Mold in Schools

Series I
Mold: Fact vs. Fiction

Payam Fallah, PhD
IDEHL Laboratories, Sammamish, WA

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Puget Sound Educational Service District
Workers' Compensation Trust
Unemployment Pool

AGENDA

Mold Training Series

- Session I: Today with Dr. Payam Fallah:
  - Overview and Possible Health Effects of Mold
- Session II: Handling Mold Exposure Claims: July 14, 2022
- Session III: Water and Mold Remediation: August 4, 2022

Mold: facts v. fictions

Payam Fallah, PhD

IDEHL, Sammamish, WA
pfallah@idehl.com
425-241-7712

Puget Sound Educational Service District (PSESD), June 2, 2022

Overview:

- History of mold scare: how did it all start?
- Mold/fungi as ubiquitous organisms- the good, the bad , and the ugly
- Mold exposure indoors/ mycotoxin myths- “black mold”
- Health effects of molds
- Sampling methods for mold: right & wrong methods
- Take home messages/ conclusions

HISTORY OF THE MOLD SCARE in U.S.A. 1993-

The birth of junk science and bad scientists

“mold is making me and my family sick” syndrome

Environmental Risk Factors Associated With Pediatric Idiopathic Pulmonary Hemorrhage and Hemosiderosis in a Cleveland Community

Eduardo Montaña, MD, MPH*; Ruth A. Etzel, MD, PhD*; Terrance Allan, RS, MPH‡; Timothy E. Horgan, MPH‡; and Dorr G. Dearborn, PhD, MD§

ABSTRACT. *Background.* Unexplained pulmonary hemorrhage and hemosiderosis are rarely seen in infancy. A geographic cluster of 10 infants with this illness was identified in a large pediatric referral hospital in Cleveland, Ohio, during the period of January 1993 through December 1994. One infant died of severe respiratory failure.

Methods. A case-control study was conducted. Three control infants were matched by age with each case infant. All study infants' guardians were interviewed. Questions were asked about child care practices and home conditions for the period before case infants' illnesses. All infants' records were reviewed, their homes were visited, and a structural and environmental survey was conducted.

Results. All 10 case infants were black, and 9 were

A cluster of 10 infants with idiopathic pulmonary hemosiderosis (IPH) was identified at a major pediatric referral hospital in Cleveland, Ohio, during the 24-month period from January 1993 through December 1994. One of the infants had died after severe respiratory failure. Pediatric pulmonologists at this hospital had seen only three cases of IPH among children in the preceding 10 years. A case-control study was initiated to identify environmental risk factors for pulmonary hemorrhage among infants.

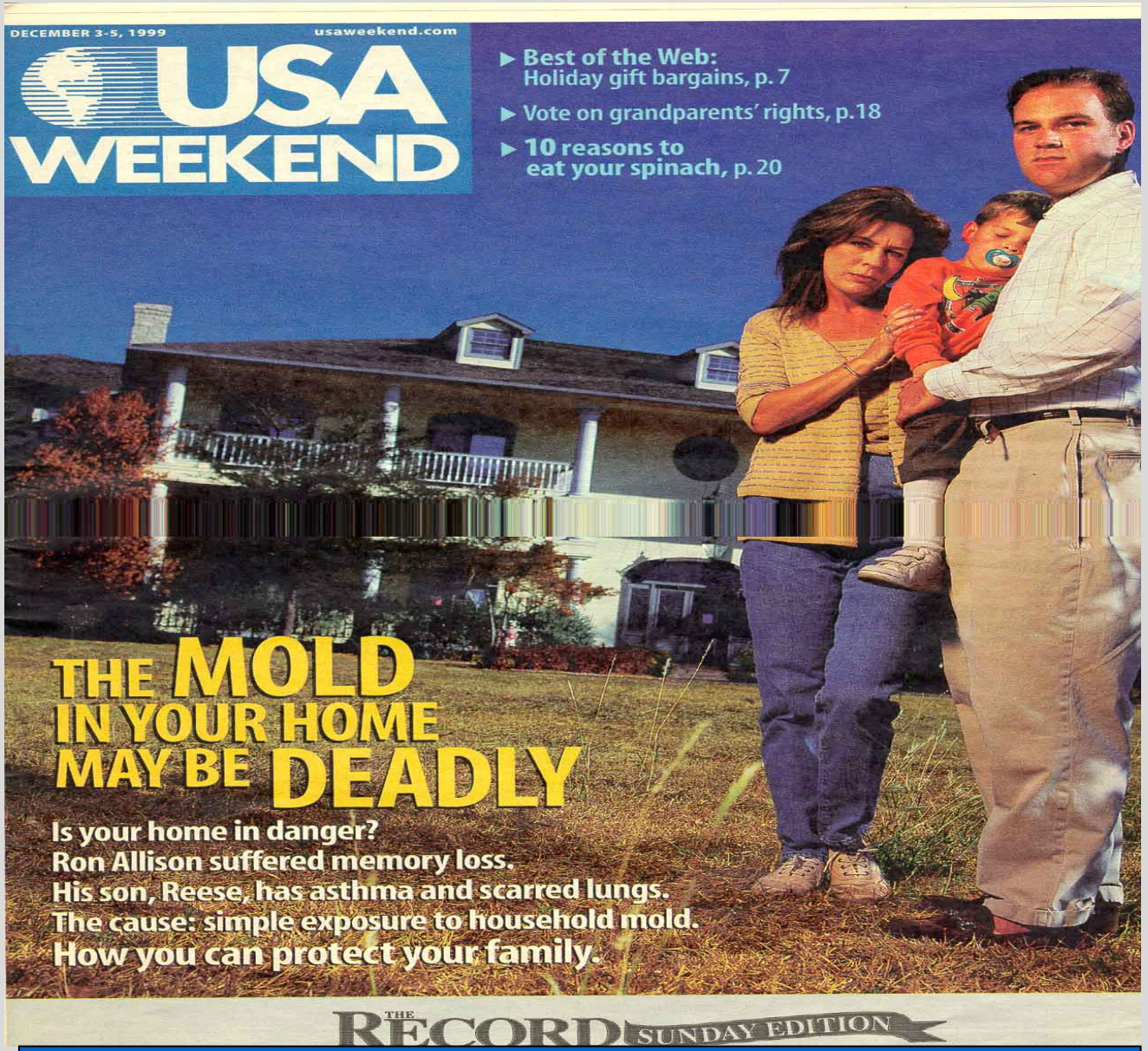
Spontaneous pulmonary hemorrhage in infants is a rare and dramatic event. In older patients, the pulmonary hemorrhage syndromes, such as Good-

1995: Black mold named as cause of deadly symptoms in Cleveland infants by CDC investigators on follow up investigations.

Mold eats husband's brain, poisons crystal chandelier. Woman gets $32,200,000 from insurance company.

FEBRUARY 2003

APPELATE COURT REDUCES
BALLARD AWARD
FROM 32 TO 4 MILLION



December 1999: Melinda Ballard and family of Dripping Springs, Texas

Update: Pulmonary Hemorrhage/Hemosiderosis Among Infants — Cleveland, Ohio, 1993–1996

A review within CDC and by outside experts of an investigation of acute pulmonary hemorrhage/hemosiderosis in infants has identified shortcomings in the implementation and reporting of the investigation described in *MMWR* (*1,2*) and detailed in other scientific publications authored, in part, by CDC personnel (*3–5*). The reviews led CDC to conclude that a possible association between acute pulmonary hemorrhage/hemosiderosis in infants and exposure to molds, specifically *Stachybotrys chartarum*, commonly referred to by its synonym *Stachybotrys atra*, was not proven. This report describes the specific findings of these internal and external reviews.

March 2000: Cleveland study placed in doubt by an extensive review

No response from news media

referred to as pulmonary hemosiderosis (*1,2*). The children resided in seven contiguous postal tracts and had had one or more hemorrhagic episodes, resulting in one death, during January 1993–December 1994. Preliminary results of a CDC case-control study

Clinical Experience and Results of a Sentinel Health Investigation Related to Indoor Fungal Exposure

Eckardt Johanning,[1] Paul Landsbergis,[2] Manfred Gareis,[3] Chin S. Yang,[4] and Ed Olmsted[5]

[1]Mount Sinai School of Medicine, New York, New York USA; Eastern New York Occupational and Environmental Health Center, Albany, New York USA; [2]Cornell University Medical College, Mount Sinai School of Medicine, New York, New York USA; [3]Federal Meat Research, Microbiology and Toxicology, Kulmbach, Germany; [4]P&K Microbiology Services, Inc., Cherry Hill, New Jersey USA; [5]Olmsted Environmental Services, Inc., Garrison, New York USA

This is a review of exposure conditions, clinical presentation, and morbidity of children and adults with indoor fungal exposure such as toxic *Stachybotrys chartarum*. Indoor exposure was characterized using different methods including microscopic, culture, cytotoxicity screening tests, and chemical analyses. Clinical case histories and physical and laboratory findings are presented of children (age < 18 years, *n* = 22; mean age 9 years; 60% females) and adults (age > 18 years, *n* = 125; mean age 39 years, 67% females) who consulted an environmental health specialty clinic. In the pediatric patients' exposure history, widespread fungal contamination of water-damaged building materials with known toxic or allergic fungi was identified. Primarily disorders of the respiratory system, skin, mucous membranes, and central nervous system were reported. Some enumeration and functional laboratory abnormalities, mainly of the lymphatic blood cells, were observed, although no statistically significant differences were found. IgE or IgG fungi-specific antibodies, used as exposure markers, were positive in less than 25% of all tested cases. In an evaluation of a symptomatic girl 11 years of age (sentinel case investigation) living in an apartment with verified toxigenic fungi (i.e., *S. chartarum*), several health indicators showed improvement after exposure cessation. *Key words*: allergy, bioaerosol, exposure, fungi, health, morbidity, mycotoxins, *Stachybotrys*, toxicity. — *Environ Health Perspect* 107(suppl 3):489–494 (1999).
http://ehpnet1.niehs.nih.gov/docs/1999/suppl-3/489-494johanning/abstract.html

sample because at that age completion of major organs and lymphoid maturity are achieved. The pediatric sample (age < 18 years, *n* = 22; mean age 9 years; 60% females) and a sample of adult patients (age > 18 years, *n* = 125; mean age 39 years, 67% females) were included if they had a verifiable history of indoor exposure to fungal air contaminants and if they had completed a standardized health symptom questionnaire. Fungal exposure was considered positive if industrial hygiene survey information and data confirmed the presence of fungi and significant moisture problems (leaks, flooding, condensation, etc.). In addition, for comparison, descriptive data from an earlier study are presented that included well-documented exposure and that used the same core questionnaire. The

1997: Occupational Health Physician reports memory loss from "Stachy" exposure. Public worried

Erin Brockovich Crusades Against Mold

State lawmakers told of potential health dangers

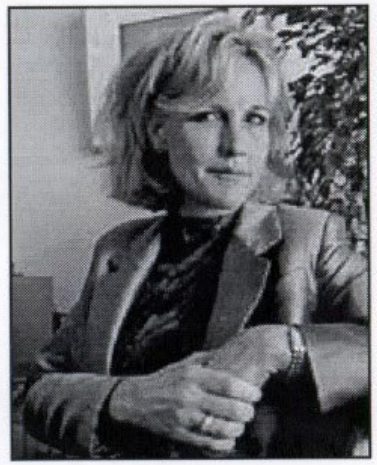
Anastasia Hendrix / SF Chronicle 8mar01

Sacramento -- In her hallmark miniskirt and stilettos, Erin Brockovich came to the Capitol yesterday -- not to talk about the crusade against PG&E that made her famous, but about her personal battle against the toxic molds ravaging her Southern California home.

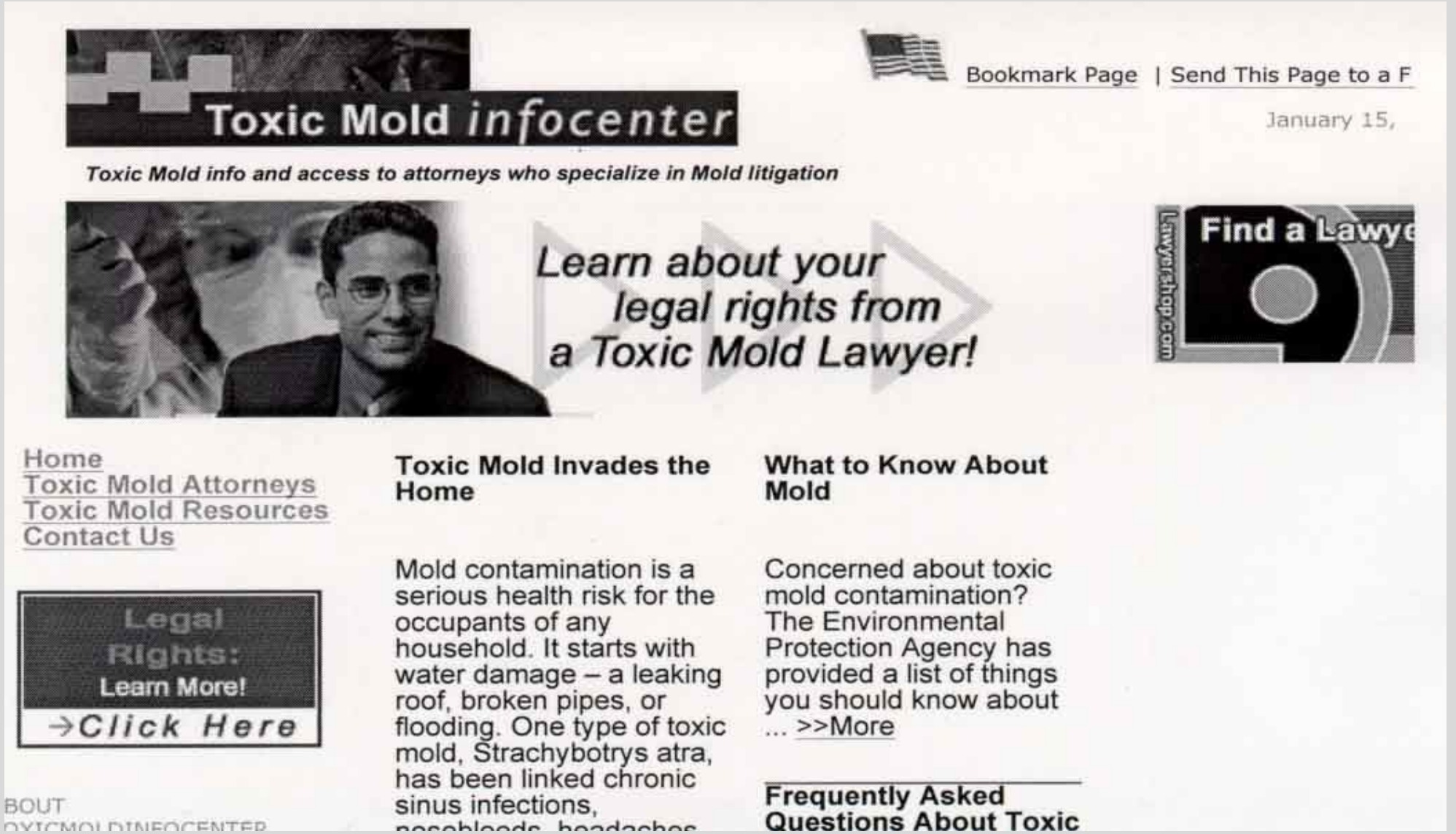
The activist-turned-celebrity was invited to address the Senate committee on Health and Human Services by Sen. Deborah Ortiz (D-Sacramento), who heads the panel. Ortiz recently introduced a bill that would institute the first statewide policy regulating molds in the country.

Erin Brockovich buys a moldy house

for lead and asbestos exposure, and I think this (mold) is akin to those."



Erin Brockovich testified before the state Senate committee on Health and Human Services about the problems she and her family received from



21,400 “HITS” ON “TOXIC MOLD LAWYER” ON INTERNET

“Current scientific evidence does not support the proposition that human health has been adversely effected by inhaled mycotoxins in the home school or office environment.”

American College of Occupational and Environmental Medicine (ACOEM), November 2002

Journal of Toxicology and Environmental Health, Part A, 72: 585–598, 2009

ISSN: 1528-7394 print / 1087-2620 online
DOI: 10.1080/15287390802706389

Taylor & Francis
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The Concentration of No Toxicologic Concern (CoNTC) and Airborne Mycotoxins

Bryan D. Hardin[1], Coreen A. Robbins[1], Payam Fallah[2], and Bruce J. Kelman[1]
[1]*Veritox®, Inc., Redmond, Washington, and* [2]*Indoor Environmental Hygiene Laboratory (IDEHL®), Redmond, Washington, USA*

The threshold of toxicologic concern (TTC) concept was developed as a method to identify a chemical intake level that is predicted to be without adverse human health effects assuming daily intake over the course of a 70-yr life span. The TTC values are based on known structure–activity relationships and do not require chemical-specific toxicity data. This allows safety assessment (or prioritization for testing) of chemicals with known molecular structure but little or no toxicity data. Recently, the TTC concept was extended to inhaled substances by converting a TTC expressed in micrograms per person per day to an airborne concentration (ng/m^3), making allowance for intake by routes in addition to inhalation and implicitly assuming 100% bioavailability of inhaled toxicants. The resulting concentration of no toxicologic concern (CoNTC), 30 ng/m^3, represents a generic airborne concentration that is expected to pose no hazard to humans exposed continuously throughout a 70-yr lifetime. Published data on the levels of mycotoxins in agricultural dusts or in fungal spores, along with measured levels of airborne mycotoxins, spores, or dust in various environments, were used to identify conditions under which mycotoxin exposures might reach the CoNTC. Data demonstrate that airborne concentrations of dusts and mold spores sometimes encountered in agricultural environments have the potential to produce mycotoxin concentrations greater than the CoNTC. On the other hand, these data suggest that common exposures to mycotoxins from airborne molds in daily life, including in the built indoor environment, are below the concentration of no toxicologic concern.

Modern analytical chemistry permits the detection of whether in air, water, food, cosmetics, or pharmaceuticals. For most of these substances, the available toxicology data are inadequate to support a conventional safety evaluation or risk characterization. It was recognized for at least 40 yr (Frawley, 1967; Munro, 1990) that a method was needed to establish thresholds for regulatory concern to determine that exposures are low enough to be confident that they pose no toxicologic concern or, conversely, to determine that exposures are such that a safety evaluation requires chemical-specific toxicologic data.

The threshold of toxicologic concern (TTC) concept developed as a means to make those determinations. The TTCs identify, with a wide margin of safety, a level of intake that is predicted to be without adverse human health effects assuming daily intake at or below the TTC over the course of a 70-yr life span. The TTCs are based on known structure–activity relationships and their application does not require chemical-specific toxicity data. This allows safety assessment (or prioritization for testing) of chemicals with known molecular structure but little or no toxicity data.

A decision tree approach to estimating toxic hazard was proposed in 1978 for chemicals with known molecular structure (Cramer et al., 1978). Consisting of "yes" or "no" responses to a series of 33 questions about molecular structure, the decision tree sorted substances to one of three categories, I, II, or III. Class I substances were described as having molecular structures and toxicity data suggestive of low oral toxicity, while Class III substances were described as lacking any strong

Community concerns:

- Schools- complaints regarding mold exposure
- Office buildings and mold claims
- Insurance companies/adjusters dealing with mold coverage

*plaintiff attorneys and defense attorneys

Sometimes when we feel we cannot find the answers for our clients, we become advocates and try to blame mold for all the health conditions

What are molds?

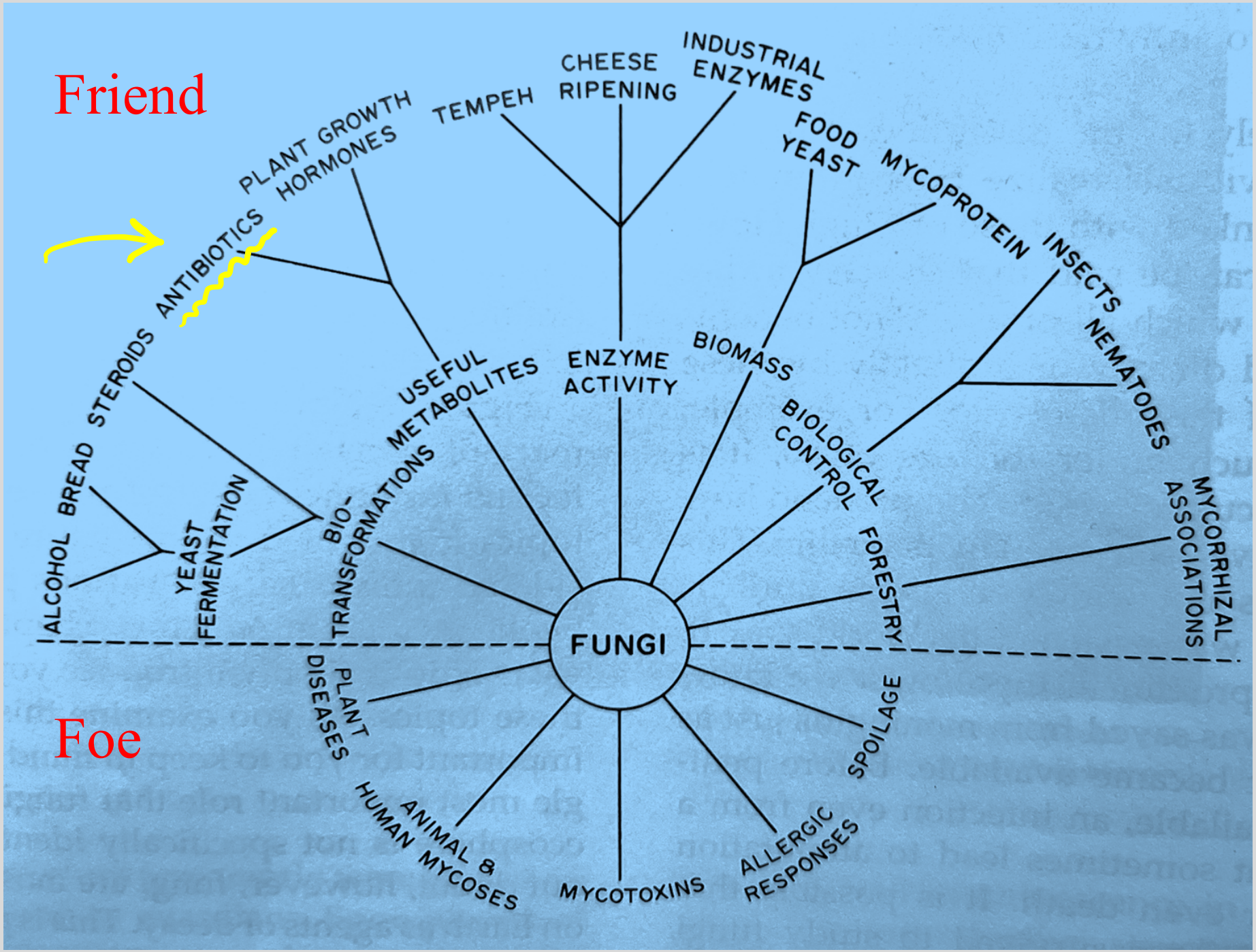
- A very small subset of fungi-fungi have their own kingdom (Mycota) like plants and animals; fungi cannot make their own food like plants can, so they absorb their foods
- Molds reproduce by **spores** which are then disseminated through air and land on surfaces
- Spores need moisture to germinate and colonize surfaces and grow
- Fungi cannot absorb moisture from air
- Mold/fungal spores are ubiquitous-they are found everywhere

How many fungi there are in the world?

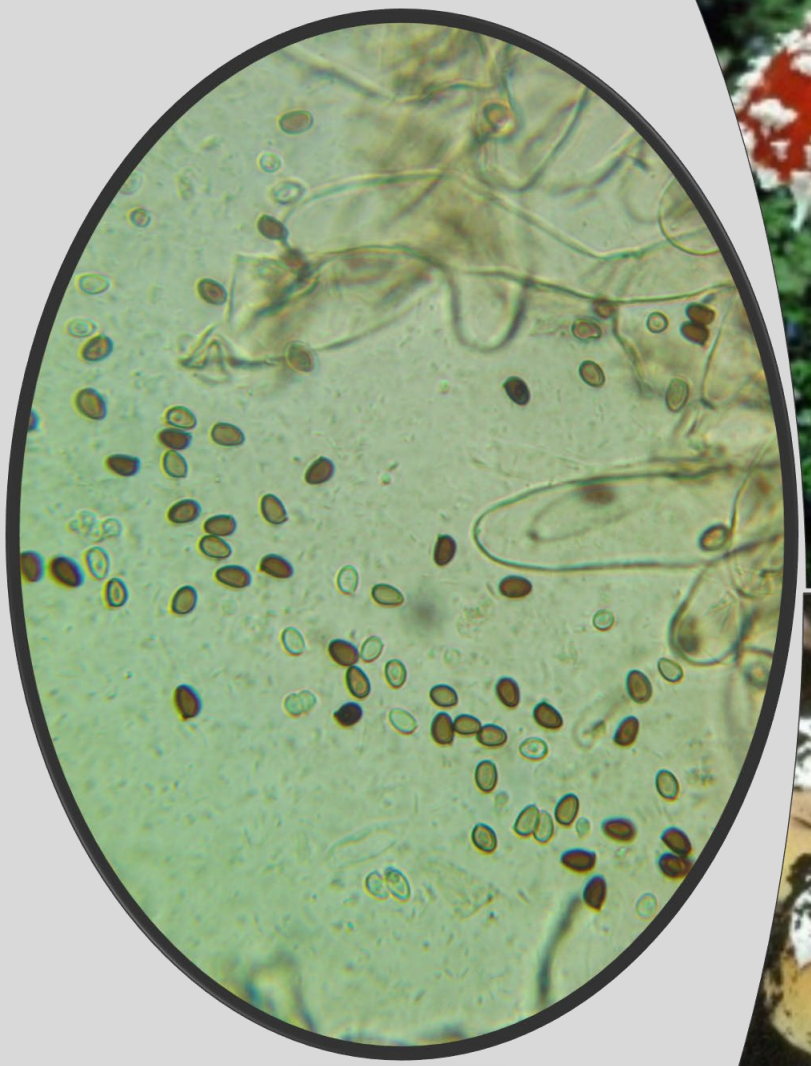
- About 100,000 species described; about 1.5 to 2 million are out there and not found yet
- Every year mycologists describe about 1,700 new species on average
- Very small percentage are mold and can grow indoors
- Mostly are useful and good for us

What is their role in nature?

- They are earth’s recyclers: they return the nutrients back to earth
- They can also be pathogens of plants and humans
- They can be sources of food for us- bread, beer, mushrooms etc.

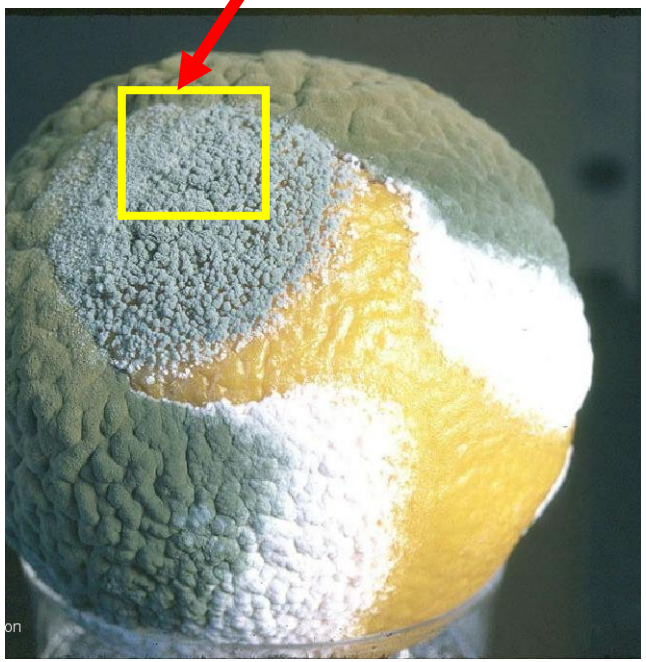

Friend
Foe
FUNGI
ANTIBIOTICS
PLANT GROWTH HORMONES
TEMPEH
CHEESE RIPENING
INDUSTRIAL ENZYMES
FOOD YEAST
MYCOPROTEIN
INSECTS
NEMATODES
STEROIDS
BREAD
ALCOHOL
YEAST FERMENTATION
BIO-TRANSFORMATIONS
USEFUL METABOLITES
ENZYME ACTIVITY
BIOMASS
BIOLOGICAL CONTROL
FORESTRY
MYCORRHIZAL ASSOCIATIONS
PLANT DISEASES
ANIMAL & HUMAN MYCOSES
MYCOTOXINS
ALLERGIC RESPONSES
SPOILAGE

Wonderful fungi




© george barron

1 square inch = ~ **400,000** spores of *Penicillium*



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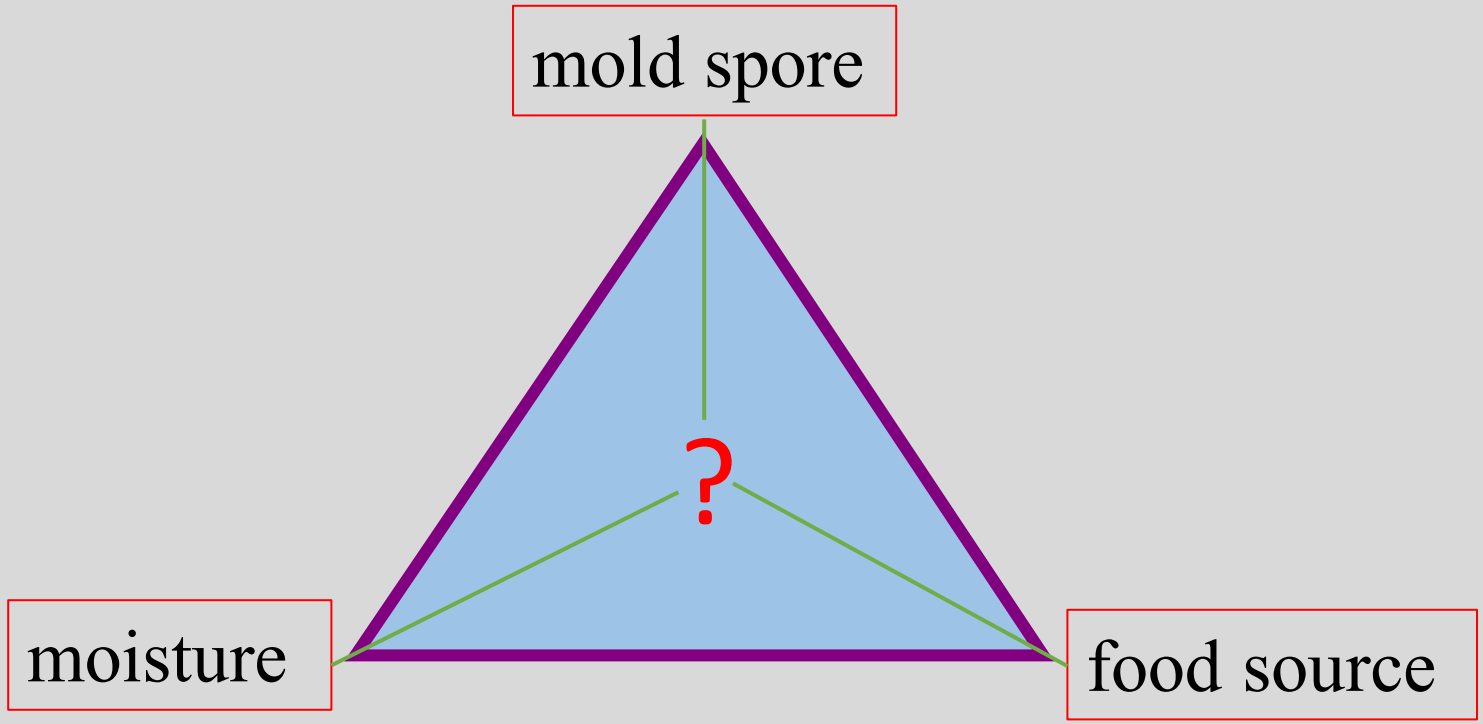
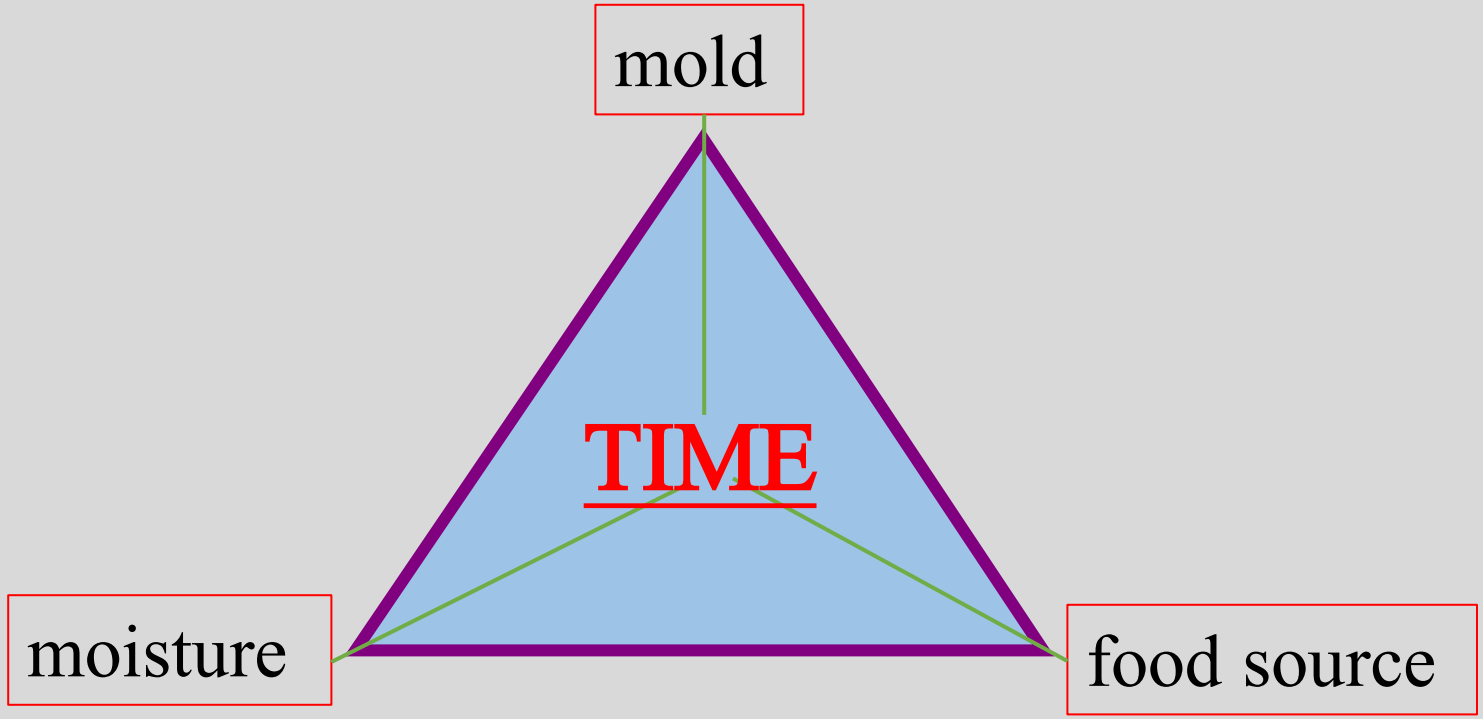
Requirements for mold growth



Spore germination → Colonization → Visually noticeable

Requirements for mold growth



Spore germination → Colonization → Visually noticeable

Fungal/mold growth indoors

General routes of exposures

Inhalation

potential health effects indoors and outdoors; allergies

Ingestion

Dermal

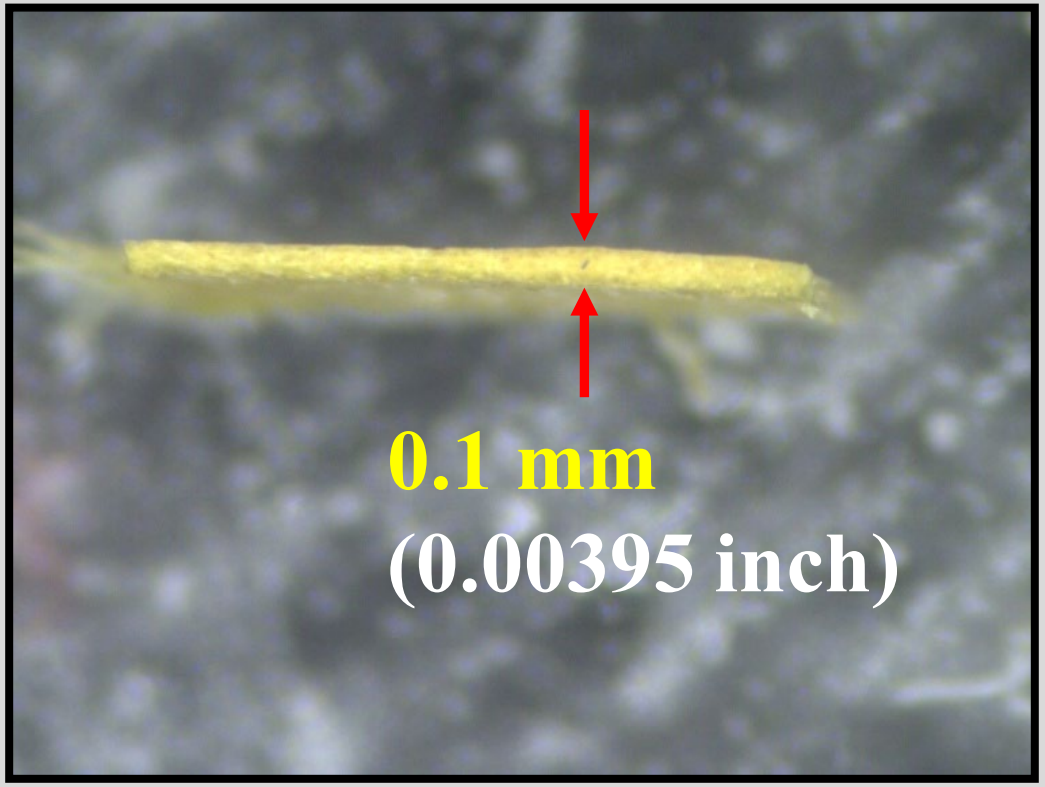
Can inhalation of mold spores indoors kill anyone?

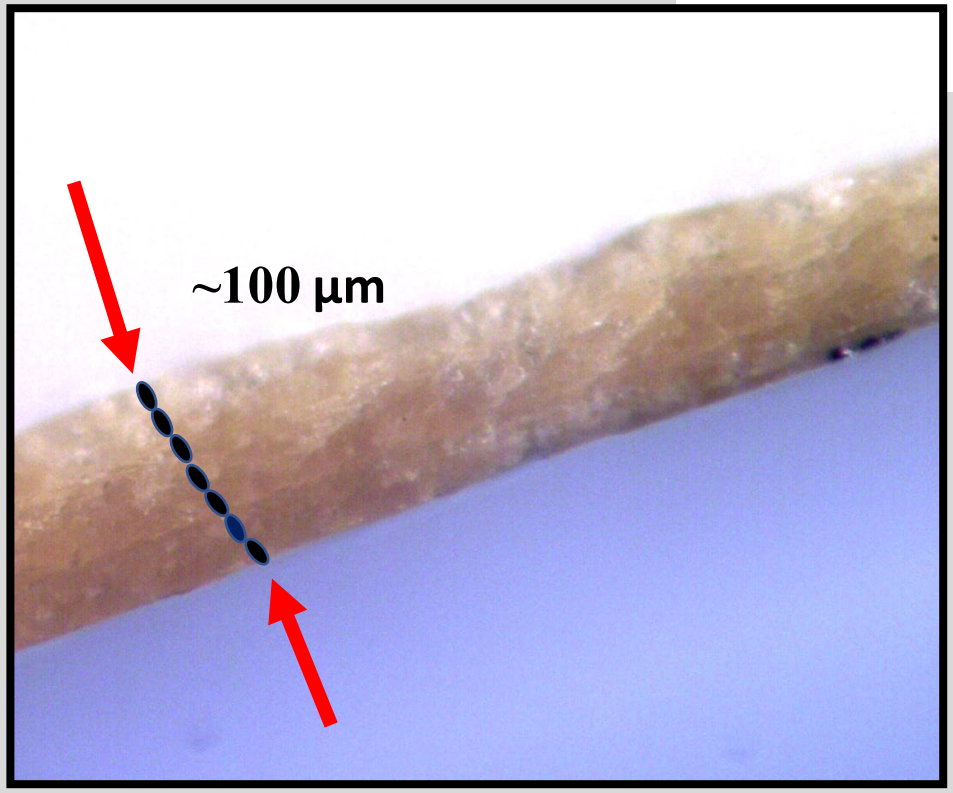
No scientific evidence exists to date that this ever happened

Moldy corn, deadly if **ingested**

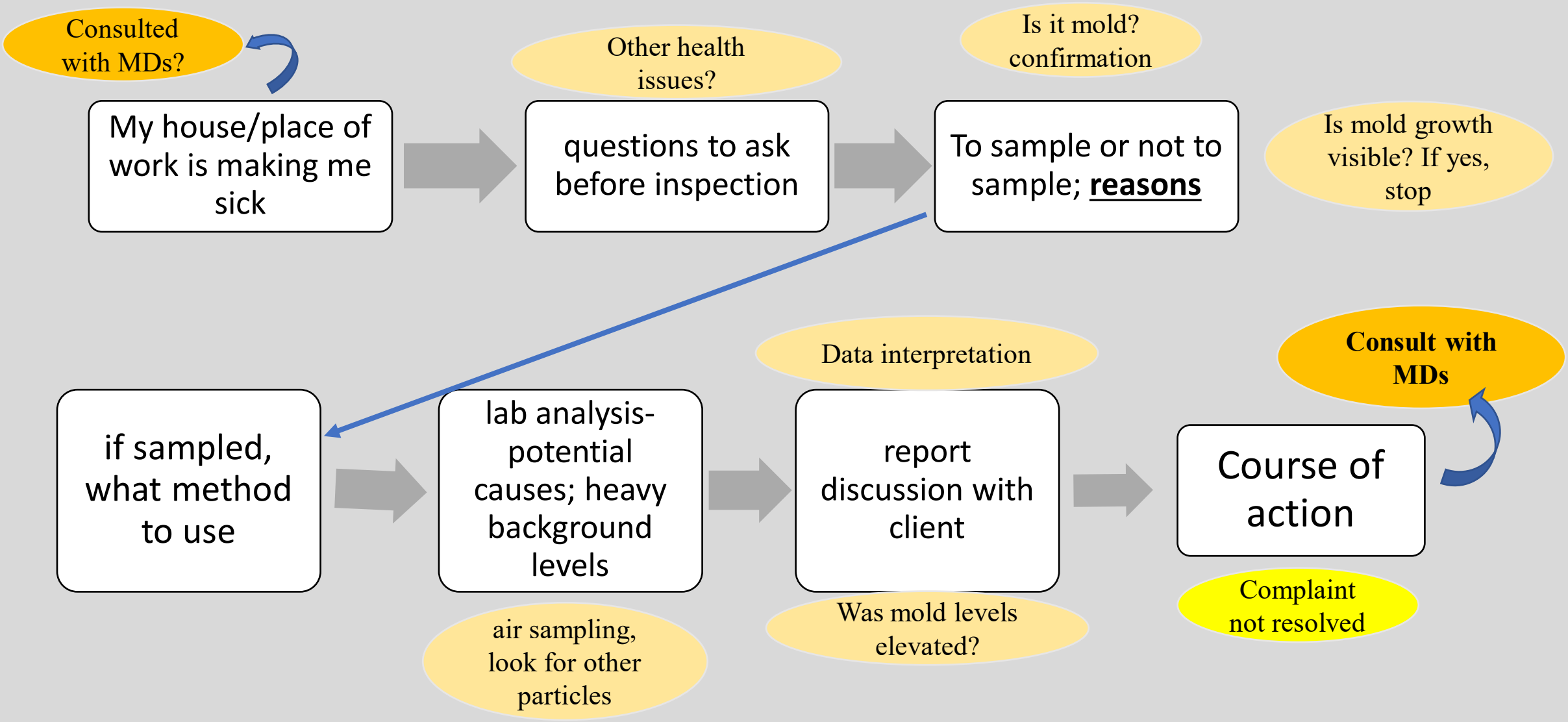
How small are the spores?

A single sheet of a paper





All starts with a health complaint: cause & possible effects



Causation by association is not valid: presence of mold ≠ health issues

How do we sample for mold?

- Simplest and most important method is direct microscopic examination (**DME**) using surface tape-lift, bulks, or swabs samples to test for mold growth
- Spore trap, most widely used air sampling for potential inhalation ("allergens"); identifies mold spores and provides counts only
- Culturable mold in agar plate from air- we can ID what species of molds we have
- The only type of analysis that tells us there is mold growth is DME
- What if one inspects a home and there is no visible mold growth found? *but complaints continue*

Mycotoxins: what are they?

- Not all molds produce mycotoxin
- Those mold species that can produce mycotoxins, might not produce every time
- Inhalation of mycotoxins and adverse health (toxicosis) not proven indoors
- Testing for mycotoxins does not prove there is a problem

Health effects of fungi/molds

- Likely effects: clinical evidence exists

  **Respiratory, eye symptoms, mucus membrane, rash

- American College of Occupational and Environmental Medicine (ACOEM) states 10% of Americans are allergic to mold and only 5% become ill
- Only a qualified doctor can diagnose the individual with mold health issues
- Types of testing may include skin test, or allergy specific IgE blood test
- Does medical community support routine testing for mycotoxin in people? NO ! Medical literatures do not support such thing (*unless individuals ate high amount of contaminated moldy food*)

Clinical fungal infections in humans

- *Allergic: Asthma triggers/ fungal sensitization

- Opportunistic fungal pathogens: *Aspergillus, Candida, Mucor, Fusarium, Acremonium, Exserohilum*
- Superficial: skin, hair, nail infections
- Chronic severe: *Cryptococcus, Coccidioides, Blastomyces, Histoplasma* immunocompetent individuals

Other potential allergens from indoor environments:

- Could there be other potential biological allergens in that environment that can be of concern? e.g., **dust mites**, cockroaches, cats, dogs, mice, pollens

- What about non-biological materials? Variety of chemicals

How do we interpret the spore trap results

- We compare number and types of molds between indoors and outdoors- our outdoor is supposed to be our baseline “control”
- Can spore trap alone give us the answer to the potential health effects that homeowner complains about?
- Is finding one *Stachybotrys* (aka “black mold”) spore a problem? So, what is the significance of *Stachybotrys* growth indoors

example of air sample report

IDEHL
31 210th PL SE
Sammamish, WA 98074

Client:
Contact:
Client Project ID:
IDEHL ID:

Sampling Date:
Receipt Date:
Reporting Date:

Spore Trap Analysis Report

Sample ID	11090665		11093814		11093803			
IDEHL ID	115-1		116-1		117-1			
Description	**Indoor area 1**		**Indoor area 2**		**Outside**		**Seattle, WA**	
	Raw ct.	**Spores/m³**	Raw ct.	**Spores/m³**	Raw ct.	**Spores/m³**		
Background debris	Moderate		Very Heavy		Moderate			
Pollen	None		None		Moderate			
Epithelial cells	Light		Heavy		Trace			
Fungal structures*	Trace		Trace		Trace			
Alternaria								
Ascospores	13	**173**	25	**333**	677	**9,027**		
Basidiospores	31	**413**	38	**507**	1,200	**16,000**		
Bipolaris group			1	**13**	5	**67**		
Botrytis	1	**13**	3	**44**	11	**147**		
Chaetomium								
Cladosporium	49	**653**	44	**587**	721	**9,613**		
Curvularia					1	**13**		
Epicoccum			1	**13**	7	**93**		
Fusarium								
Nigrospora	2	**27**						
Oidium								
Other Colorless spores	4	**53**	1	**13**				
Other Pigmented spores								
Penicillium/Aspergillus-like	27	**360**	17	**227**	17	**227**		
Pithomyces								
Rusts	2	**27**	5	**67**	12	**160**		
Smut-like spores	4	**53**	3	**40**	18	**240**		
Scopulariopsis								
Stachybotrys								
Torula	2	**27**			2	**27**		
Unknown								
Total Spores/m³		**1,799**		**1,844**		**35,614**		
Air Volume	75		75		75			

Lab notes:

NAB= National Allergy Bureau

National Allergy Bureau

- NAB Home
- My NAB
- Pollen & Mold Counts
- Using the Counts
- Common Outdoor Allergens
- Certified Counting Stations
- No pollen counter where you live?
- Media Center
- Contact the NAB

Pollen & Mold Information

- Frequently Asked Questions (FAQs)
- Pollen & Mold Photo Gallery
- 2000 AAAAI Pollen & Spore Report
- Seasonal Allergen Maps
- Educational Opportunities

NAB: Reading the Charts

The following Aeroallergen Network calculations are based on the data (per cubic meter) reported by all certified counting stations for trees, grasses, weeds and molds.

- Median or 50th percentile (half of counts are below this point)
- 75th percentile (75% of counts are below this point)
- 99th percentile (99% of counts are below this point)

Based on these calculations, we suggest the following definitions for low, moderate, high and very high:

NAB SCALE

MOLD		GRASS		TREE		WEED	
0	Absent	0	Absent	0	Absent	0	Absent
1 - 6499	Low	1 - 4	Low	1 - 14	Low	1 - 9	Low
6500 - 12999	Moderate	5 - 19	Moderate	15 - 89	Moderate	10 - 49	Moderate
13000 - 49999	High	20 - 199	High	90 - 1499	High	50 - 499	High
>50000	Very High	>200	Very High	>1500	Very High	>500	Very High

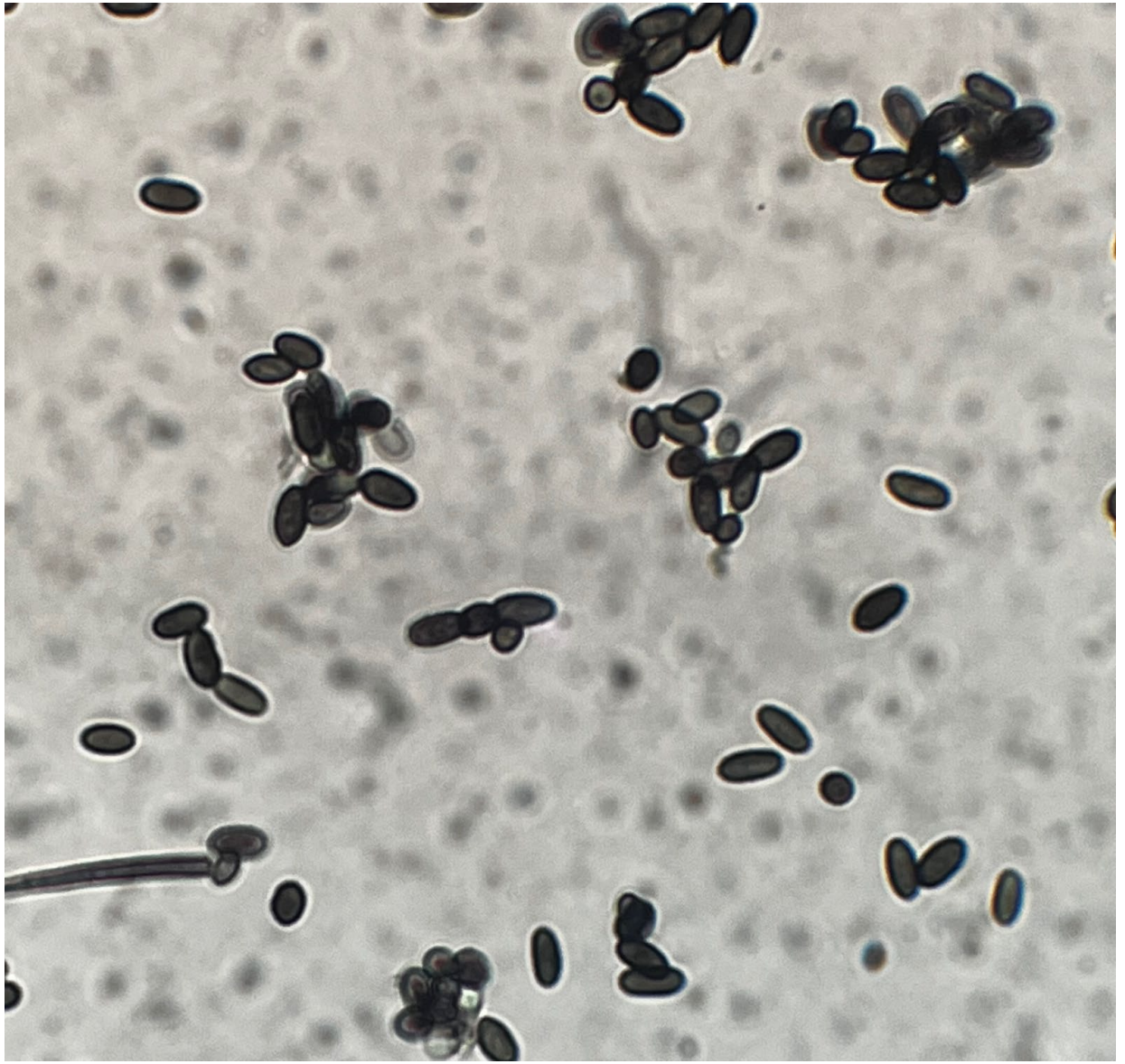
These definitions would allow comparison between sites across the country. They are based on ecological measurements, not health effects. However, assuming dose/response relationships are the same across the country, the definitions are probably more appropriate than a definition based on local numbers. This does mean that, for some stations, some categories will never be high.

If the count falls within this category:	Allergy sufferers who are allergic to these pollens or molds may experience symptoms of hay fever or asthma.
Absent	No symptoms.

A few words about our infamous “black mold” friend, *Stachybotrys:*

- Can *Stachybotrys* be found outdoors as well as indoors? Absolutely; but does not become aerosolized easily because it is sticky—CDC’s wrong assumption
- Is *Stachybotrys* the only mold that is “black”? No. There are hundreds of molds that can grow indoors, and they are black/pigmented color
- When we find it growing indoors, it means moisture was available to it for a long time

The poor “black mold”, *Stachybotrys*



Useless & uninformative indoor mold test methods

ERMI (Environmental Relative Moldiness Index)

- According to EPA, ERMI estimates the "mold burden" in homes

2009

- EPA questioned the role and uses of ERMI in mold remediation

- EPA science advisory board established to address applicability, limitation and utility of ERMI

EPA has not yet reached any conclusion on the use and health prediction

Environmental Relative Moldiness Index (ERMI)

The Environmental Relative Moldiness Index (ERMI) is a research tool developed by EPA scientists for estimating mold contamination. Researchers can use the index to estimate the amount of mold and some of the types of mold present. ERMI has been peer reviewed for research purposes but has not been validated for non-research purposes.

- ERMI Factsheet (pdf)

Problems with ERMI

- The concept of “mold burden” or “moldiness” has never been explained in any literature, while we have a clear understanding of mold growth
- Dust sampling can be biased and is based on couple of locations and not representative of the area
- Certain MDs have referred their patience to use ERMI
- ERMI has been expensive- a cheaper analysis is called **ARMI**: 10 species

Other problems with ERMI…

- ERMI does not provide evidence for mold growth regardless of concentrations
- ERMI values may be high for non problematic homes
- Dust samples cannot be used as a surrogate for health exposure or mold growth
- No scientific bases for fungal species used for ERMI as species in either group can overlap; meaningless classification

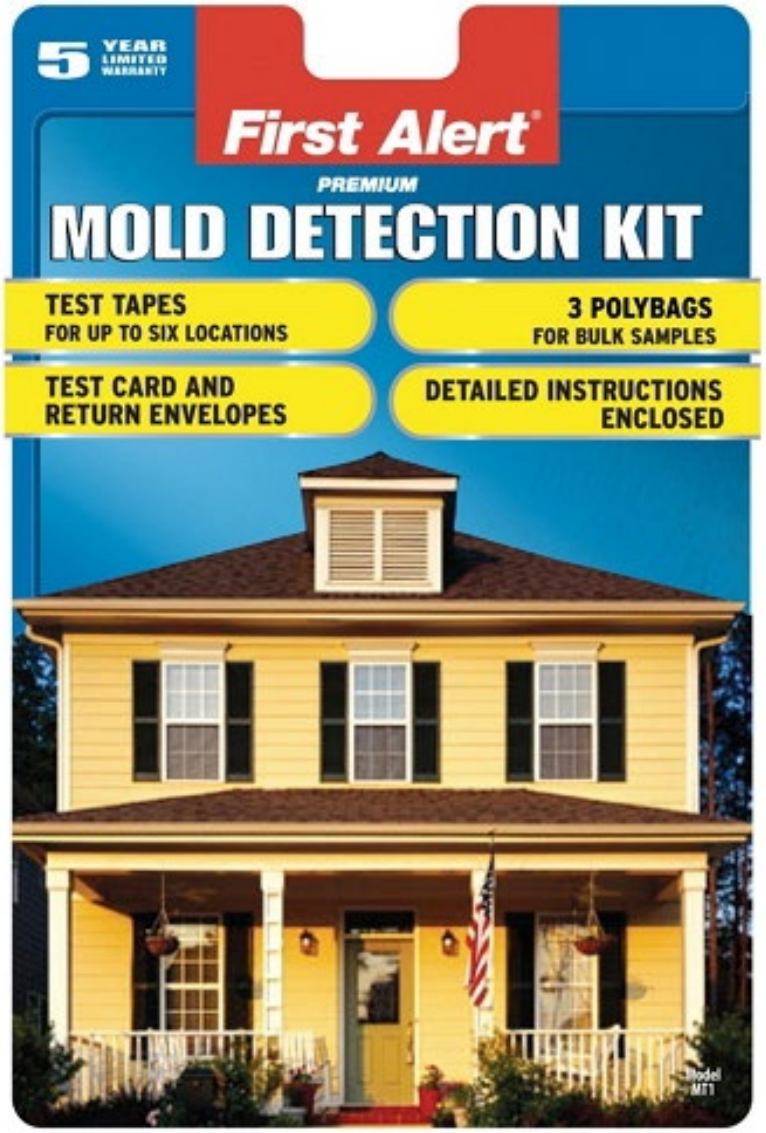
Latest paper

Choi et al. 2013. *Indoor Air*

* No association between culturable fungi in dust and children health outcomes

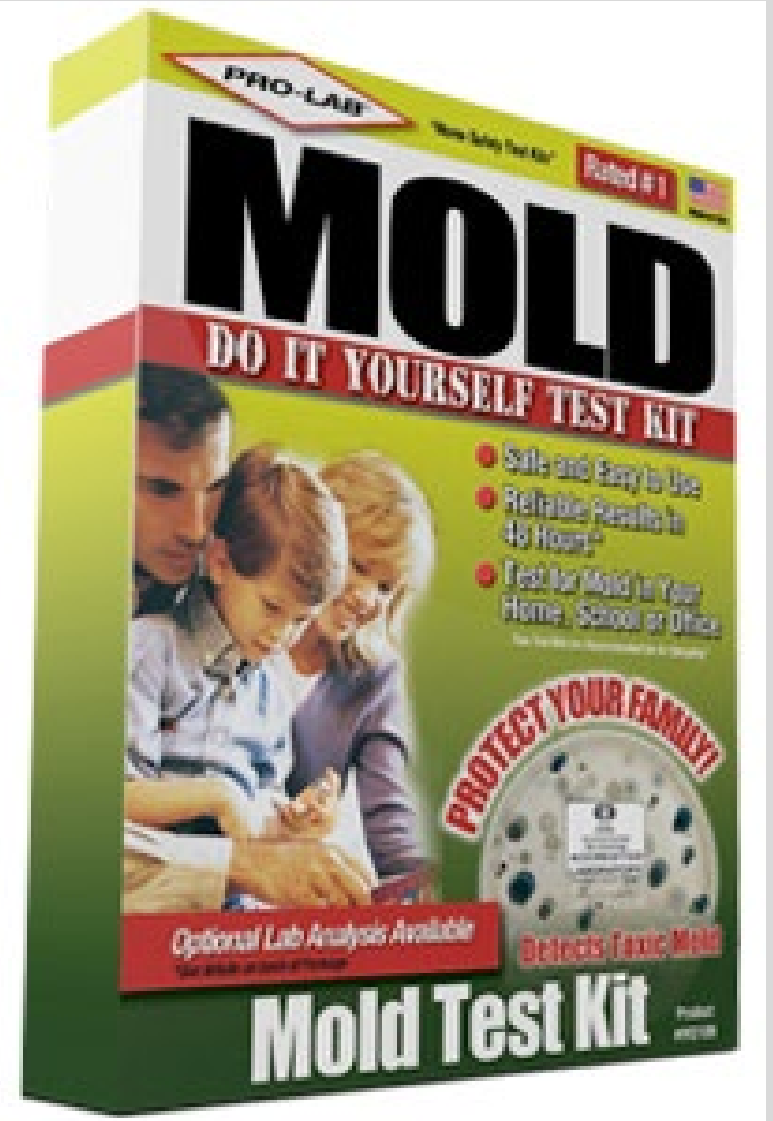
Settling/Gravity plates “method”

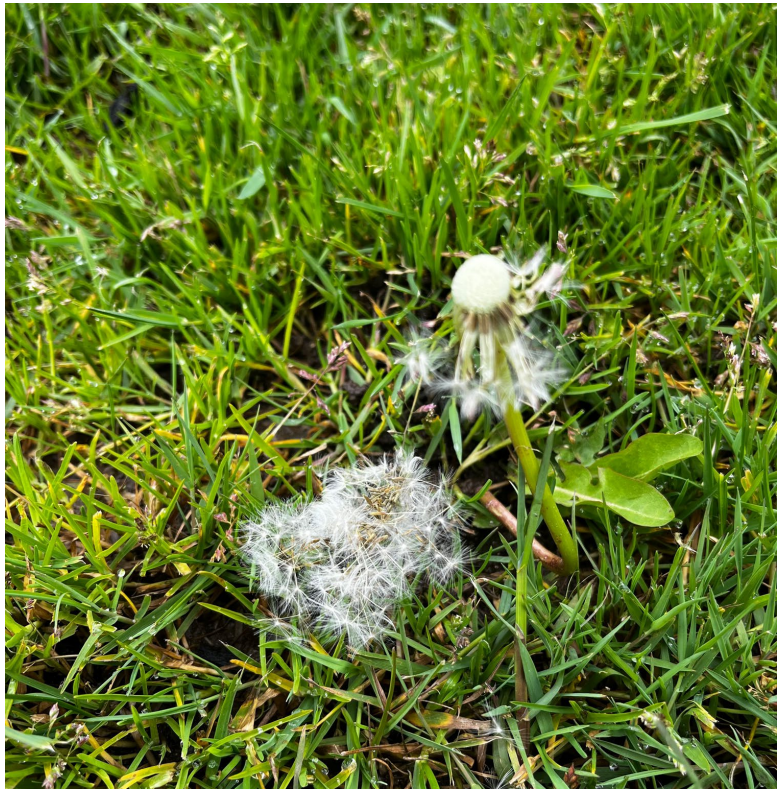
- Captures settled random viable mold spores on Petri dishes with agar
- Swabs are provided for surface sampling then placed on agar plates
- Plates sent to labs for mold ID

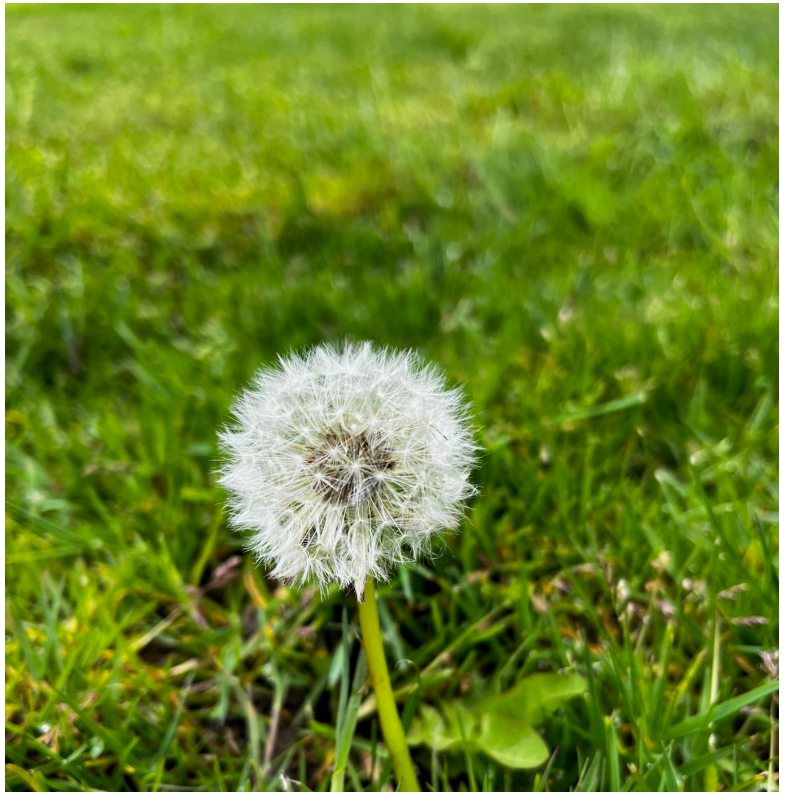

5 YEAR LIMITED WARRANTY
First Alert
PREMIUM
MOLD DETECTION KIT
TEST TAPES
FOR UP TO SIX LOCATIONS
3 POLYBAGS
FOR BULK SAMPLES
TEST CARD AND
RETURN ENVELOPES
DETAILED INSTRUCTIONS
ENCLOSED


Indoor Air Quality
Test Kit
Test your home or office for
• Mold
• Bacteria
• Yeast
HAZARD
After
Before

Even EPA says if you see visible mold growth do not need to sample!!







Is this plant growth?

Settled plates

- Do not provide information regarding exposure

- Answers one question: Do I have viable mold spores in my environment? Of course, we ALL do; but do I have mold growth? NO

- Interpretations not meaningful

- Claims that ID molds are “toxic”; not scientific and meaningless
- Great for any students to grow their own mold gardens/ fun school project

Conclusions: Facts

- Indoor mold spore inhalation will not lead to toxicity
- In our indoor environments, mold spore exposure can be allergenic
- There is no correlation between mold growth on surfaces and mold spores in the air
- There are no mold spore threshold to date that we can use to predict health
- Outdoor spore levels are usually much higher than indoors, so higher exposures outdoors! MOLD SPORES ARE EVERYWHERE
- ERMI cannot and should not be used for indoor mold investigation
- Mold air sampling is just a small piece of a puzzle and not always recommended
- Only a professional medical doctor (allergist) can diagnose people's condition; not labs or field investigators

Thank you!

Acknowledgment

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QUESTIONS?

Elizabeth Jakab, MS, CSRM

Industrial Hygiene Consultant

Workers' Compensation Trust / Unemployment Pool

Puget Sound Educational Service District

Email: ejakab@pswctup.org

Phone: (425) 917-7640

Cell: (206) 200-4463

Fax: (425) 917-7661

TTY: (425) 917-7833

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Upcoming Events

Date	Events
June 08	Advocacy-Based Claims Management
June 17	Strengthening our Racial Equity Partnership – Part 2
July 14	Handling Mold Exposure Claims
Aug 04	Mold and Water Remediation

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Thank You!

We appreciate your time and participation!

We invite you to complete the post-event survey.

Your feedback will inform our efforts to continually enhance the value of these events!

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800 Oakesdale Ave SW Renton, WA 98057

425-917-7600

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