor mold toxins requires that the toxin containing mold spores be airborne so they can be inhaled. Generally speaking, mold trapped inside of walls results in limited exposure to occupants.

Health problems resulting from mold toxin exposure are almost always related to mold contaminated ducting and/or AC — no matter how many times the AC or ducting has been "cleaned". Even if there

Example of black toxic mold hiding in AC closet. Invisible unless the air handler is first removed. Not accessible to air duct cleaners.

Example of white toxic mold hiding in the fiberglass lined AC supply plenum above the AC. Invisible unless the air handler is first removed. Not accessible to air duct cleaners.

is only a small amount of mold growth in the AC or ducting, occupants will be constantly exposed — constantly breathing mold spores and their toxins — with resultant illness and/or irritation when occupants are mold sensitive. Duct cleaners are neither licensed nor trained to deal with mold. Even if a new AC has been installed, the problem is almost always AC, AC closet and/or ducting related. Fixing (remediating) the problem/ damaged house or office is generally straightforward when the problem is properly diagnosed. Oftentimes repair of the individual is not so simple and will require treatment under Doctor supervision.

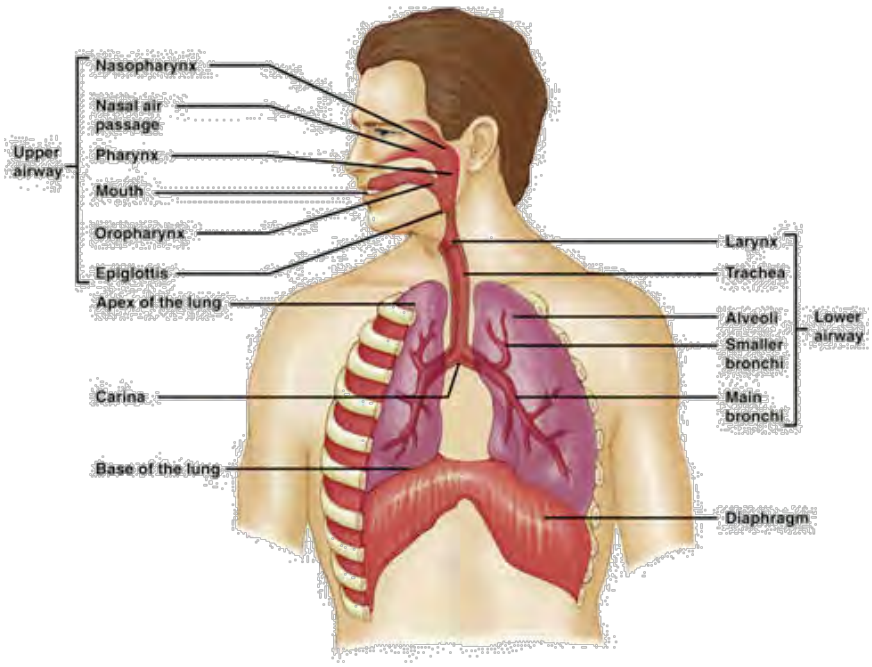
In this review, our focus is on illness and irritation from mold:

1. Mold allergens;
2. Glucans (mold cell wall irritants);
3. Mold gas irritation; but we have a major emphasis on ...
4. Mycotoxin exposure.

Bacteria and endotoxins and other factors besides mold may also be involved in causing indoor irritation and illness as a result of indoor dampness/ water damage. For an excellent review of the many illness-promoting factors involved in damp or water damaged buildings see: Biocontaminants and Complexity of Damp Indoor Spaces.

Main Mycotoxin Exposure Pathways

Eating: People are constantly being exposed to significant levels of mold toxins via their diet when they eat grains, meat, farmed fish, poultry and many fruits. Generally the level of mycotoxin exposure through the food chain, at least in the U.S. and Europe (but not so in sub-Saharan Africa), is low enough so that a healthy body's natural detox functions (via liver and kidneys) can adequately clean these toxins from the body quickly enough so they do no damage.



Breathing: The human respiratory tract can be considered to consist of two regions:

(1) Upper airway. Nose through Epiglottis
(2) Lower airway. Larynx through Lungs

People living in mold contaminated homes and/or with mold growth in their AC's, ducting and/or AC closet, breath elevated levels of mold spores and/or mold fragments. In the recent CDC funded research study on mold spore inhalation (Cho et al.) it was shown that the majority of inhaled mold spores land in the upper airway and never reach the lungs.

The (toxin laden) mold spores that land in the upper airway adhere to the airway mucous lining. Once embedded in the mucous, the spores are rapidly cleared from the airway and are deposited in the digestive tract for later excretion.

The majority of inhaled toxin laden mold spores therefore *are effectively eaten*.

Mycotoxins absorbed from the digestive tract will enter the blood stream and directly affect the body.

But often more important is the indirect affect on the body by damage occurring to gut bacteria/ microflora because mycotoxins are strongly bacteriocidal.

Levels of mold toxins that can negatively affect the gut microflora (microbiome) are likely 100's or even thousands of times lower than mycotoxin levels required to directly cause mold related illnesses by toxic impact on human organs/cells.

Therefore gut related problems from mold toxin exposure can be particularly common.

The principal route of exposure from *breathing* mold toxins is via the gut and not the lungs.

Subsequently, a common result of elevated mycotoxin exposure is damage to gut microflora.

Conclusions Section 1

- Most inhaled mold spores are quickly cleared from the upper airway before reaching the lungs.
- They are then deposited into the gut for later excretion in the stool.
- Most inhaled mold spores are effectively eaten.
- As a result, mold toxin exposure in the indoor environment is predominantly through the digestive tract and not respiratory system.
- Gut related problems from mold toxin exposure are common.

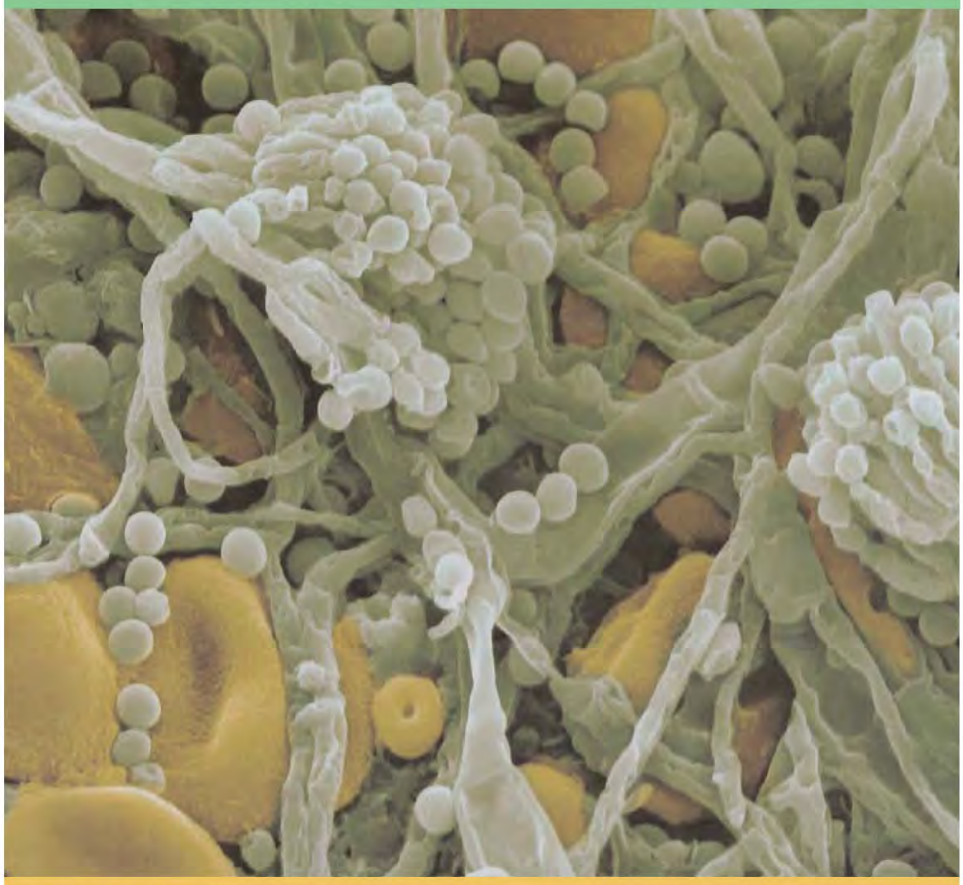
But as we shall see in the next section, continued exposure to elevated levels of mycotoxins can affect a whole lot more than just gut bacteria.

Section 2

Since mold exposure in the indoor environment is predominantly through the digestive tract and not respiratory system, the thousands of studies on illnesses caused by ingesting mold toxins (mycotoxins) are applicable to indoor environmental exposure to mold.

There is a great deal of accepted, non-controversial medical science on mycotoxin exposure via the digestive tract including concrete proof of *cancer*, *immune suppression; neurological impairment*; and *harm to intestinal lining and gut microflora* and other serious ailments.

PENICILLIUM sp.



ALLERGENICITY:	Allergenic.
MYCOTOXINS PRODUCED:	Various toxins by different species: Anacine, Arisugacins A&B, Auranthine(sclerotigenin), Aurantiamine, Belfedrin A, Botryodiplodin, Brevianamid A, Chaetoglobosin A, B&C, Chlororugulovasines A&B, Chrysogine, Citromycetin, Citreoisocoumarinol, Citreoviridin, Citrinin, Communensins A&B, Compactin, Curvularin, Cyanein, Cyclochlorotine, Cyclopenin, Cyclopenol, Cyclopiazonic acid, Cytostipin, etc. Complete list available at reference below.
HUMAN PATHOGENICITY:	Bronchopulmonary, nail, (sub)cutaneous, ear infections; systemic disease; osteomyelitis; endophthalmitis; keratitis; esophagitis; pericarditis; endocarditis. Effects found mostly in immunocompromised patients.
REFERENCE:	http://www.ttuhsc.edu

Mycotoxin Exposure

Since the majority of the inhaled mold spores wind up in the digestive tract (not deposited in the lung) and are effectively eaten, all of the medical and scientific research on what happens when mold toxins (mycotoxins) are eaten is applicable to indoor mold exposure. While there is limited research on mold toxins that enter the lungs, there are literally thousands of scientific articles on illnesses resulting from mold toxins that enter the body through the digestive system (are eaten.) There are many excellent reviews on the subject.

One of the best reviews is *Mycotoxins: Risks in Plant, Animal, and Human Systems* *by the U.S.* Council for Agricultural Science and Technology.

Another by Bennett & Klich (research sponsored by the U.S. Department of Agriculture) is available here.

Another excellent review on mycotoxins is the World Health Organization (WHO) Mycotoxin Training for Health Professionals. The WHO report explains why children are especially affected by mycotoxins.

In the WHO report they highlight a study on U.S. school children performed by the U.S. CDC. Burritos eaten at school lunch were contaminated with the mold toxin Vomitoxin. This is one of the six mold toxins regulated in foods produced in and imported into the E.U. but is not regulated in the U.S.

Predominant symptoms in the children (mostly gut related) were:

- Abdominal cramps in 88%
- Vomiting in 62%
- Headache in 62%
- Nausea in 39%

According to the WHO report, mold toxins (mycotoxins) probably evolved as a kind of "chemical defense system" to protect the mold from insects, microorganisms [such as other molds], nematodes, grazing animals and humans. Clearly humans should not be eating the mycotoxin contaminated burritos. The mold toxin chemical defense system seemed to be making its point!

According to the WHO report: "Mycotoxins are associated with human disease and cause acute and chronic effects. Trichothecenes inhibit protein synthesis and have many acute effects, including anemia and infant pulmonary hemorrhage. Ochratoxins and citrinin cause nephropathy and immunosuppression. Aflatoxins are hepatotoxins and are carcinogenic."

Note that all of these mycotoxins are commonly found in the indoor air of water damaged/ damp homes as well as part of our daily intact of foods.

Carcinogenic Mycotoxins

Several common molds produce very strong cancer causing agents. Aspergillis *flavus*, which grows on peanuts and corn (and in homes), produces the potent carcinogen Aflatoxin (causes liver cancer). Fusarium mold which grows on corn produces the carcinogen Fumonisin B1 and causes esophageal cancer. Aflatoxin is strictly regulated in foods and animal feed by both the U.S. Government and the E.U. but Fumonisin B1 in not regulated in the U.S. (only in the E.U.)

Liver cancer as a result of eating Aflatoxin contaminated corn is a huge problem in Sub-Saharan Africa. Drought weakens the growing corn's immune system resulting in heavy colonization by Afla-

toxin producing molds. Esophageal cancer from Fumonisin B1 contaminated corn is observed in people living in Italy, Iran, Kenya, Zimbabwe, United States and Brazil. (Wiki)

Non-Carcinogenic Mycotoxins

There are many non-carcinogenic mycotoxins and they can impact different organs in the body. None of these toxins are regulated by the U.S. Government but currently five non-cancer causing mold toxins, the ones most commonly found on corn and grains, are strictly regulated by the E.U. for both animal as well as human consumption.

The web site for the European Food Safety Authority (http://www.efsa.europa.eu/en/topics/topic/mycotoxins.htm) has a wealth of information on mold toxins and why the E.U. regulates them in animal foods and foods for human consumption.

China & Brazil also extensively regulate mycotoxins in food and animal feed. Only the U.S. does not.

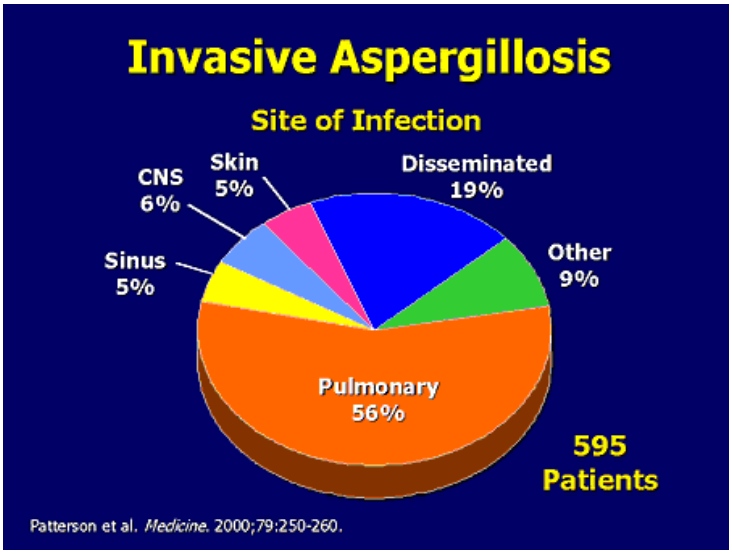
The non-carcinogenic mold toxins can affect different organs. Some are neurotoxic and have been used in biowarfare.

Other mycotoxins affect diverse organs including skin, lungs, liver, kidneys etc — in both people and animals. Many such as Gliotoxin (produced by the common indoor molds Aspergillus *fumigatus*, A. *terreus*, A. *flavus* and A. *niger*) are immunosuppressive.

And yet others principally impact the gastrointestinal tract (GIT) affecting not only the gut microflora but also the cells lining the gut (gut epithelial cells.) These epithelial cells are involved in food absorption, immunity, as well as other functions.

Immunosuppressive Mycotoxins

Aspergillus *fumigatus*, an opportunistic fungus (mold), is responsible for a life-threatening systemic disease called "invasive aspergillosis" (IA) in immunocompromised individuals where mold actually grows inside the lungs but can invade other areas as well. Insufficient immune defense mechanisms result in high IA mortality rates in neutropenic (low white blood cell count) and immunosuppressed patients. The incidence of IA has increased in recent decades, largely due to an increased population of immunosuppressed patients at risk after organ transplantation or therapy for cancer. In spite of advances in early diagnosis and new antifungal therapy, IA continues to be a leading cause of death in these patients, with mortality rates reported to be as high as 80% to 95%.



Aspergillus *fumigatus* produces the immunosuppressive agent Gliotoxin. Gliotoxin is a well-studied mold toxin and has long been fingered as the main chemical player contributing to the virulence of A. *fumigatus*. For studies on how the mold toxin Gliotoxin can compromise human immune system response see the following links (α, β, γ, δ, ε, ζ, η, θ).

Although not common, molds have been found growing in the brain as well as the lungs. See case study by Thrasher et al. of a deceased child where mold was found growing in the child's brain

(eating his brain) as a result of living in a water damaged home. The Thrasher paper has an excellent, concise review of molds and their secondary metabolites (toxins/immunosuppresives).

Neurotoxic Mycotoxins

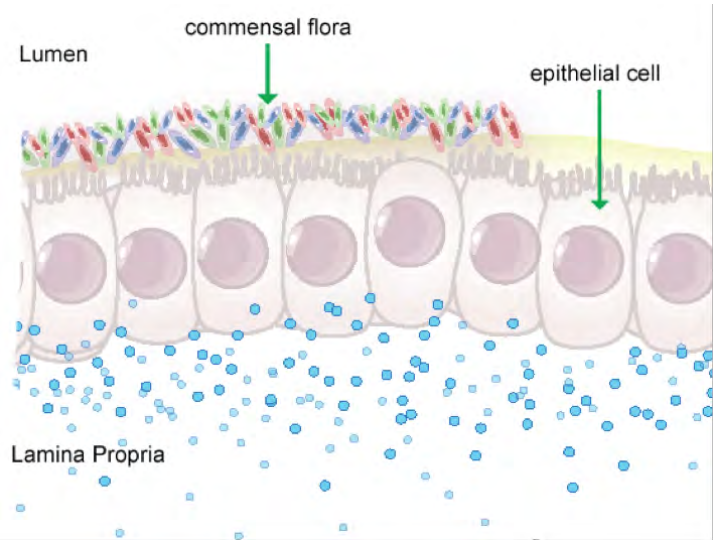
Some commonly occurring mold toxins can cause Neurological problems such as: Hheadaches, short term memory loss, attention deficit problems, anxiety, neurological impairment in children and other problems. It is well established that some mycotoxins (toxins from Stachybotrys and Trichoderma both molds commonly found in water damaged homes) are neurotoxic and exposure to such neurotoxins can result in some degree of neurological impairment.

The diagnosis of such exposure can be aided by the Visual Contrast Sensitivity (VCS) deficit test developed by Dr. Hudnell of the U.S. EPA, when there is no other reasonable explanation for the illness.

Since there are usually no reliable tests available to identify these neurotoxins in human tissue, blood or urine, proof of the cause of illness is VCS recovery and symptom resolution following treatment with toxin binders. The test can be taken online at: www.chronicneurotoxins.com. Note that unless the individual is removed from the mycotoxin laden environment, or the environment is fixed, the individual cannot heal. If you test positive, call your doctor and your mold remediator.

Mycotoxins and the Gastrointestinal Tract

Gut Microflora: Many or most mycotoxins of concern (including the well known mold toxin Penicillin) exhibit strong anti-bacterial affects (bacteriocidal). Chronic exposure to even very low levels of these bacteriocidal toxins (at mold levels in many homes) can damage the good gut bacteria that make up our gut micro flora. For more on gut flora see: http://en.wikipedia.org/wiki/Gut_flora.



A healthy gut is critical to overall health. Commensal gut microflora are involved in many critical functions including production of essential vitamins; proper and complete food digestion; as well, gut microflora are an important player in the body's detox capability.

When the gut microflora become out of balance as a result of mycotoxin exposure (dysbiosis), many adverse health effects can result including: a shift toward intestinal aerobic bacteria such as observed in inflammatory bowel diseases; obesity (additional obesity links †, ††, †††); as well as yeast/Candida overgrowth in the gut.

Yeast/Candida secretes the powerful immunosuppressive Gliotoxin (the same causative agent produced by Aspergillus molds resulting in Invasive Aspergillosis) and Candida also secretes proteins so it can attach itself permanently to the intestinal lining. Once yeast has taken over the gut, it does not simply go away. A healthy gut cannot be restored without medical treatment. No carb/ no sugar diets, anti-fungals, probiotics and sometimes fecal transplants (all under Doctor supervision) are solutions to yeast over-growth. Again, unless the sick individual is removed from the mycotoxin-laden environment they will not get better no matter how brilliant the doctor!

Intestinal Flora Affect Your Health

ASU BIODESIGN INSTITUTE
ARIZONA STATE UNIVERSITY

The microbes that live inside your intestines influence your health in beneficial and harmful ways

Immunity

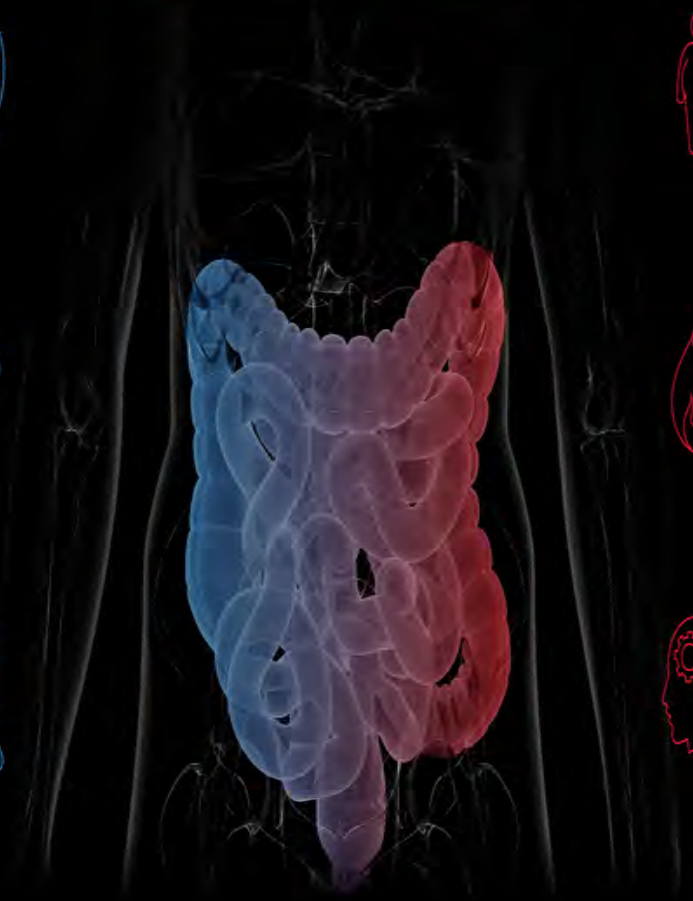
Providing a physical barrier to invasive microbes, our gut flora enhances the functionality of the immune system

Vitamins

Bacteria in the gut play a direct role in the synthesis of vitamins B and K as well as the absorption of calcium and iron

Metabolism

Metabolic activity of the gut flora allows our body to utilize food that would otherwise not be digested



Obesity

In 2009, Dr. Krajmalnic-Brown discovered gut bacteria of obese patients differ significantly from normal individuals

Inflammation

Gut flora likely play a major role in the development of various inflammatory diseases including IBD and colitis

Autism

New research by Dr. Krajmalnic-Brown suggests a link between autism and decreased gut bacterial diversity

An added advantage of a no carb/no sugar diet that starves yeast growth in the gut is that the grains and fruits avoided in this diet will have contained some level of mycotoxins. Therefore no carb/ no sugar diets will be naturally low in consumed/ eaten mycotoxins. And that's a good thing for those with elevated levels of mycotoxins in their system.

Note that research has shown that *organic grains* and fruits are often high in mycotoxins because antifungals are not used during the growth cycle or after harvest. So you cannot fix the gut problem by "going organic." It can make matters worse.

Intestinal Epithileum: An excellent review on the impact of mycotoxins on the lining of the intestine *(Modulation of Intestinal Functions Following Mycotoxin Ingestion)* can be found here. The article points out that intestinal cells are the first cells to be exposed to mycotoxins and at higher concentrations than internal body organs. The article concludes:

"The maintenance of a health gastrointestinal tract (GIT) is crucial as it:

1. Insures that nutrients are absorbed at an optimal rate;
2. It provides efficient protection against pathogens through its own immune system; and
3. It maintains the indigenous microflora in adequate numbers and confined to their natural niche.

These three functions of the GIT might be pictured as a "menage a trois" in which each component interacts with each other to maintain intestinal homeostatis".

They note that mycotoxin uptake and subsequent tissue distribution is governed by GIT absorption. The passage across the intestinal barrier can be very fast as with aflatoxin, but with other mycotoxins can be very slow and limited.

A substantial portion of non-absorbed mycotoxins remain in the GIT thereby exposing the gut epithelium (and gut microflora) to a very high concentration of toxins.

Is it any wonder that toxin binding therapy for mycotoxins present in the GIT for livestock (as well as humans) can be so effective?

Research Has Linked Indoor Mold to Many Illnesses

Research has linked exposure to elevated levels of mold mycotoxins during childhood to many diseases including:

- **MS:** Recent research has implicated the mold produced immunosuppressive Gliotoxin as a likely cause of Multiple Sclerosis in people that have a genetic disposition for MS. The frequency of MS has been increasing.
- **Autism:** Recent research has linked childhood exposure to neurotoxic mycotoxins with autism. The frequency of autism has been increasing.
- **Asthma:** Asthma in children is dramatically up and most certainly correlates with childhood exposure to mold.
- **Fungal Sinusitus:** Allergic Fungal Sinusitis (AFS) is now believed to be an allergic reaction to environmental fungi that is finely dispersed into the air. The frequency of AFS has been increasing.
- **Alzheimer's:** Vulnerability to Alzheimer's disease is the result of dysbiosis.
- **Obesity:** Recent research has shown that gut bacteria play a role in obesity.

Keep in mind that central air conditioning which cools and dehumidifies homes (always wet inside the AC) started becoming popular in the U.S. in the 50's and 60's. Then in the 70's came the energy crisis and buildings became tightly sealed/ air conditioned boxes. Today's children spend 90% of their time sealed indoors, exposed to indoor environmental chemicals. It would be surprising to this author if environmental based illness was not increasing.

Mycotoxins in Foods

A main worldwide concern with mycotoxins has been with regard to mold growth on improperly stored grains used as animal food for pigs, cattle and poultry and increasingly farmed fish. Toxic mold growing on animal feed causes billions of dollars of animal losses each year.

Assessing, avoiding, and treating these mold related illnesses in farm animals is big business. And that means much attention is given to this issue and a great deal of money is spent on researching the impact of molds on food and feed. Much of the research that has been done and is currently being done is in Europe on not only the six E.U. government-regulated common mycotoxins but also on dozens of other, as yet, unregulated mycotoxins.

Pigs are particularly sensitive to many mycotoxins that grow on feed grains, particularly corn. Researchers estimate that the number of stillborn piglets increases from 6.6% to 15.5% due to ingestion of mycotoxins. Other problems caused by mycotoxins in pig food include increased levels of abortions and loss of fertility. So we not are talking about eye irritation and runny noses — these are serious, life threatening problems!

Problems are avoided by reducing the amount of moldy grains fed to pigs (toxin avoidance) but there is also a huge business adding mold toxin binders to pig food (cattle and poultry food also) so that mycotoxins are eliminated (toxin removal) from the animals in their excrement as a mycotoxin toxin + toxin binder complex. This is treatment/removal.

Our concern is not brain fog in chickens, headaches in cows, or attention deficit issues in pigs. Even if they were our concern these would be very hard to measure! Our concerns are sinus/ respiratory problems, memory loss, attention problems, headaches, inflammation, IBS, low energy, etc. as a result of mold toxin exposure in people.

So you might ask what this has to do with people getting sick in moldy houses. They are not eating moldy walls or carpeting. This is true. But recall that in problem homes or offices, when mold spores are breathed, within several minutes the majority of the mold spores and the mycotoxins contained in and on the spores are being cleared by the upper airway (before reaching the lungs) and deposited into the stomach. Inhaled mold spores are *effectively eaten.*

With most people, research shows that absorbed toxins are excreted rather quickly from the body via urine and stool. But with mold sensitive people, they do not detox well and mold toxins are not rapidly excreted from the body thereby affecting organs all over the body. Just remember what happens in pigs from eating mold toxins. They have life threatening ailments — not just itchy eyes and runny noses.

Yes mold toxin exposure by animals eating contaminated feed stocks is at much higher levels than humans breathing mold toxins from mold contaminated buildings; but what is being measured in animals is liver cancer, organ failure, abortions, infertility, death, etc—not subtle issues such as headaches and brain fog.

The mycotoxin levels needed to affect people (sinus, respiratory problems, brain fog, inflammation, headaches, Irritable Bowl Syndrome, low energy or Chronic Fatigue Syndrome, etc) are going to be 100's or even thousands of times lower than those that actually kill or severely damage livestock.

Indoor mold exposure levels are often sufficiently elevated to cause illness in mold sensitive individuals including the elderly, very young, asthmatic, and immune compromised.

Toxin binding therapies (cholestyramine, charcoal, algae cell walls etc.) along with avoidance (remediation or moving from the problem home or office) are both used to restore the health of individuals with mycotoxin related illness — just as being done on a mega scale on farms with pigs, poultry, cattle and farmed fish.

Anti-fungals and probiotics along with proper diet can help restore balance to gut micro flora and combat fungal sinusitis. Molds growing in sinuses (see Mayo Clinic article) are typically living as a biofilm and can be hard to kill (see Biofilm book) and may require treatment with Eugenol (clove oil) or other.

But nothing works to restore health if the person continues to be exposed to the problem environment ... continues to be exposed to mold toxins.

Note that toxin binders, also called sequestering agents, will strongly bind vitamins and other nutrients so the timing of administration is critical. Treatment should be under Doctor's supervision.

Conclusions Section 2

- Mold toxin exposure in the indoor environment is predominantly through the digestive tract and not respiratory system.
- The thousands of studies on the illnesses caused by ingesting mold toxins (mycotoxins) are applicable to indoor environmental exposure to mold.
- There is a great deal of accepted, non-controversial medical science on mycotoxin exposure via the digestive tract including concrete proof of *cancer*, *immune suppression; neurological impairment*; and *harm to intestinal lining and gut microflora* and other potentially serious ailments.

Section 3

Historically it has been claimed that it is not possible to establish thresholds for exposure levels of indoor mold.

It has been claimed that it is not possible to prove an indoor environment is problematic.

We will show otherwise.

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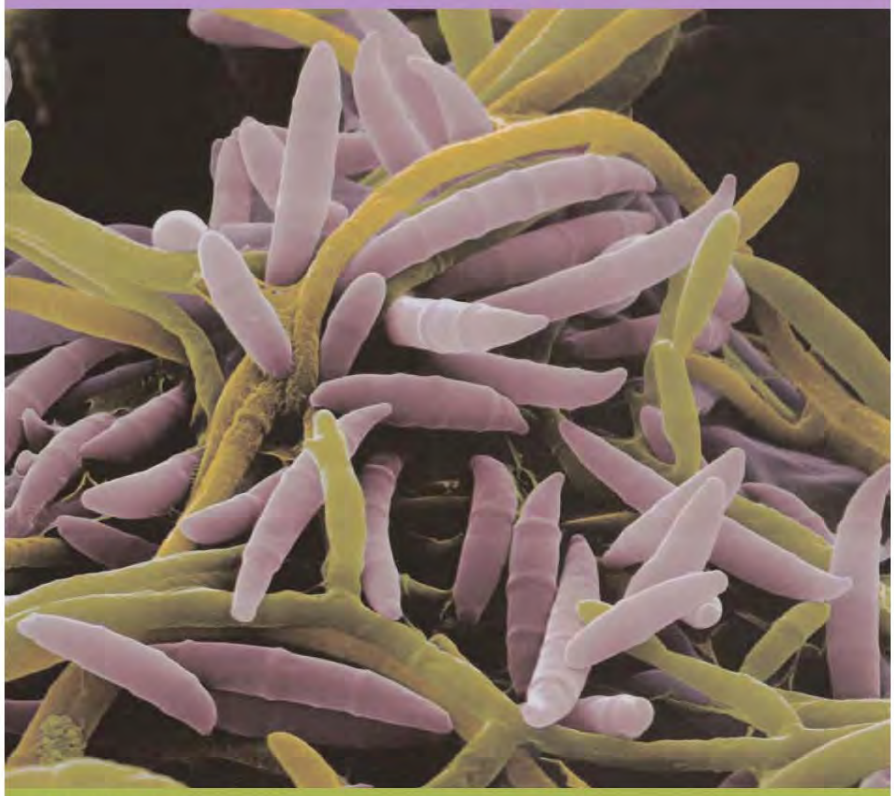


ALLERGENICITY:	Allergenic.
MYCOTOXINS PRODUCED:	Acetoxyscirpenol, Acetoxyscirpentriol, Acetyldeoxynivalenol, 3-Acetyl-neosolaniol, 15-Acetyl-nivalenol, 3-Acetyl-HT-2 toxin, Acetyl-T-2-tetraol, Acetyl-T-2 toxin, Acuminatopyrone, Antibiotic Y, Apotrichothecenes, Beauvericin, Butenolide, Calonectrin, Chlamydospordiol, Chlamydosporol, Culmorin, Deacylcalonectrin, Deoxyfusapyrone, Deoxynivalenol (Vomitoxin), Diacetyl-nivalenol, Diacetoxyscirpenol, etc. Complete list available at reference below.
HUMAN PATHOGENICITY:	Causes eye, (sub)cutaneous, nail, pulmonary, and heart infections; mycetomas; arthritis; peritonitis; cerebral, disseminated, or systemic opportunistic infections in immunocompromised patients.
REFERENCE:	http://www.ttuhsc.edu/

No Numerical Criteria Exist to Define Mold Exposure Levels

Reponen et al *Visually observed mold and moldy odor versus quantitatively measured microbial exposure in homes* (funded by HUD) found that associations between health outcomes and measured concentrations of microorganisms (fungal spores, bacteria) or microbial components (endotoxins or fungal cell walls (glucans)) in the indoor environment are inconsistent and even contradictory.

- Some studies have shown that elevated concentrations of fungi (total or specific species) in the indoor air are associated with increased risk of respiratory health outcomes.
- Other studies did not find such associations.
- Additionally, previous investigations have revealed increased risk of adverse respiratory health outcomes associated with elevated concentrations of fungal cell walls (glucans) or endotoxins, but a protective effect has also been demonstrated for both fungal cell walls and endotoxins.

The scientific literature on the inhalation toxicity of mycotoxins is sparse. No chronic (more than 90 days of 4 to 5 hours) exposure studies have been done. Sub-chronic studies (1 to 3 months exposure) have also not been done.

Not very many moms are going to sign up to have their children participate in exposure studies of mycotoxins known to cause cancer and neurological disorders! All kidding aside, such experiments are morally and ethically problematic and will never be done.

Technical difficulties in determining and measuring indoor levels of mold-related agents have prevented the establishment of numerical criteria that could be used to define mold exposure levels in homes or offices or schools as either *acceptable* or *inacceptable* for susceptible populations.

Given that mold is always present in buildings, the question remains how do you determine what is a "moldy building" and what is a "non-moldy building" particularly in regard to susceptible populations (the young, elderly, immunocompromised, asthmatic etc.)

Most have agreed that defining a building as having a mold problem or no mold problem when issues are subtle is not possible. The reason is that the individual species of microbes and other biological agents that are responsible for health effects in damp buildings cannot be easily identified or their levels determined. This is due to the fact that:

- People are exposed to multiple agents simultaneously and methods to detect and enumerate all species involved is inherently limited or inaccurate.
- There are complexities in accurately estimating exposure (just how much is inhaled?);
- There are large numbers of potential symptoms and health outcomes due to mold exposure.
- There are varying sensitivities of occupants.
- Mold that has the potential of making a toxin, is it actually making it?

However the broad medical and scientific community generally agree that:

1. From the EPA guide on Mold in Schools. We quote:

- "All molds [growing indoors] have the potential to cause health effects.
- "Molds can produce allergens that can trigger allergic reactions or even asthma attacks in people allergic to mold.
- "Others are known to produce potent toxins and/or irritants.
- "Potential health concerns are an important reason to prevent mold growth and to remediate/ clean up any existing indoor mold growth."

1. The community also agrees that: Damp buildings increase the risk of respiratory symptoms.

The EPA guidance says indoor mold can cause health effects. Take care of it and avoid health problems. But what amount of mold in the indoor environment will cause a health problem? That question is difficult to answer.

Because of the difficulties in quantifying mold problem in homes, most efforts have traditionally focused instead on defining problem homes in terms of "dampness". What everyone seems to agree on is that damp homes are always considered to be problem homes.

And people also seem to agree that identifying a home as damp or not damp is something that is *always* possible to do. In contrast, identifying a home with subtle mold problems as moldy or not moldy in regard to impact on occupants of varying sensitivities *may not always* be possible.

Damp Buildings Increase the Risk of Respiratory Symptoms

Reviews and meta-analyses have concluded that sufficient epidemiological evidence is available from over 100 studies conducted in different countries and under different climatic conditions to show that the occupants of **damp buildings** are at increased risk of respiratory symptoms, respiratory infections, and exacerbation of asthma (IOM 2004; Fisk et al. 2007; Antova et al., 2008; WHO Europe, 2009).

So while the scientific and medical community conclude: "**Damp** Buildings Increase the Risk of Respiratory Symptoms" but how do you *precisely* define what a **damp** building is?

The CDC defines dampness as *excessive water or elevated humidity*.

- This definition is problematic. What is "excessive" and what is "elevated"?

NIOSH defines dampness as the *presence of unwanted and excessive moisture in buildings.*

- But again what is "excessive" and what is "unwanted"?

The Institute of Medicine (National Academy of Sciences) in their 2004 publication *Damp Indoor Spaces and Health* defines dampness as: *Dampness is used to signify a wide array of signs of moisture damage of variable spatial extent and severity. It may represent visual observations of current or prior moisture (such as water stains or condensation on windows), observed microbial growth, measurement of high moisture content of building materials, measurement of high relative humidity in the indoor air, moldy or musty odors, and other signs that can be associated with excess moisture in a building.*

- This definition is problematic. Earlier water stains or prior moisture or even earlier microbial growth does not mean that a building is currently damp. What does "high" humidity or excess moisture mean?

World Health Organization *Guidelines for Mold and Dampness* defines dampness as: *Any visible, measurable or perceived **outcome** of excess moisture that causes problems in buildings, such as mould, leaks or material degradation, mould odour or directly measured excess moisture (in terms of relative humidity or moisture content) or microbial growth.*

- This definition is problematic for the same reasons as stated above but is perhaps the best of the bunch as it focuses on current problems and not earlier problems such as prior water stains and focuses on outcomes from dampness.

Our definition of dampness is a modification of the WHO definition and is based on outcomes and not measurements:

* *Dampness is defined as excess moisture in the indoor air that results in one or more of the following conditions. Some of these conditions actually prove dampness by themselves, others only prove dampness in combination with other outcomes.*

1. *Indoor condensation on surfaces;*
2. *Ongoing mold or microbial growth on structure or content resulting from indoor humidity not from a water leak.*
3. *Ongoing mold or microbial growth inside the AC system or ducting "beyond" the always wet cooling coils which will always have some degree of mold growth unless recently cleaned.*
4. *Mold/musty odor.*
5. *Dampness and resulting microbial growth that often result in adult occupant irritation (headaches, stuffiness, eye irritation or other); that repeatedly goes away when the occupant leaves the building; and repeatedly returns when they enter the building. When the occupants have mold related symptoms in the absence of a water leak and visible mold, look to damp as a likely cause.*

Armed with this definition, once we define a home as damp, that home can generally be accepted to be a health risk or at least irritating to sensitive individuals.

Five Factors that Define a Building Indoor Space as Damp

1. **Indoor condensation on surfaces:** When the outside temperature is cool, window glass and metal window frames will be cool. If indoor humidity is elevated, moisture will condense on the interior surface of the windows. In air conditioned homes, during warm summer months if there is elevated indoor humidity, moisture will visibly condense on the cold metal AC supply vents/grills. Moisture on the insides of windows or AC grills are signs that the indoor humidity is elevated and can result in the growth of indoor microbial contaminants. Oftentimes a little mold will result on the inside window sill or AC grill. Such growth can easily be removed with a little Tilex® or other treatment and is not typically a threat to health.

Indoor condensation alone does not mean a home is damp or a health risk. There must be mold growth related outcomes such as mold odor or significant (more than a few square inches of) visible mold growth or occupant irritation. Indoor condensation is an indicator of dampness but does not prove dampness.

2. **Ongoing mold or microbial growth on structure or content resulting from indoor humidity not from a water leak.** When the humidity in indoor air is significantly elevated so that the building can be classified as damp, there will often be recurring mold growth on content especially interior doors and other wood items and on clothing and leather purses and shoes located in poorly ventilated closets. Such ongoing microbial growth is not only an indicator of dampness but it actually *proves* dampness.

3. **Mold in the AC system.** When mold is actively growing in the AC, ducting or plenums, it is sure to be airborne, resulting in a home becoming irritating to sensitive occupants. Mold will not grow in the AC ducting or plenums unless there is a problem with indoor dampness. Often the problem with indoor dampness is localized in the AC closet and is caused by the closet walls or ceiling not being completely sealed. Resultant moist air from the wall cavities or ceilings will then enter the home almost always causing mold growth and/or occupant irritation.

Visual inspection of AC ducting and plenums that determines that there is mold growth present is a valid method of assessing if occupants are at risk. It is widely accepted that mold growth in the ducting or plenums results in occupants being at risk. Such mold growth will be the result of either current or earlier dampness. Mold growth in the AC and/or plenum/ducting does not in itself prove dampness — but if accompanied by odor, which means mold is active, resulting from elevated indoor humidity — this combination is proof of dampness.

(Note: There is always mold growth on (always wet) AC coils. Dirty coils should be cleaned but wet mold does not aerosolize.)

Dr. Philip Morey, one of the nation's foremost experts on mold assessment and remediation, concurs. In his chapter in the book *Bioaerosols* by Fungal Research Group (2012) he states:

"The most important aspect of a mold assessment is the physical inspection of the building and its HVAC system for evidence or dampness and biological growth. … the greatest limitation in mold assessments occur when there is over reliance placed on data obtained from sampling."

We certainly agree with this. Almost every mold assessor focuses too much on taking air samples which unless they come back grossly elevated, rarely if ever provides information as to either the extent or location of indoor mold.

This is not to say that we don't recommend testing. Our firm does mold sampling for every job that we do. But there is a great deal more to a mold assessment than simply taking a few air sample.

4. **Mold/musty odor.** We again refer to the Reponen et al study *Visually observed mold and moldy odor versus quantitatively measured microbial exposure in homes* (funded by HUD). The study concludes: "Moldy odor appears to be an important home characteristic that should be included in the health outcome assessment."

If mold is growing in a home, office or school it will be giving off mold odors (musty smells). Mold that is not active because the humidity is below 70% or there is no water source will not produce odor. Only active (growing) mold produces odor. If the level of mold odor is detectable it is generally agreed that there is a mold problem in the home and that sensitive occupants can be at risk. If there is no water source and mold is active (alive and growing) as evidenced by production of mold odor then the indoor space is proven damp.

Several excellent studies exist on mold odors — microbial volatile organic compounds or mVOCs:

- Polizzi et al. *Influence of various growth parameters on fungal growth and volatile metabolite production by indoor molds.*
- Walinder et al. *Acute Effects of a Fungal Volatile Compound.*

This Walinder study finds: "Acute effects in the eyes, nose, and airways were detected and might be the result of the biologically active properties of 3-MF [identified as the gas mold's produce]. Thus, 3 -MF may contribute to building-related illness." Furthermore the chemical 3-MF was the exact same chemical that causes the characteristic mold odor.

5. **Irritation of adult occupants.** Why do we say "adult occupants"? Because in our experience it is very difficult to determine if children are irritated by subtle mold related issues. Clearly if adult occupants are irritated or sick by the indoor environment it is a problem environment. However this definition is subjective and greatly depends on the sensitivities of occupants. Nevertheless from our experience it is extremely reliable in determining whether a home is problematic or not. But mold related indoor irritation is not always the result of dampness. There may be mold growth related to a current water leak. Or the home may have had an earlier mold problem and it was not properly remediated. As a result there will be mold present but not as a result of what we define as "dampness".

   Mold and mold spores can be irritating even when dead/ inactive. That means that mold that has formed from an earlier leak but is not removed can cause irritation or illness even though the leak was fixed and the mold is no longer growing and giving off gases, and even if dead. Irritation results from dampness and subsequent microbial growth but does not prove dampness because there may be existing hidden mold not related to dampness.

Conclusions Section 3

At the beginning of this section we stated …

1. Historically it has been claimed that it is not possible to establish thresholds for exposure levels of indoor mold.
2. It has been claimed that it is not possible to prove an indoor environment is problematic.

And we made the bold statement that we will show otherwise. Have we done that?

1. **Establish exposure levels:** Clearly the EPA has stated that any indoor mold is a potential problem and needs to be remediated and the source of the problem (water leak or dampness) fixed. They have set the exposure level for mold to be any visible mold.

   So yes we can establish thresholds for exposure. Just not numerical thresholds.

2. **Proving an indoor environment is a health issue.** Since it is generally accepted that a damp indoor environment can be hazardous to occupant health all we have to do is apply our 5 factors for determining dampness. If the indoor environment is damp = problematic. If not damp then it is not likely to have *ongoing* problems. Of course *not damp* doesn't mean that there are no mold problems. Why? Because not currently damp does not rule out mold from earlier water damage problems such as a plumbing leak that was not properly remediated.

   So yes we can prove an indoor environment is problematic by proving that it is damp.

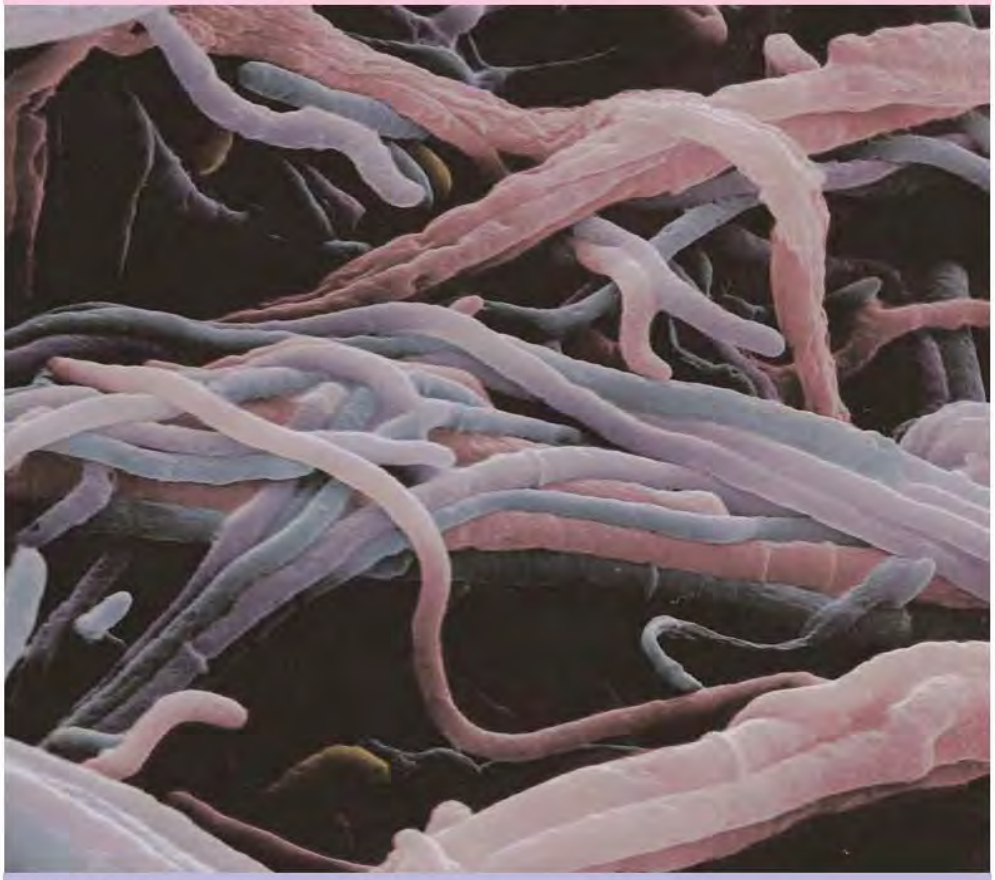
As mentioned earlier, one of the issues complicating the discussions of indoor mold exposure concerns the question as to whether mold growing in the damp or wet indoor environment has both the potential for making a toxin and is actually making it. We will look at these issues in Section 4.

Section 4

Studies convincingly show that toxin producing molds are:

- ***Always present*** **in water damaged homes and**
- ***Always producing*** **toxins.**

STACHYBOTRYS sp.



ALLERGENICITY:	Can be allergenic.
MYCOTOXINS PRODUCED:	3-Acetyl-deoxynivalenol , Atranones A-G, Cyclosporins, Diacetoxyscirpenol, Deoxynivalenol or Vomitoxin, Epoxytrichothecene, Isosatratoxins F, G & H, Phenylspirodrimanes, Roridins A, E, Satratoxins F, G & H, Stachylysin, Trichoverrols A, B, Verrucarins A,J, Verrucarol (T-2-tetraol).
HUMAN PATHOGENICITY:	Mycotoxin-caused pulmonary hemorrhage/hemosiderosis in infants; dermatitis; cough; rhinitis; itching or burning sensation in mouth, throat, nasal passages, and eyes.
REFERENCE:	http://www.ttuhsc.edu

The U.S. Center for Disease Control (CDC) Funded Study

The extensive CDC study (table below) of molds growing in water damaged homes in New Orleans after Rita/Katrina found toxin producing molds were always present.

Toxin Producing Mold	Frequency Found	Toxins Produced
Asp *Versicolor, Flavus, Terreus, Ustus, or Fumigatus*	100	Versicolor: Gliotoxin; Flavus: Aflatoxin; Terreus: Tremorgenic; Ustus: Ausdiol Fumigatus: Gliotoxin
Aspergillus *Niger*	95	Gliotoxin
Chaetomium	50	Chaetoglobosin
Stachybotrys	25	Satratoxin Neurotoxin
Trichoderma	25	Trichothecene Neurotoxin
Alternaria	20	Tenuazonic Acid

- The toxic mold Chaetomium was found in 50% of the homes.
- The (infamous) toxic black mold Stachybotrys that produces the cytotoxic and neurotoxic Satratoxin was found in 25% of the homes.
- The toxic mold Trichoderma that produces the neurotoxin Trichothecene was found in 25% of the homes.
- One or more species of toxic Aspergillus strains were *always* present.

True these homes in the CDC study were likely more water damaged and moldy than most occupied homes that we visit, but we find a similar mix of toxin producing mold in water damaged homes in South Florida just less mold overall than in New Orleans homes after Rita/Katrina.

No doubt the exact mix of molds growing in homes depends on the type of building materials used, as well as temperature, weather patterns and other factors so there may be some variation throughout the country.

Nevertheless, our in-house studies (unpublished studies by Gary Rosen, Ph.D.) find a similar distribution of mold species in water damaged South Florida homes.

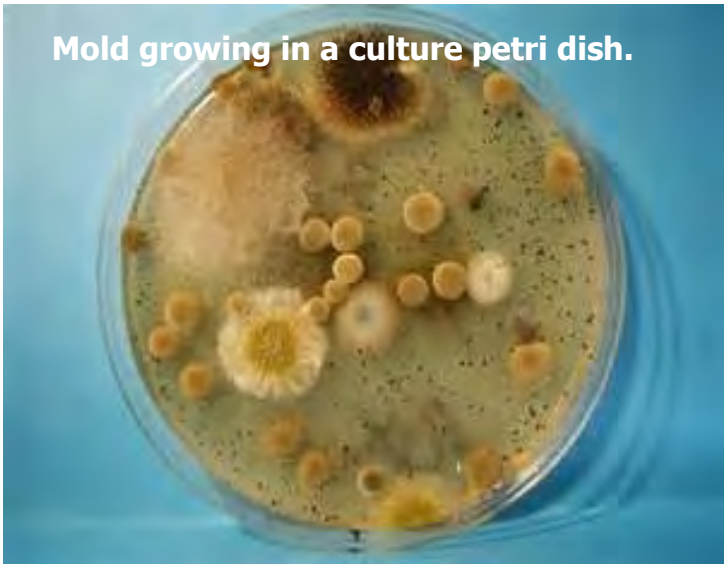
We find, as the CDC study found, toxin producing molds are always present in water damaged homes.

However we find that Stachybotrys is almost always present (much more frequent than the 25% found in New Orleans) in water damaged homes when the homes are built with *drywall* which is most homes in S. Florida. Wood or plaster interior walls are significantly more resistant to Stachybotrys than drywall based interior construction.

Stachybotrys loves wet drywall.

Does Mold that CAN Produce Toxins ALWAYS Produce Toxins?

As the CDC New Orleans study found, and no doubt due to the nature of indoor environments (materials, temperature, lack of sunlight, etc.), there is always a significant mix of molds present on wet materials — especially wet drywall. And some of these molds *will always be toxin producers* because molds produce toxins to compete for turf against other molds which are always present as well as against bacteria.


Mold growing in a culture petri dish.

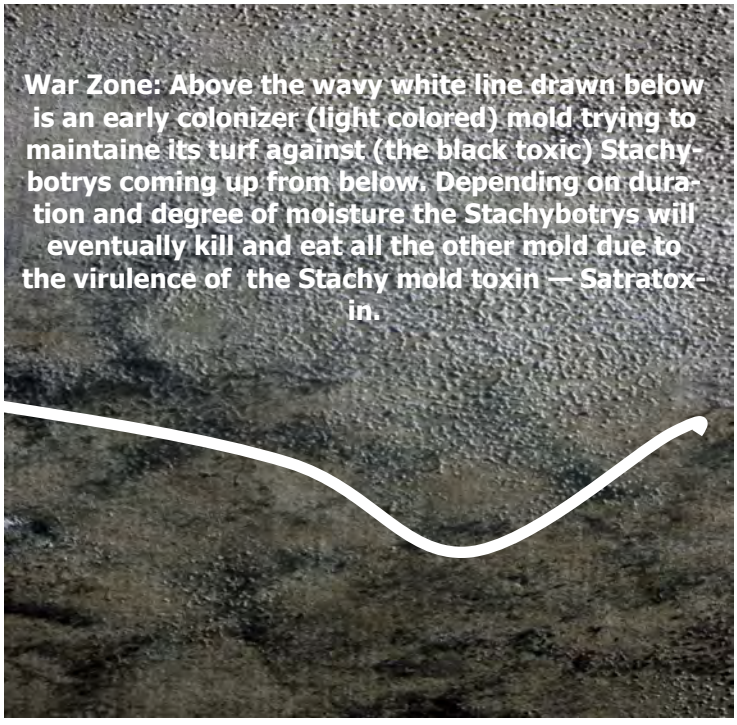
Everyone knows the story of how Sir Alexander Fleming (1945 Nobel Prize in Medicine) accidentally discovered the antibiotic Penicillin. Fleming was studying bacteria and noticed that one culture was contaminated by fungi (mold). The bacteria immediately surrounding the fungi were dead — because the mold was producing an antibacterial agent. He later named the antibacterial agent Penicillin because it was produced by the mold Penicillium.

Penicillin, the antibiotic was discovered, and medicine as we know it was changed forever.

Penicillin is an antibiotic that targets bacteria. It is toxic to bacteria. Most mold-produced toxins (mycotoxins) are toxic, not only to bacteria, but also to other molds, animals and to people.

Mycotoxins are produced by molds as a defense mechanism to avoid being eaten as well as an offensive weapon for molds to take over turf from other molds and bacteria.

Some molds such as Penicillium as well as Aspergillus are fast growing molds and are called early colonizers. They need the least amount of water to grow, and they start to grow on wet drywall and other indoor surfaces as early as 48-72 hours.


War Zone: Above the wavy white line drawn below is an early colonizer (light colored) mold trying to maintaine its turf against (the black toxic) Stachybotrys coming up from below. Depending on duration and degree of moisture the Stachybotrys will eventually kill and eat all the other mold due to the virulence of the Stachy mold toxin — Satratoxin.

Later come the slower growing molds (starting 10-14 days) such as Stachybotrys.

Stachybotrys produces the virulent toxin Trichothecene Satratoxin — toxic to other molds — and will eventually, and given sufficient water and time, kill and consume all the early colonizer molds. "Stachy" will eventually spread and take over all the wet drywall.

See picture above taken by author — what we call the War Zone.

Satratoxin (a Trichothecene toxin) which Stachybotrys produces to kill other molds is not only toxic to molds but also to people. It is one of the most toxic substances known to man — 5 times more toxic than another Trichothecene toxin T-2 (produced by Fusarium) which has been weaponized and used in biowarfare.

In the indoor environment, molds are always fighting one another for turf.

In the indoor environment there are always toxin producing molds and it would make sense that they are ALWAYS producing mold toxins in their fight against other molds. But can we actually prove that they always produce toxins?

Many Mold Toxins are Fluorescent under Black (UV) Light

Fortunately for mold toxin investigators, many mold toxins fluoresce under black light. Farmers extensively use this method to detect toxin producing molds on their grains. If fluorescent mold is present, farmers then send the samples to a lab for analysis of the levels and types of mycotoxins present.

To the right is a picture the author took at night in a water damaged home of mold growth that is fluorescing under UV light. Fluorescence happens when the mold is producing or has been producing one of the many mold toxins that are fluorescent — which so happens to be many molds toxins.

Laboratory methods (discussed next) can determine the actual type of toxins produced. But in many cases we care only if there are toxins present, not the type of mold toxins.

So checking the water damaged premises using a black light to determine if there are toxins present can be extremely useful:

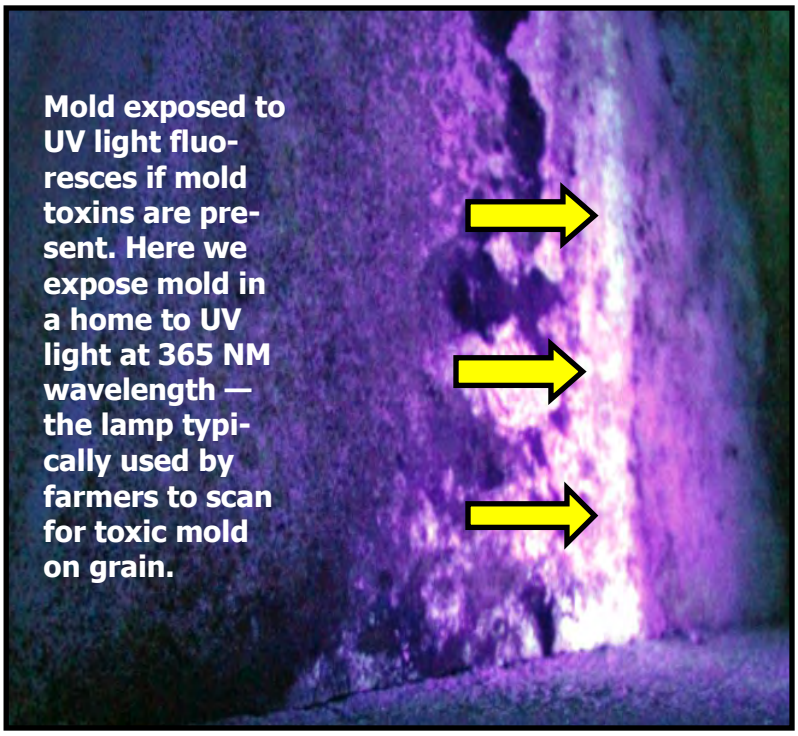
- Works well
- Immediate results
- No lab fees

Not all mold toxins fluoresce under black light but many of them do.

To the right is a list of major mold toxins that fluoresce under black light.

Scanning for fluorescent mold toxins is proven technology and widely used.

Farmers check their grains for the presence of mold toxins using UV light at 365 nanometer wavelength. That's also what we use.



Mold exposed to UV light fluoresces if mold toxins are present. Here we expose mold in a home to UV light at 365 NM wavelength — the lamp typically used by farmers to scan for toxic mold on grain.

Mycotoxin	Molecular weight	Max (nm)
Aflatoxin B.	312	353
Aflatoxin B1	312	353
Aflatoxin B2	314	355
Aflatoxin G1	328	355
Aflatoxin G2	330	357
Aflatoxin M1	328	357
Ochratoxin A	403	333
Ochratoxin B	369	320
Patulin	154	276
Sterigmatocystin	324	325
Citrinin	259	322
Zearalenone	318	236

Laboratory Mold Toxin Analysis

Once drywall (or if you are a farmer, grains such as corn or wheat) is scanned by UV light and mold toxins are detected, the moldy material can be sent to a lab that tests for mold toxins in order to obtain a detailed analysis of toxins present and their levels.

Because mold toxin testing has been developed for analyzing mold toxins as food contaminants, the testing is limited to detecting toxins commonly found in food. Fortunately many of the mold toxins produced by molds that commonly grow in water damaged homes are the same ones in foods.

The lab we use for mold toxin testing (Alltech) can test for 37 different types of mold toxins (commonly found in food) simultaneously in one sample. Besides testing for mold toxins they are a major supplier in the U.S. and Europe of mold toxin binder additives to livestock and poultry feed. . We are not affiliated with Alltech in any fashion.

Below we show test results for mold toxins from the same home where we took the fluorescence picture on the previous page. Three toxins, from three different molds, are present.

ALLTECH 37: Mycotoxin Analysis Report

Sample ID #: Fluorescent mold Pembroke Park	Customer Sample ID: GaryRosen0023	Mold Analysis	Origin: Pembroke Park

Internal Ref	Mycotoxins	Levels Detected (ppb)	± Stdev (ppb)	Detection Limit (ppb)	Lower Quantification Limit (ppb)
5	Ochratoxin A	5.18	0.50	0.362	1.208
18	Fumonisin B1	181.66	0.93	20.426	68.086
27	Roquefortine C	1.69	0.03	0.196	0.653

Unfortunately a number of the most common problem toxins produced by molds in the indoor environment are not typically present in foods and are not available for lab toxin analysis e.g.

- Satratoxin — from Stachybotrys. Toxin testing NOT available
- Chaetoglobosin — from Chaetomium. Toxin testing NOT available
- Ausdiol — from Asp Ustus. Toxin testing NOT available
- Cyclopiazonic Acid — from Asp Versicolor. Toxin testing NOT available

ALL of these are toxins produced by molds commonly found in water damaged homes but for which there are no options for commercial toxin testing.

So when one reads a report that lab results found no detectable presence of mold toxins in a home, beware. Many of the mold toxins produced by molds most commonly found in water damaged homes are not detectable by any currently available commercial lab procedures.

Conclusions: Section 4

- Based on the CDC studies and our experience, at least some (or perhaps all) of the mold growing in water damaged homes will be toxin producers.
- In our experience, molds that fluoresce under black light will ALWAYS be present in water damaged homes indicating mycotoxins. This technique cannot determine if the toxins are currently being produced or if they were produced earlier. Only that they are present.

Wrap Up

The latest studies convincingly show that mold exposure is hazardous, especially to children, elderly or people with asthma or with compromised immune systems.

ASPERGILLUS niger

ALLERGENICITY:	Allergenic.
MYCOTOXINS PRODUCED:	Malformins B&C, Naphtho-gamma-pyrones, Ochratoxin A, Oxalic acid.
HUMAN PATHOGENICITY:	Etiologic agent of otomycosis; "Swimmer's ear;" onychomycosis; can cause bronchopulmonary, pulmonary, nasosinus aspergillosis; pneumonia; eye infections; invasive lung, heart and other disease.
REFERENCE:	http://www.ttuhsc.edu

Wrap Up

Mold hidden in closed up walls or sealed attics as a result of earlier (not ongoing) water leaks — even if present in significant quantities — is rarely a health problem as mold particles released from mold inside of walls do not penetrate the drywall/ plaster.

Of course ongoing water leaks and resultant visible mold are health risks but rarely is this an issue (except in rentals) as such problems are typically remediated quickly and the air cleaned as part of a homeowner insurance claim.

Principal areas of concern are hidden mold involving the AC system. Typically not an insurance claim.

- Mold, even small amounts, inside the AC, ducting or growing on water damaged drywall in the AC closet will be spreading mold and mold fragments throughout the home. These contaminants will be constantly breathed by occupants in every room in the home.
- Air handlers located in basements will be pulling in moist / mold-contaminated basement air when the air handler and ducting are not sealed completely air tight. The AC is then spreading bad basement air (including mold and mold fragments growing on damp content stored in the basement) throughout the home. These contaminants will be constantly breathed by occupants in every room in the home.
- Air handlers located in attics will be pulling in moist / dirty / moldy attic air when not sealed completely air tight. The AC is then constantly spreading contaminants from the attic throughout the home including not only mold and mold fragments but also bacteria; insect parts; rat and roach feces; micro-particles from attic insulation; and often toxic dusts from insecticides. These contaminants will be constantly breathed by occupants in every room in the home.

AC related mold exposure will cause irritation or serious illness in sensitive individuals because such growth is *always* accompanied not only by mold allergens and irritants but also by mold toxin production.

Mold toxins in the indoor air, even quite low levels, will impact the good bacteria in the gut as most of the mold that one breathes winds up in the gut since most of the mold particles are cleared from the upper respiratory system before they reach the lungs and are then deposited in the gut for later excretion.

The results of chronic exposure of gut bacteria to mold toxins can be quite serious due to Candida over growth as well as problems caused by disturbing the correct, healthy mix of good gut bacteria. As good bacteria are killed off, the species of gut bacteria will become out of balance. And as a result *you* will become out of whack!

Gut related problems from mold toxin exposure include:

- IBS
- Reduced immune capability
- Weight gain
- Lack of certain essential vitamins produced by good gut bacteria
- Headaches from yeast overgrowth bi-products (alcohol and others)
- Reduced capability for bacterial supported elimination of toxic compounds from the gut.

These are not your typical allergy-like symptoms one commonly attributes to mold and can be and often are far more serious. Treatment should be under a doctor's care. Be aware, that many treat-

ments focus on alleviating symptoms and do not treat the root cause and therefore will never result in healing.

Treatment will never be successful unless the mold exposure is eliminated by proper remediation which includes post remediation cleaning of toxin containing dusts and micro-particles from both the air and surfaces (such cleaning also removes problem bacteria and mites in the dusts.)

Besides the gut (and sinus problems), many molds that are common to problem homes produce toxins that not only impact gut bacteria and so *indirectly* impact health but also *directly* affect the body's organs and in particular the brain.

Mold neurotoxins cause:

- Headaches
- Attention deficit
- Short term memory loss
- Anxiety
- Brain fog
- Vision problems
- Joint pain, and
- Many other health problems

While not so common as gut and sinus issues, many people, often without their knowing it, are affected by mold neurotoxin exposure in homes, offices or schools. Diagnosis can be aided by the Visual Contrast Sensitivity Test developed by EPA scientist Dr. Hudnell. Treatment should be under a doctor's care. **Again, treatment will never be successful unless the mold exposure is eliminated by proper remediation.**

What Toxins are Typically Found in Homes?

Our internal studies as to the species of mold in water damaged homes have shown similar mold species distribution to that found in the extensive studies conducted by the CDC in New Orleans homes after Rita & Wilma. Commonly found molds in water damaged homes include:

- Stachybotrys
- Chaetomium
- Aspergillus including: *niger; ustus; versicolor; sydowii* (similar to versicolor)

These common molds are also toxin producers and as part of their fight for survival in their indoor environment are always producing toxins.

While people in the mold remediation field and the doctors that specialize in treating mold-related illnesses are well aware of the impact of mold toxins on health, the overall acceptance by traditional medicine that mold toxins from indoor environments cause illness is not widespread.

The principal reference guidance for physicians regarding mold related illness has been the 2004 Institute of Medicine report by the National Academy of Science. The only conclusion the Institute of Medicine (IOM) makes in that report about illness related to indoor environment is that dampness will cause illness. Their review did not find that there was sufficient evidence that mold by itself will cause illness.

Of course most of the studies reviewed in the IOM review published in 2004 were based on findings of research performed in the 90's. Since the release of the IOM report, a powerful new technique for analyzing mold, based on DNA assessment techniques (called MSQPCR) has been developed by EPA scientists.

> "Along with Dr. Haugland, Dr. Vesper patented in 2002 "mold specific quantitative PCR" (MSQPCR). In conjunction with HUD, MSQPCR was used to quantify 36 molds in a random national sampling of homes to create the Environmental Relative Moldiness Index (ERMI). In a 10 year prospective study with the Univer-

sity of Cincinnati Environmental Health Department, we found that infants exposed to very moldy, i.e. high ERMI, homes were much more likely to develop asthma. "

This new analytical tool for mold analysis developed Dr. Vesper and the EPA results in far more accurate and far more reliable procedures for analyzing mold than earlier technologies. Currently most of the major commercial analytical labs (α, β, γ) that do mold testing offer this capability.

A great deal of recent research has applied these EPA developed mold DNA assessment techniques. Newer reviews (since the 2004 IOM report) have now implicated mold in directly causing indoor illness especially childhood asthma see link to Lawrence Berkeley National Laboratory (LBNL) article *Health Risks of Dampness and Mold in Homes.*

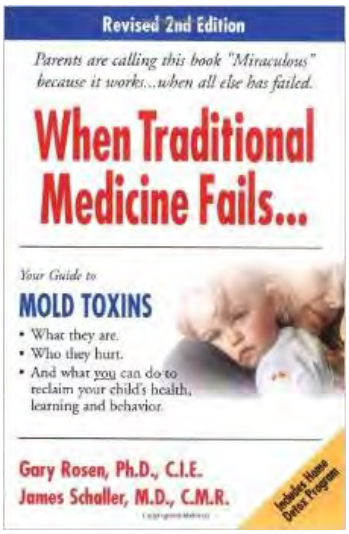
According to the Lawrence Berkeley National Laboratory, based on the latest research:

1. Building dampness and mold were determined to be associated with 30% to 50% increases in a variety of respiratory and asthma-related health outcomes … the observed increases in these adverse health effects in damp or moldy homes were very unlikely to be the result of chance.
2. The proportion of current U.S. asthma cases attributable to dampness and mold exposure was estimated to equal 21%, with uncertainty bounds of 12-29%.
3. The analyses further estimated that from 8% to 20% of respiratory infections were potentially attributable to dampness and mold in houses, and might be preventable if these conditions were avoided.
4. Strong relationships exist between development of new asthma in children and each of three types of evidence of dampness or mold in homes: mold odor, visible mold, and water damage.

So even if you don't believe that mold toxins can cause brain damage in children, the latest research is out — not only dampness but also mold exposure itself is certainly harmful especially to children.

Consult your physician for more information on mold and health or our book *When Traditional Medicine Fails … Your Guide to Mold Toxins.*

About the Author



The review author Dr. Rosen (President of Certified Mold & Allergen Free Corp.) is a biochemist and a state (Florida) licensed mold assessor, mold remediator, building contractor and state licensed mold training provider. Dr. Rosen has written a number of books on mold. All available on Amazon.com

Certified Mold & Allergen Free Corp. performs specialized mold testing and mold toxin testing services principally when requested by a person's doctor or for legal cases. Such testing can be expensive and usually does not need to be performed to determine the location and extent of mold for the purpose of removal.

EPA guidance is that any indoor mold growth is problematic and should be remediated. EPA recommendations state that it is not necessary to know what kind of mold is growing in a home in order to have effective remediation and that resources are often best spent removing the mold rather than testing. Our principal focus is on mold remediation including walls, ceilings, AC's and ducting — and not simply testing.