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Lyme and Mold

Jill Crista, ND
International IV Nutrition Therapy
Chronic and Neurological Infections:
Strategies for Immune and Inflammatory Diseases
Online Seminar | April 1-2, 2022

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Disclosures

Disclosure: My book
Break The Mold,

Disclosure: Mold-literacy CME/CE course for practitioners
Are You Missing Mold Illness?

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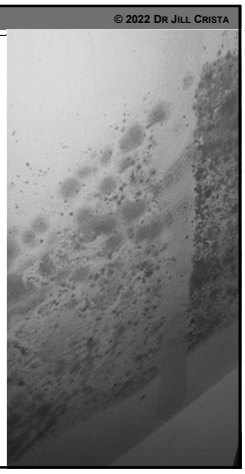
Main Points

1. How Lyme & Mold affect the body, similarities + differences
2. How the immune system gets "set up for failure"
3. Diagnostic aids
4. Overall treatment plan + proposed therapeutic order
5. Nutrient/botanical treatment tools
6. Using caution with antimicrobial treatments in mold patients & how to use side-effects as a clue that mold is the hidden complication
7. Methods to reduce resistance



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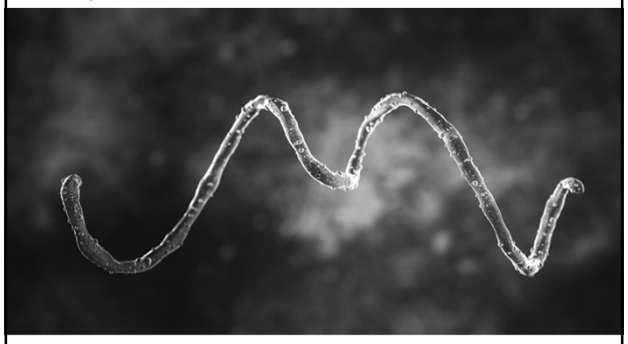
10,000 Foot View



Lyme needs you alive to survive

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10,000 Foot View

Mold wants to compost you

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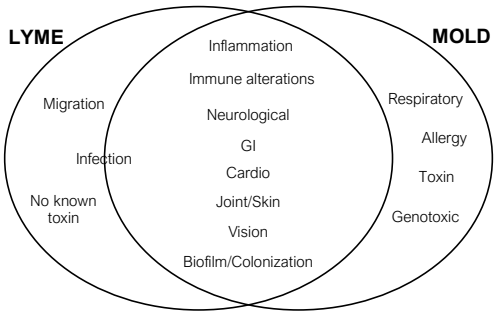
The Great Imitators



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Lyme Disease, The Umbrella Term

Technically refers to Borrelia burgdorferi sensu lato
Encompasses 18 known species
(ex: B. burgdorferi sensu stricto, afzelii, garinii, mayonii, californiensis, japonica, andersonii, lusitaniae, bissettii, spielmanii)
The most human pathogenic species to date (N of equator) ~
- B. burgdorferi sensu stricto (US & Europe)
- B. afzelii, garinii (Europe & Asia)

Tick-borne relapsing fever Borrelia (TBRF) ~
B. hermsii, turicatae, parkeri, miyamotoi

Louse-borne relapsing fever Borrelia (LBRF) ~
B. recurrentis

Coinfection is the norm, not the exception ~
Bartonella, Babesia, Anaplasma, Ehrlichia, Powassan, Franciscella (Tularemia), Rickettsia (RMSF), Q Fever, etc

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Overcoming Barriers

Spirochete negotiates numerous barriers to establish a disseminated infection

These barriers include ~

Migration from the tick midgut to the salivary glands

Deposition in skin

Manipulation or evasion of the localized host immune response

Adhesion to and extravasation through an endothelial barrier

Hematogenous dissemination

Establishment of infection in distal tissue sites

PMID: 26593255

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Mold's Assistance

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PMID: 26593255

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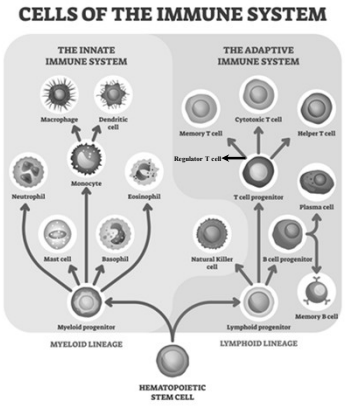

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Lack of Induction of Immune Response

In early stages of Bb infection, problem generating a proper immune response via lack of induction of strong adaptive immune response.
∴ innate doesn't feel like adaptive has its back so it overworks
→ delayed hyperinflammatory reaction later with exhausted innate and adaptive seeming "overactive"

Several proposed mechanisms - molecular mimickry, autoimmunity, rxn to remnants, *surviving bacteria, etc.

Murine studies suggest the inflammatory responses are initiated by innate immune cells, but this does not exclude involvement of the adaptive immune system in the dysregulated immune profile.

Mast cells are important for the development of immune response in early infection, while the spirochetes still reside in the skin.

PMID: 31930745, 31753921

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How **Mold** Makes It Worse

In early stages of Bb infection, problem generating a proper immune response via lack of induction of strong adaptive immune response.
∴ innate doesn't feel like adaptive has its back so it overworks
→ delayed hyperinflammatory reaction later with exhausted innate and adaptive seeming "overactive" ← **impairs macrophage polarization & NK cell fxn**

Several proposed mechanisms - molecular mimickry, autoimmunity, rxn to remnants, *surviving bacteria ← **genetically rewires I/S for susceptibility**

Murine studies suggest the inflammatory responses are initiated by innate immune cells, but this does not exclude involvement of the adaptive immune system in the dysregulated immune profile. ← **cytotoxic to PMNs, reduce phagocytosis**

Mast cells are important for the development of immune response in early infection, while the spirochetes still reside in the skin. ← **incr survival and #**

PMID: 31930745, 31753921

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Adaptation to Host

During transmission & dissemination within the host, the bacteria undergo dramatic changes in gene expression, resulting in adaptation to the host environment.

Ie: Bb surface protein gene switching to stay 1 step ahead of adaptive I/S ~
Continually modify through segmental gene conversion events the sequence of the surface-bound lipoprotein VlsE.
Small stretches of information are transferred from a series of silent cassettes.

PMID: 31930745, 26295288

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How **Mold** Makes It Worse

During transmission & dissemination within the host, the bacteria undergo dramatic changes in gene expression, resulting in adaptation to the host environment.

Ie: Bb surface protein gene switching to stay 1 step ahead of adaptive I/S ⟵**mycotoxins impede protein synthesis leading to T- and B-cell deficiencies, increase inflammatory cytokines/chemokines, and genotoxic**
Continually modify through segmental gene conversion events the sequence of the surface-bound lipoprotein VlsE.
Small stretches of information are transferred from a series of silent cassettes.

PMID: 31930745, 26295288

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Lyme Immune Factors Involved

After "treatment"*, persistent AB-tolerant/resistant Bb survive w increasingly heterogeneous subpopulations.
These spirochetes are non-cultivable.
Resurge in multiple tissues at 12 months after Lyme arthritis tx, with Bb-specific DNA copy levels nearly equivalent to those found in sham-treated experimental animals.
Remain viable, but divide slowly, thereby being tolerant to antibiotics.

*Note: Initial (and in some cases the only) tx period - median of 4 weeks.
Primarily doxy, also ceftriaxone.

Conventional argument - extended duration of Ab use encourages resistance…not what the research bears out.

Because Bb divides slowly.

Research implying that ***too short*** of tx may encourage tolerance/resistance.

PMID: 31930745, 26295288, 30344080

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Th17, ECM & Lymph

Compared with healthy subjects, EM+ Lyme pts had significantly higher levels of innate, TH1, and TH17-associated mediators in serum.
Their levels of inflammatory mediators (particularly TH17-assoc cytokines) correlated directly with Bb IgG antibodies.

Levels of TH17-assoc mediators correlated strongly with autoantibodies to endothelial cell growth factor, MMP-10, and apolipoprotein B-100 in joints of patients with antibiotic-refractory LA,
"implying a shift in TH17 responses toward an autoimmune phenotype."(??)

OR Is the combo of Th17 and autoantibodies really the body's biofilm combat weapon in the absence of antimicrobial aid?

MMPs - family of zinc-binding metalloproteinases that participate in the degradation of ECM components. (cancer-angiogensis & METS, Lyme-migration/dissemination, Mold-invasion/colonization)

IV therapy - unique opportunity for improved delivery to ECM, but what clears it? Lymph

PMID: 31930745, 26295288, 28077518

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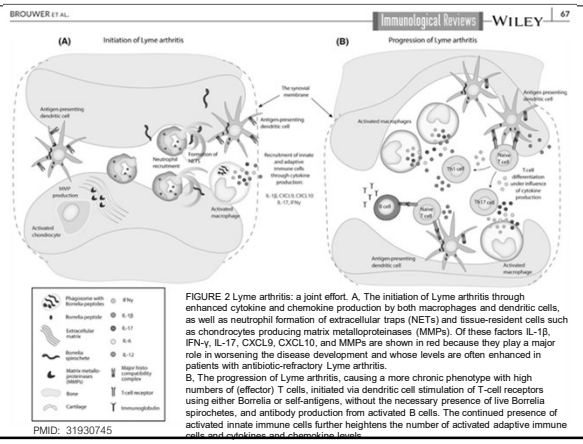

FIGURE 2 Lyme arthritis: a joint effort. A, The initiation of Lyme arthritis through enhanced cytokine and chemokine production by both macrophages and dendritic cells, as well as neutrophil formation of extracellular traps (NETs) and tissue-resident cells such as chondrocytes producing matrix metalloproteinases (MMPs). Of these factors IL-1β, IFN-γ, IL-17, CXCL9, CXCL10, and MMPs are shown in red because they play a major role in worsening the disease development and whose levels are often enhanced in patients with antibiotic-refractory Lyme arthritis.
B, The progression of Lyme arthritis, causing a more chronic phenotype with high numbers of (effector) T cells, initiated via dendritic cell stimulation of T-cell receptors using either Borrelia or self-antigens, without the necessary presence of live Borrelia spirochetes, and antibody production from activated B cells. The continued presence of activated innate immune cells further heightens the number of activated adaptive immune cells and cytokines and chemokine levels.

PMID: 31930745

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How **Mold** Makes It Worse

Inflammatory markers in common with Lyme:

IL-1β, TNF-α, IFN-γ, IL-17, TLR4 overexpression, TGF-β1, VEGF, MMP-9

M1 to M2 polarization - "nothing to see here" effect

Let's understand the full impacts of mold…

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Mold: More Than Spore Illness

Spores
- IgE | Allergic rhinitis, asthma, hypersensitivity pneumonitis (CDC)
- Non-IgE | Non-IgE mediated Asthma exacerbation (CDC)
- Mast cell | Recruitment, degranulation, enhanced survival
- Infection | Aspergillosis

Fragments
- "Mold-othelioma"

Other Mold Dangers
- Mycotoxins | Colonization
- Chemicals | VOCs, aldehydes, alcohols, MPA

Biofilm
- Water-damage=increased microbial diversity+quorum behavior

PMID: 24368325, 20537281, 24368325, 23710148

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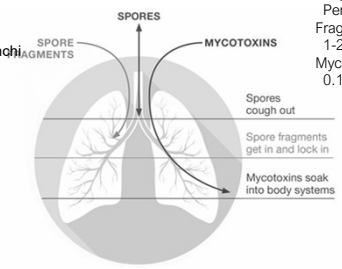
Respiratory System vs Mold

Respiratory System
- >7m Nasal
- 5-7m Pharynx
- 3-5m Trachea
- 3-5m 1° Bronchi
- 2-3m 2° Bronchi
- 1-2m Terminal bronchi
- <1m Alveoli



Mold
Spores-
- Cladosporium 3-5m
- Aspergillus 2-5m
- Penicillium 1-5m

Fragments-
- 1-2m

Mycotoxins-
- 0.1m

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Spores

Immune responses are highly variable - from allergic response to life-threatening disseminated fungal infection (IFI)

General ROT - spores induce, mycotoxins suppress
*but both deplete with ongoing exposure

Mechanisms ~
- Induce inflammatory reaction
- Reduce respiratory mucosal ciliary function
- Adhesion
- Evasion
- Invasion

Allergic recruitment induction ~
- Influence mast cell homeostasis to enhance survival
- Induce pulmonary mast cell degranulation even in the absence of antigen-specific IgE
- Increased allergic responses to other respirable antigens (dust, grass, pollen, pet dander, exhaust)

Inflammation/irritation/degradation of mucosal linings over time

Spore invasion/infection due to LT immune depletion

PMID: 27623953, 26600019, 29371501, 27092126, 8463496, 19527167, 19201896

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Spore Fragments

500:1 Fragment:spore

Usu occurs when dead/dried mold is disrupted

Become ultrafine particulate in permanent suspension, even in lungs

Highly inflammatory to sinus & lung tissue ~
- More potent than spores at inducing proinflam cytokines
- Asp/Pen - enhance TLR2-dependent expression and release of IL-6 + IL-8 in human bronchial epithelial cells

Airway remodeling if persistent exposure

"Mold-othelioma" - mesothelial inflammatory condition related to mold fragment exposure vs asbestos:
Shortness of breath, cough, pain in the chest or abdomen, fatigue, fever or night sweats, respiratory complications, muscle weakness, nausea or bloating

PMID: 30917597, 31116698

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Mycotoxins

Aflatoxin
- Aspergillus flavus, A. parasiticus

Chaetoglobosin A,C
- Chaetomium globosum

Citrinin
- Aspergillus, Penicillium, Monascus

Enniatin B_1
- Fusarium spp

Gliotoxin
- Aspergillus fumigatus, Candida spp

Ochratoxin A
- A. ochraseus, A. niger, Penicillium verrucosum, P. nordicum, P. chrysogenum

Patulin
- Aspergillus spp, Penicillium spp, Mucor, Fusarium spp

Sterigmatocystin
- Precursor of Aflatoxin, A. versicolor

Trichothecenes (Roridin, Verrucarin, Nivalenol, Deoxynivalenol, Diacetoxyscirpenol, Satratoxin)
- Stachybotrys chartarum, Trichoderma viridae, Fusarium spp, Myrothecium

Zearalenone
- Fusarium spp

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Mycotoxins - Health Impacts

Immunotoxic, neurotoxic, dermatoxic, alimentary tract toxic, nephrotoxic, hepatotoxic, hepatocarcinogenic, teratogenic, carcinogenic, genotoxic

Lipophilic

Highly inflammatory to sinus & lung tissue
- Alter lung surfactant
- Airway remodeling if persistent

Inflammation/irritation/degradation of mucosal linings
- Respiratory, GI, bladder

Induce apoptosis of intestinal epithelial cells

↓PC ratio of hepatocyte lipid rafts affecting basic function

PMID: 26474839, 27178040, 25449202, 12221236, 26600019, 29309824

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Mycotoxins - Health Impacts

Modified by multiple enzymes ~
Cyt P450s, glutathione S-transferases, UDP-glucuronosyltransferases, sulfur-transferases

Deplete glutathione, Nrf-2 → excess ox stress + inflam

Protein synthesis inhibitors ~
Actin/myosin, keratin/elastin, enzymes, heme, DNA/RNA, etc

Cause mitochondrial damage

Interfere with vital cellular processes, many are cytotoxic

Some xBBB and reduce its integrity, activate microglia

Inhalation - olfactory n. to hippocampus, frontal lobe

Many cross the placenta, bioactivate in utero, found in breast milk

PMID: 26474839, 27178040, 25449202, 12221236, 26600019, 28181396, 30336475, 30006720

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Mycotoxins - Immune

Immunosuppressive via:
- Direct action on immune cells
- Epigenetic alterations to the immune response
- Direct genetic alterations

Inhibit host defense via:
- NK cell hypofunction
- T-/B-cell deficiency
- LT exposure - Ig subclass deficiency (false neg mold allergy, infection labs)

↓WBC - relative lymphopenia w neutrophilia & eosinophilia

TGF-β1↑
- ↑ impairs T-reg fxn → immune overactivation/asthma

Disorder the GALT, intestinal apoptosis

PMID: 26474839, 27178040, 25449202, 12221236, 26600019

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Mycotoxins - Immune Specifics

Aflatoxin
- ↓Lymphocytes
- ↓sIgA

Chaetoglobosin
- Necrosis of spleen/thymus

Enniatin
- Carcinogenic to brain astroglia
- Immunotoxic to fetus during embryo development

Gliotoxin
- Immunosuppressive: T-lymph, PMNs, macrophages, monocytes, NK cells
- Inhibits phagocytosis

Ochratoxin
- ↓Aby-producing cells & aby titres in blood serum
- Cytotoxic to neutrophils
- Inhibits phagocytosis

Trichothecenes
- Thrombocytopenia & leukopenia
- Compromised resistance to infection

PMID: 12573908, 713122, 30259633, 27048806, 7637687, 27597255, 15342083

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How **Mold** Makes Your Job Harder

Immune depletion - chronicity, altered labs

Inflammatory - exaggerated reactions

"Sensitive" patients - minute doses

Burdened organs of detox & snps expressed - drug clearance/counter-intuitive reactions

Sm vessel vasculitis & coagulation abnormalities - remedy delivery

Cardiac - carditis, conduction

Sleep issues

Neuro - "mold brain", anxiety

∴ Don't/can't stick to tx plan

= "The Sensitive Patient"

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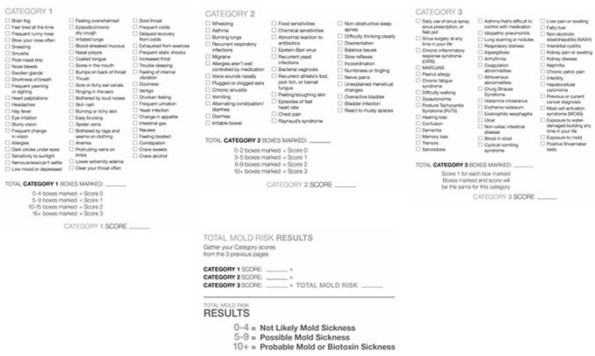
Questionnaire



CATEGORY 1
- ☐ Brain fog
- ☐ Feel tired all the time
- ☐ Frequent runny nose
- ☐ Blow your nose often
- ☐ Sneezing
- ☐ Sinusitis
- ☐ Post-nasal drip
- ☐ Nose bleeds
- ☐ Swollen glands
- ☐ Shortness of breath
- ☐ Frequent yawning
- ☐ Fatigue
- ☐ Heart palpitations
- ☐ Headaches
- ☐ Hay fever
- ☐ Eye irritation
- ☐ Blurry vision
- ☐ Frequent change in vision
- ☐ Allergies
- ☐ Dark circles under eyes
- ☐ Sensitivity to sunlight
- ☐ Nerve pain/sciatica/numbness
- ☐ Low mood or depression
- ☐ Feeling overwhelmed
- ☐ Episodic/chronic dry cough
- ☐ Irritated lungs
- ☐ Blood-streaked mucous
- ☐ Nasal polyps
- ☐ Coated tongue
- ☐ Sores in the mouth
- ☐ Bumps on back of throat
- ☐ Tinnitus
- ☐ Sore or itchy ear canals
- ☐ Ringing in the ears
- ☐ Bothered by loud noises
- ☐ Skin rash
- ☐ Burning or itchy skin
- ☐ Easy bruising
- ☐ Spider veins
- ☐ Bothered by bags and seams on clothing
- ☐ Anemia
- ☐ Throbbing veins on limbs
- ☐ Lower extremity edema
- ☐ Clear your throat often
- ☐ Sore throat
- ☐ Frequent colds
- ☐ Delayed recovery from colds
- ☐ Exhausted from exercise
- ☐ Frequent static shocks
- ☐ Increased thirst
- ☐ Trouble sleeping
- ☐ Feeling of internal tremors
- ☐ Dizziness
- ☐ Vertigo
- ☐ Drunken feeling
- ☐ Frequent urination
- ☐ Yeast infection
- ☐ Change in appetite
- ☐ Intestinal gas
- ☐ Nausea
- ☐ Feeling bloated
- ☐ Constipation
- ☐ Crave sweets
- ☐ Crave alcohol

TOTAL **CATEGORY 1** BOXES MARKED _____
0-4 boxes marked = Score 0
5-9 boxes marked = Score 1
10-15 boxes marked = Score 2
16+ boxes marked = Score 3

CATEGORY 1 SCORE _____

CATEGORY 2
- ☐ Wheezing
- ☐ Asthma
- ☐ Burning lungs
- ☐ Recurrent respiratory infections
- ☐ Migraine
- ☐ Allergies aren't well controlled by medication
- ☐ Voice sounds nasally
- ☐ Plugged or clogged ears
- ☐ Chronic sinusitis
- ☐ Vomiting
- ☐ Alternating constipation/diarrhea
- ☐ Diarrhea
- ☐ Irritable bowel
- ☐ Food sensitivities
- ☐ Chemical sensitivities
- ☐ Unexplained reaction to antibiotics
- ☐ Epstein-Barr virus
- ☐ Recurrent yeast infections
- ☐ Bacterial vaginosis
- ☐ Recurrent athlete's foot, jock itch, or toenail fungus
- ☐ Peeling/sloughing skin
- ☐ Episodes of fast heart rate
- ☐ Chest pain
- ☐ Raynaud's syndrome
- ☐ Non-obstructive sleep apnea
- ☐ Difficulty thinking clearly
- ☐ Disorientation
- ☐ Balance issues
- ☐ Slow reflexes
- ☐ Incoordination
- ☐ Numbness or tingling
- ☐ Nerve pains
- ☐ Unexplained menstrual changes
- ☐ Overactive bladder
- ☐ Bladder infection
- ☐ Reactive to musty spaces

TOTAL **CATEGORY 2** BOXES MARKED _____
0-2 boxes marked = Score 0
3-5 boxes marked = Score 1
6-8 boxes marked = Score 2
10+ boxes marked = Score 3

CATEGORY 2 SCORE _____

CATEGORY 3
- ☐ Daily use of sinus spray, sinus prescription, or Neti pot
- ☐ Sinus surgery at any time in your life
- ☐ Chronic inflammatory response syndrome (CIRS)
- ☐ MARCoNS
- ☐ Peanut allergy
- ☐ Chronic fatigue syndrome
- ☐ Difficulty walking
- ☐ Dysautonomia
- ☐ Postural Tachycardia Syndrome (POTS)
- ☐ Hearing loss
- ☐ Confusion
- ☐ Dementia
- ☐ Memory loss
- ☐ Tremors
- ☐ Sarcoidosis
- ☐ Asthma that's difficult to control with medication
- ☐ Idiopathic pneumonitis
- ☐ Lung scarring or nodules
- ☐ Respiratory distress
- ☐ Aspergillosis
- ☐ Arrhythmia
- ☐ Cardiac conduction abnormalities
- ☐ Atrioventricular abnormalities
- ☐ Churg Strauss Syndrome
- ☐ Histamine intolerance
- ☐ Erythema nodosum
- ☐ Eosinophilic esophagitis (EoE)
- ☐ Non-celiac intestinal disease
- ☐ Blood in stool
- ☐ Cyclical vomiting syndrome
- ☐ Liver pain or swelling
- ☐ Fatty liver
- ☐ Non-alcoholic steatohepatitis (NASH)
- ☐ Interstitial cystitis
- ☐ Kidney pain or swelling
- ☐ Kidney disease
- ☐ Nausea
- ☐ Recurrent pelvic pain
- ☐ Infertility
- ☐ Hepatocellular carcinoma
- ☐ Previous or current cancer diagnosis
- ☐ Neurologic symptoms (MS, ALS, ADD)
- ☐ Exposure to water-damaged building any time in your life
- ☐ Exposure to mold
- ☐ Positive Shoemaker tests

TOTAL **CATEGORY 3** BOXES MARKED _____
Score 1 for each box marked
Boxes marked and score will be the same for this category

CATEGORY 3 SCORE _____

TOTAL MOLD RISK **RESULTS**
Gather your Category scores from the 3 previous pages

CATEGORY 1 SCORE: _____ +
CATEGORY 2 SCORE: _____ +
CATEGORY 3 SCORE: _____ = **TOTAL MOLD RISK** _____

TOTAL MOLD RISK
RESULTS
0-4 = **Not Likely Mold Sickness**
5-9 = **Possible Mold Sickness**
10+ = **Probable Mold or Biotoxin Sickness**

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Diagnostics

VCS: Visual Contrast Sensitivity (online)

CBC ~
- ↓WBC: relative lymphopenia w neutrophilia & eosinophilia
- ↓T- and B-cell total count
- Fe-def anemia

↓NK cell *function* (<7 lytic units) + poss ↓NK cell total

↓Vit D 25-OH (receptor blockade)

↑Liver enzymes - esp GGT

↓IgG subclass, esp subclass 3

+IgE Mold (not useful for mycotoxins)

↑MMP-9 (85-332 ng/ml)
- Tissue repair enzyme induces I/S stim (Drs. Patel/Farshchian recent discovery)

↓ADH with increased serum osmolality

+Organic Acids Test

+Mycotoxins

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Urine ELISA Myctoxin

Established use for 15 years

Indirect measure

The idea - due to the body's ability to modify mycotoxins, antigen detection vs molecular matching will catch more metabolites and give a better view of body burden

Strengths ~
- Detect both the mycotoxin in pure form and metabolites of mycotoxins due to common antigens on most modified forms
- Levels correlate to symptoms in majority of my patients ("bell-curve")

Challenges ~
- Not controlled for creatinine
- Antigen selection by lab
- Non-specific reactions (aka background noise) w poss false-positives
- Varying accuracy for pts w issues detoxing and excreting
- Doesn't help answer the question of whether currently being exposed
- Unknown degree of contamination via ingestion

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Urine LC-Mass Spect Myctoxin

Gold standard for small molecules

Direct measure

The idea - molecular identification as direct detection of the presence in the urine

Strengths ~
- Controlled for creatinine
- Specific metabolites of mycotoxins can be tested and reported as an individual finding, then grouped for a bigger picture
- Levels correlate to symptoms in majority of my patients ("bell-curve")

Challenges ~
- Some of the molecules are similar in structure, peak together, leading to possible cross-reporting
- May miss metabolites if not specifically identified as a structure to monitor
- Extraction method to prep sample varies
- Varying accuracy for pts w issues detoxing and excreting
- Doesn't help answer the question of whether currently being exposed
- Unknown degree of contamination via ingestion

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Serum Mycotoxin Antibody

New kid on the block commercially

Indirect measure

The idea - the meer presence of a mycotoxin not as important as knowing what the body thinks about it

Strengths ~
- Not an excretion test
- Detection of metabolites of mycotoxins that share common antigens
- IgE helps to answer whether it's a current exposure

Challenges ~
- Antigen selection by lab
- May miss metabolites if antigens have been modified
- Immune status of the pt
- IgG remains positive for up to 6 months
- Unknown degree of contamination via ingestion

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So Which Do I Treat?

Lyme?

Mold?

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So Which Do I Treat?

Lyme?

YES!

Mold?

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The Path of the Mycotoxin

In WDB exposure ~
Inspiration
Absorption - sinus mucosa to lung alveoli
Carried via blood
Liver & Kidney
Kidney - filtration
Liver - bound to bile and delivered to lumen
Left-over absorbed into lipid-rich tissue for later mgmt

Note 1: Ingested mycotoxins may remain unbound in lumen
Note 2: No data on mycotoxin secretion in sweat

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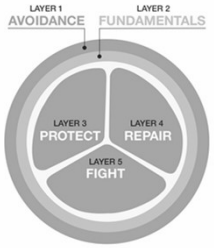
Therapeutic Order - Peel The Orange

1 AVOIDANCE
2 FUNDAMENTALS
3 PROTECT
4 REPAIR
5 FIGHT



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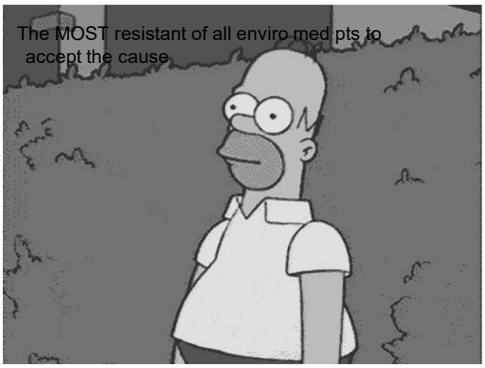
Avoiding Avoidance



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Avoidance

Environment - home/office/gym, car, water sources, toys

Hobbies - brewmaster, breadmaker

Diet - no fungi/fermented, not mycotoxin contaminated, low carb

Supplements - no fungi, no mycotoxins, not synthesized by fungi

Medications*

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Fundamentals

Naturopathic Basic Treatment Guidelines ~

- Circadian rhythm alignment
- Sleep/wake
- Hydration
- Digestion
- Movement
- Community
- Spiritual practice
- Healthy diet*

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Overview of Protect & Repair

The solution to pollution is dilution - Crinnion
Dilution of lipid soluble toxins
Copious Clean Correct fats (PC, EFAs, CoQ10)

Restoration of fat-soluble nutrients

Make and move more bile

High bioflavonoids, specifically polyphenols

Support detoxification - from the cell on through the phases

Restore mitochondrial function

Immune restoration - including genes

Choose treatments with multiple desired MOAs

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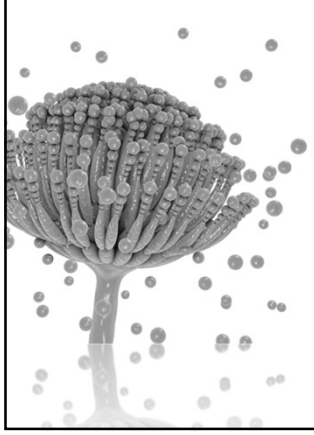

Bile's Critical Role

Bile is what is bound

Detergent
1° fxn ~ emulsify fats
2° fxn ~ eliminate toxins
3° fxn ~ non-liver
(sIgA, surfactant, retina, etc)

10:1 PC:cholesterol

1L/d of which ~93% recycled via hepatic portal vein

Bile salts - bile acids conjugated by glycine & taurine

Induces lipase

PMID: 29686653, 24891994, 25972546

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Phosphatidylcholine (PC)

Primary lipid in cell membranes & organelles within the cell

Role in membrane fluidity & transport "lipid rafts"

Primary component of bile (10:1), therefore plays a role in liver + non-liver bile functions ~
lung surfactant
retina
↑sIgA
recruitment of enterocytes
stimulates innate I/S in lumen
induce peristalsis
↑probiotic mucosal adherence

Theory: high dose (IV) may provide negative feedback against Borrelia enzyme synthesis of PC in its own membrane

PMID: 29672156, 14766917

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Pollution Dilution with DHA

ω-3 fatty acid

1° structural component in brain

Neuroprotective

Protects against aflatoxin-induced hepatocellular carcinoma

Attenuates mycotoxin-induced IgA nephropathy

Suppresses MMP-9

Potentiates effects of cerebral VEGF-repair BBB

Dose ~
Acute/rescue: 6-10gm/d
Chronic: 2gm/d

Mouse study - 30g/kg safe w no AE
Translation to humans? Empirically 10gm/d safe LT

PMID: 27513579, 27435775, 15570035, 24794156

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Restore Vitamin D

Role in both innate & adaptive immunity
T-cell regulator
Upregulates monocyte genes

Vit D receptor in intestine & kidney significantly down-modulated after aflatoxin exposure

Promote LU tissue repair in *particle-induced pulmonary injury* ~
Repress TGFβ1 signaling pathway
Upreg MMP9 expression
Activation of Nrf2 transcription factor

Dose to lab levels
Goal 25-OH Vit D 60-90 ng/mL
Emulsified best, esp if cholecystectomy
Oral (daily-weekly), IM

PMID: 30698894, 25483621, 25912039, 26404359,18569389

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Bioflavonoids - Vitamin C

Acts against inflammation, oxidative stress, autophagy chaos, and immune dysfunction

Diminishes the adverse effects of AFB1 on activities of ~
hematological (Hgb, total erythrocytic count, packed cell volume)
biochemical values (total protein, albumin, glucose)
enzymatic (AST, ALT, Alk phos)

Inhibits ZEN-induced mechanisms on reproductive toxicity, immunotoxicity and hematological toxicity

Positive effects seen for mold considered "low-dose" IV

Caution: synthesized with fungus

PMID: 29715633, 12617557

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Bioflavonoids - Green Tea

Camellia sinensis

EGCG polyphenols - postharvest inactivation of phenol oxidases via steaming & drying prevents oxidation of catechins vs fermented tea prods

Antifungal, antibacterial, antiviral, antitoxin

Cytoprotective to macrophages against DON (Fusarium) in a dose-response manner

Inhibits cytP450

PMID: 23410590, 23605930, 17195249, 17548142, 27518169

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Bioflavonoids - Quercetin

Polyphenolic compound

Potent antiox, anti-inflam, antigenotoxic

Pretreatment before mycotoxin exposure is cytoprotective

Modulates Ochratoxin-induced ox stress via Nrf2 expression, NF-kB and COX-2

Protects peripheral blood PMNs from OTA-induced ox stress, genotoxicity & inflam

Reduces Alternaria mycotoxin dmg to human adenocarcinoma cells

Protects cells from Zearalenone-induced (Fusarium) apoptosis

Down-regulates MMP-9

PMID: 24161694, 25532488, 26802676, 26134454, 31212975

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MycoDetox - Turmeric

Curcuma longa

Antioxidant, hepatoprotective, nephroprotective, epigenetic protection

Amelioration of aflatoxin-induced effects via:
Up-reg of antiox enzyme gene expression
Activation of the expressed genes
Increase in the availability of GSH

Provides protection against toxic effects of aflatoxin on liver & kidney

Dose: start low, titrate slowly

Cautions: inhibits cytp450

PMID: 25639897, 26450181

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MycoDetox - ALA

Alpha-Lipoic Acid

Hepatoprotective, anti-inflammatory, genoprotective

Engages molecular mechanisms against liver oxidative damage & inflam responses after aflatoxin exp

Inhibits NF-κB expression after aflatoxin exp

Alleviates Aflatoxin-induced ox stress & immune changes

Modulates inflam response partly through changes in the expression of proinflam cytokines such as IL6 and TNFα

Dose ~
Oral 300mg bid, R+ allele
Take with food reduces reflux SE
IV administration most remarkable shift

PMID: 26694462, 24699046, 20390578

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MycoDetox - Glutathione

"The one antioxidant to rule them all"

Hepatoprotective, anti-inflammatory, genoprotective, redox support

Pharmacokinetics ~
Hydrolysis in the ECM
2 metabolites: γ-glutamylcysteine, glycine

Pros ~
Straight to the end game
Brain fog
Lung function
Kidney sparing

Cons ~
Too intense for many mold-Lyme; IV well tolerated
Cofactor/coenzyme depletion

Dosing ~
Form matters & is very individual
Start low & titrate
Dose to lab values

PMID: 24517907, 23710148, 10852775, 11409324

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Taurine

Cytoprotective amino acid

"Master osmolyte in the body" (IIVNTP)

Plays an important role as a basic factor for maintaining cellular integrity homeostasis

Nephroprotective, neuroprotective, retinal component

Decreases OTA-induced cytotoxicity + attenuates apoptosis in kidney

Blocks ROS-dependent autophagy via inhibiting AMPK/mTOR signaling pathway

Acts as a "pre-binder"
If on a high fat diet (the dilute pollutants solution diet), taurine inhibits bile acid absorption in the colon.

PMID: 32371067, 30332612, 19239159

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Fight

Mold - systemic and intranasal

Lyme - companion treatments are possible…

Recognize when mold is a hidden barrier to recovery,

To be more selective with choice of txs,

By knowing antimicrobial sources,

And drug side-effects as mold clues

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Intranasal Options

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Complications

Many antimicrobials are derived from mold

More reactions occur if use Rx derived from same mold species as made them sick

Side-effects may not be from the drug but mycotoxin reactions and/or nutritional deficiencies

Resistance and transmutation is a concern, especially in immune depleted patients

Some patients don't tolerate pharmaceutical medications

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Antimicrobials

Many are derived from mold, some are actual mycotoxins
- Compare to enviro testing (if available) before prescribing

Penicillium
- Penicillin, amoxicillin

Acremonium
- Cephalosporins

Actinomycetes/actinobacteria
- Tetracyclines, macrolides, aminoglycosides, rifamycins

Actinobacteria
- Ivermectin

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Side-Effects as Clues

Penicillin

Allergy - IgE-mediated pruritis, rash, GI
- Correlated with exposure to environmental Penicillium

"IgE-mediated allergy wanes over time, with 80% of patients becoming tolerant after a decade."…why? tolerance or move?

"Cross-reactivity between penicillin and cephalosporin drugs occurs in only about 2% of cases."

+penicillin skin testing, high-risk anaphylactic cases, +spores

∴ Low- to moderate-risk missed w skin testing, +mycotoxins

PMID: 30644987, 405332

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Side-Effects as Clues

Tetracyclines

S/E - photophobia
- Correlated with mold exposure
- Vitamins A & D deficiency also correlated, common in mold-exposed patients, esp if being treated with LT Rx binders

PMID: 14650691, 26269110

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Side-Effects as Clues

Macrolides

S/E - Tinnitus
- Correlated with mold exposure
- Neurotoxic. "First pass" effect at the sinuses
- Cavernous sinus - many nerve pass-throughs
- Internal carotid artery, abducens nerve (cranial nerve VI)
- Cranial nerves III, IV, V1, V2, (oculomotor, trochlear, ophthalmic, and maxillary)

S/E - Cholestatic hepatitis
- Inflam/congestion of bile ducts also correl with mold exposure

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Side-Effects as Clues

Daptomycin

S/E - Dyspnea
- Correlated with mold exposure
- PC depletion of surfactant

S/E - Eosinophilia
- Clue it may be mold (also consider parasites)
- WBC alterations - relative eosinophilia & neutrophilia with relative lymphopenia

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Side-Effects as Clues

Daptomycin

Rarer S/E - Myopathy/myositis
- Correlated with statin use and CoQ10 deficiency
- If occurs and not on statin, clue it may be mold
- Mold depletes CoQ10

Rarer S/E - Eosinophilic pneumonia
- Most prevalent in elderly
- If occurs in young, clue it may be mold

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Secondary Benefits as Clues

Disulfiram (Tetraethylthiuram Di**sulfide**)

Borreliacidal activity against both the log and stationary phase of B. burgdorferi sensu stricto (mouse study), plus ~
- Reduced expressions of inflammatory markers.
- Significantly lower amounts of total Aby titers (IgM+IgG) at day 21.
- Lymph nodes revealed a decrease in % of CD19+ B cells and an increase in total % of CD3+ T cells, CD3+ CD4+ T helpers, and naive and effector memory cells.

Secondary benefit - ***antifungal***
- MIC50 and MIC90 for yeast isolates is 4 and 8 microg/ml, respectively.
- MIC50 and MIC90 for Aspergillus spp. is 2 and 8 microg/ml, respectively.
- (MIC range is 1-16 micro g/ml for both fluconazole sensitive and resistant strains)

Disulfide bond ~
- also found in Ajoene from garlic

PMID: 32971817, 32858987, 17667894

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Combatting Resistance - Garlic

Allium sativum

Bioactive sulfur-containing compounds (allicin, alliin, ajoene)

Antifungal - Aspergillus & Penicillum species
Mouse study-Efficacy against Candida slightly less than fluconazole (fungal burden reduction, host survival time at 1mg/kg/d)

Ethanol prep effective against MDR candida (fluconazole, clotrimazole, Amphotericin B, itraconazole, ketoconazole, miconazole, nystatin)

Antimicrobial - Staph aureus, E coli, Pseudomonas, Bacillus

PMID: 27259073, 31284512, 30345234, 28584446, 30319862

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Combatting Resistance - Thyme

Thymus vulgaris

Reliable broad-spectrum antifungal, antibacterial

Action against fluconazole resistance
- (A. fumigatus, Trichophyton rubrum/athlete's foot, Candida spp)
- Effective against both the macro and arthroconidia growth (MIC 72 µg/mL) in fluconazole-resistant fungi
- >80% reduction in elastase activity

Inhibitory effects on Aflatoxin prod found at lower doses than required for antifungal activity

High safety profile - nontoxic even up to concentration 2x higher than their respective MFCs

PMID: 25466118, 28062283, 25242937, 31359292

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Combatting Resistance - Oil of Oregano

Origanum vulgare

Volatile oil extract

Antifungal - Candida spp, Aspergillus, Penicillium

Antimycotoxic - Aflatoxin

Antibiotic - E.Coli, Staph aureus, Enterococcus

Combine safely w fluconazole & cipro
- ↓drug resistance
- ↓free-rad formation + S/E

PMID: 27222835, 28176439, 29402621, 29846575, 29987237, 25364204, 25952773

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When No Rx Works

Pau D'Arco (Hydroanthus impetiginous/Tabebuia spp)

Taheebo tea - traditional tea from inner bark

Antifungal - MICs similar to those of amphotericin B

Antimicrobial - activity against MRSA

Immunomodulator, antitumor, adaptogen

Expectorant to deeply embedded mucous & contaminants

Not cytotoxic to normal cells at concentrations that were active against fungi and bacteria

PMID: 9517956, 23778660, 16553949

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Or … IV H2O2

Poor man's HBOT

Antibacterial and antifungal

Increases the oxygen available to tissues ~
- Dilates small arteries (small vessel vasculitis-mold, Lyme, Bart)
- O_2 remains in circulation after infusion
- Secondary manufacture by the body in response

Neuroprotective - clears up brain fog

PMID 22352897, PMC1944813,
Farr, Charles H. "Physiological and biochemical responses to intravenous hydrogen peroxide in man." J ACAM 1 (1988): 113-129.

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How My Mission Makes Your Job Easier

SAVE YOU TIME!

Loads of free info for patients

Short videos

Free handouts

Free courses

Social media replies (sporadic, but I try)

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Thank You

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