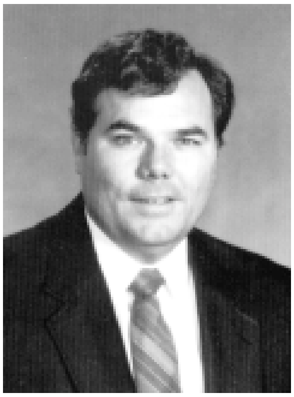
MOLDY BUILDINGS:

It's a Jungle in There . .



Ritch Shoemaker, MD

Why are there so many moldy buildings?
Because there's too much moisture indoors.

That's right, good old H20. Too much water, more than 60 percent, makes us sick by letting molds grow around us. And the reverse . . too little water in our air. . less than 30 percent, makes us sick by letting viruses and bacteria grow too easily on or in us. We need moisture for health, like Goldilocks needed her porridge. For us, just right means between 30 and 60 percent.

When indoor moisture is excessive, mold growth is guaranteed to happen. If conditions are right indoors, with few competitors, mold growth will be amplified . . growing without control. With amplified mold growth, the people with genetic susceptibility to mold toxins will become ill. Without amplified mold growth indoors, there *won't* be mold-induced human illness. It's really that simple: No unnecessary moisture . . no illness.

However, raise the indoor moisture levels to 70-80 percent relative humidity and just watch the *Stachy* and *Aspergillus* come from nowhere within a few days to grow as if they were fed a miracle growth fertilizer.

The humidity needs of indoor fungi are well defined and are supported by a solid scientific body of knowledge. Although much of the research is complex, one basic theme recurs: Indoor toxigenic fungi are capable of manufacturing many different poisons that pose a health threat to those who share living space in the water damaged buildings.

But remember, they can only do it in the presence of excessive moisture.

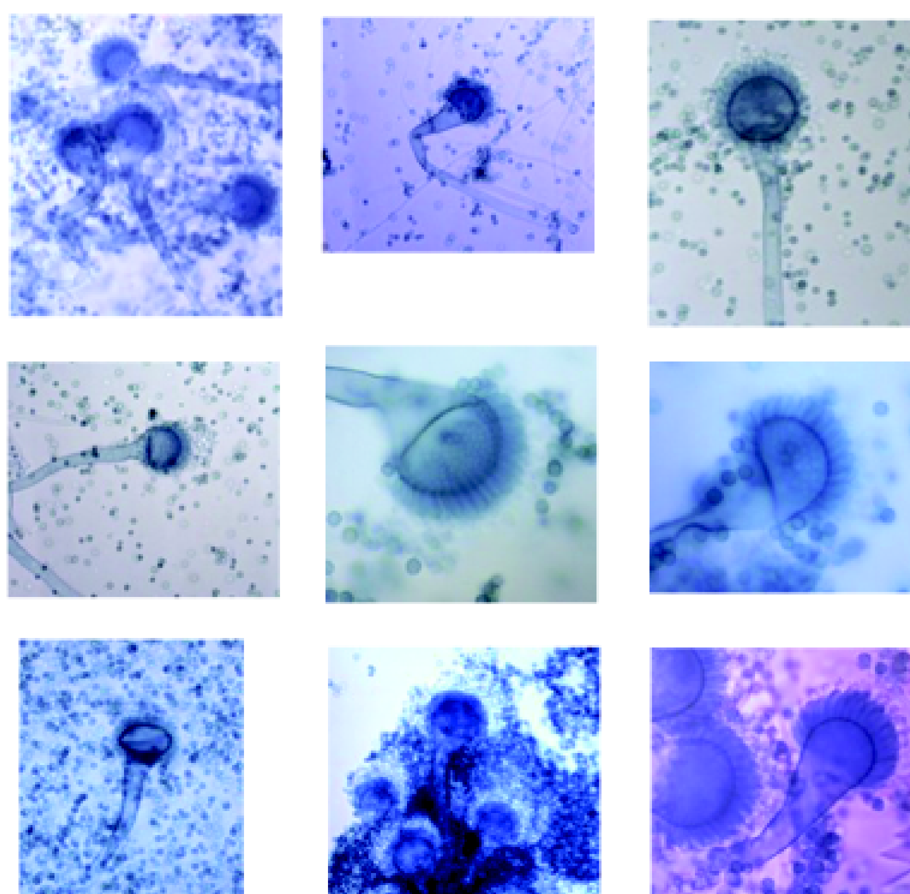
The Critical Meaning of Humidity: The Life Blood of Mold

Some background:
In order to better understand the relationship between indoor humidity and growth of toxic molds, let's think about moisture and temperature. When we measure the amount of moisture in air, or the humidity, we're referring to the amount of water in the air that can be held in air at a given temperature. Cold air doesn't hold much water, but warm air holds a lot. To illustrate, just think about the humidity in a typical home in Vermont in January. The cold air outside means that there isn't much moisture in the air, but when we take the dry outdoor

Aspergillus Mold

Stachy

ASPERGILLUS FUMIGATUS



Continued on Page

Moldy Buildings . . . Continued from Page

air indoors and heat it, we expand the capacity of air to hold water. If that Vermont homeowner doesn't work really hard to evaporate water indoors in the cold seasons, the air in his living room in winter will be drier than the Sahara desert.

On the other side of the moisture concern is the home in Florida in July. The air conditioner runs constantly just to keep the temperature at 74 degrees. You can be sure that the AC is working overtime to take moisture out of the air as it is cooled.

There's no doubt that managing these complicated temperature-humidity dynamics requires some engineering expertise. In the USA, that expertise usually comes in the form of a Heating, Ventilation, and Air Conditioning (HVAC) system built to regulate temperature and the moisture in the indoor air. If the HVAC is designed right, mold won't be a problem. But where you find mold, you'll usually be able to pinpoint a defective HVAC system that failed to control indoor moisture.

In theory, if the HVAC and the building envelope (the walls, windows, doors, roof and floors) are each designed properly, you could have a sieve for a roof, ponds forming in the basement and windows constantly dumping rain indoors, and yet mold wll *not* grow. When it works, HVAC offers protection from mold illness; but when it doesn't work, it's a facilitator for mold. This simple fact tells us something about legal liability and mold: when illness occurs, it usually is someone's fault.

A simple example of the HVAC-linked liability can be found when administrators who don't understand the mold health threat decide to shut down a school building for the summer. In most areas of the country, schools try to save a few dollars, so the maintenance crew locks up the windows, turns out the lights and sets sail for September. Only September brings an unwelcome surprise: the results of the summer-long greenhouse effect indoors . . a lush lawn of colorful molds growing on books and carpets, in air ducts and even under the windows of the principal's office. *Welcome back, kids, but don't worry, a little mold never hurt anyone. We'll clean it up this weekend.*

But the cleanup won't work if mold spores have already migrated throughout the building. And that's exactly what will happen, the moment the maintenance folks turn on the AC again. Why? Because HVAC system is also the most efficient "mold distribution" system anyone could ever hope to design!

Remember, usually, indoor temperatures in residences, workplaces and schools, in session will be around 70 degrees. HVAC is the key controller here. If there are no sources of water intrusion and the HVAC is designed well and working properly, indoor moisture will remain under control and localized mold outbreaks won't be spread. But if the HVAC isn't working correctly, it becomes your worst enemy. Once spores bearing toxins are released into the air as "bioaerosols," airborne bits of biologically active material, however, the HVAC is no longer the controller; it becomes the distributor.

Miss Kelly asks for a HEPA filter at her school.

Miss Kelly was angry. As a long-time public relations staffer at her college, Salisbury University in Salisbury, MD, she was a veteran expert at making friends and influencing people. But now she was sick, *very* sick from mold exposure, and no one seemed to care. As a matter of fact, no one at the entire university dared to contradict the Department of Human Resources, who continued week after week to insist that mold wasn't a problem. They sent in a worker from the Environmental Safety Department to look around her office. He spent about 30 seconds and left.

Nope, not one employee was sick from mold, the administrators said.

So when Kelly continued to complain about her illness . . the visible mold and the musty smells, she became *The Troublemaker.* Like administrators everywhere, troublemakers are pigeonholed into three groups: one person is a "complainer", two are a "conspiracy" and three are a "class action lawsuit".

But Miss Kelly refused to back down.

"They've got the AC running, but it doesn't work", she told everyone who would listen."The humidity in Holloway Hall stays at about 80 percent all year until the heat comes on, and then it bottoms out at 10 percent. We get the mold from that Godforsaken, soggy basement blown up here in the summer, and then in winter we just get the dried-out mold from leftover summer blooms!"

"All I want is a humidifer for the dry season and a *de*humidifer in the rainy season, with a HEPA (high-efficiency particulate air) filter to keep me from getting sick from whatever is going on in this building. And Human Resources wouldn't do a damn thing. Hey, if I wanted to work with molds, I would have majored in ceramics!"

The mold growth fueled by humidity like that is going to make somebody very sick, guaranteed. Including Ms. Kelly.

Well, why don't they fix the HVAC?

There's no good answer.

Why not give her a HEPA filter or let her bring in her own?

Nope, Human Resources and Salisbury University refused to help Shelly breathe any easier, literally or figuratively. Like we saw in Marty Bernstein's case, Kelly had no choice but to seek legal assistance. So she did.

Her only option was to file a claim with Worker's Compensation for the right to bring in her own HEPA filter. What a ridiculous situation!

Her hearing was one of a long list of items on the WC docket, but there were more members of the Salisbury University administration attending than the sum total of lawyers on both sides.

Someone at Salisbury Univer. was worried.

The outcome was incredible. Kelly's attorney hadn't asked for a formal medical report, so the 5-step repetitive exposure protocol that proved causation of her illness wasn't introduced. Without proof of her illness, the Commissioner decided there wasn't proof she needed a HEPA filter, and since the school said she didn't need any filter or air protection, he wasn't going to allow her claim.

In an office visit shortly after her case was denied, Kelly told me that the same Commissioner had been asked about Sick Building Syndrome several weeks earlier. According to Shelley, he had said he knew nothing about it. Apparently, he had no interest in finding out, either.

"We're not going to put up with this garbage", Kelly said. "My attorney told me that the Assistant State's Attorney told him that you, Dr. Shoemaker, are some kind of quack, anyway. So now, I don't care how far we have to go, this isn't right. I'll take it the the end".

Kelly just enlisted as a Mold Warrior.

Kelly was a member of the double-blinded, placebo-controlled clinical trial demonstrating the validity of the 5-step repetitive exposure protocol. When a knowledgeable judge hears her case with a jury to decide whether or not she could use a HEPA filter at work, she'll have overwhelming scientific

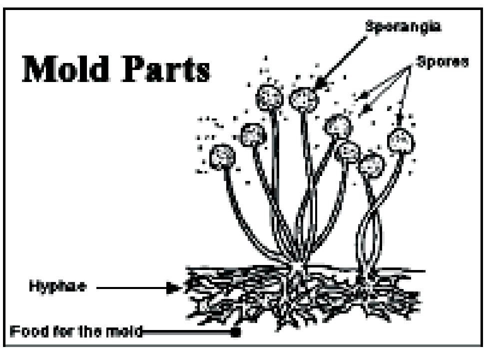
Continued on Page

data to prove her point. If she had instead asked for the right to open her egg on the little end, like the Lilliputians in Gulliver's Travels, the case would have been equally absurd.

Part of the reason we have so many moldy buildings is due to owner/administrators who will fight the truth tooth and nail when their pocketbook is potentially at stake.

Moisture and mold: Inside the Toxic Jungle

As any good microbiologist will tell you, the battle for survival among indoor resident species of fungi, bacteria and other germs is fascinating to watch. Especially interesting, say the experts, is the way so many of these organisms make biotoxins in order to fight for dominance in their particular environments. Remember, these indoor organisms



don't have to face much competition for their place in the food line. In most indoor environments, they have plenty of energy available (beyond the requirements of living and breeding) to make expensive chemical and biological weapons, such as biotoxins. Essentially, toxins are weapons employed by microorganisms to compete against other microbes. It's a jungle in there.

When we find sick patients, in a place like SU's Holloway Hall, we can be sure of one thing: There are toxigenic fungi present due to amplified growth due to excessive moisture occurring somewhere in the distribution range of the HVAC. Sick patients are the markers for Sick Buildings.

Another certainty. . and this was especially true at Holloway Hall, is that administrators responsible for an outbreak will insist that *their* testing shows no toxic mold effects and therefore, no one could possibly be sick. Here, we smile wryly, knowing that the repeated battles for truth and justice that you have read so far in "Mold Warriors", will once again be waged against denial and deception. The new venue, of course, will be Holloway Hall.

Wouldn't it make more sense to simply admit there's a moisture problem and fix it, instead of bringing a legal battle to the front pages of of the Daily Times of Salisbury?

Let's face it: Now that medical doctors can precisely identify cases of mold illnesses with screening . . diagnose & treat them successfully, patients need not be denied either justice *or* the possibility of a return to good health. Why don't we simply identify the problem when it occurs, fix it and tell obstructionist bureaucrats to get out of the way!

Here's a simple prescription to ease Kelly's pain:

1). Find the mold problem
2). Fix the moisture problem & remove the mold
3). Find the sick patients; heal them
4). Go back to work

No one at Salisbury University did anything right for Shelley.

While we're at Salisbury University, since we're having a hard time finding an indoor air company that isn't golfing with SU, we'll ask our independent building inspectors to actually do the job correctly instead of "sham testing". Meaning, they will sample not only the boss-designated areas, but also in the *unaffected* areas.

Cross the street to sniff around in the Alumni House, for example. Even in winter, the indoor humidity is over 80 percent, the windows sweat and I'm told the drapes smell like closed-up locker rooms (I wouldn't dream of going in there because amplified mold growth like that makes me quite ill).

Oh, yes, the records at my office clearly show there are sick workers there, too. When a graduate of '48 comes by for a visit to walk down Memory Lane, why should he or she end up carrying away a bucketful of mold spores as a memento of "good old SU?"

Some buildings . . even in winter, the indoor humidity is over 80 percent, the windows sweat and drapes smell like closed-up locker rooms (I wouldn't dream of going in there because amplified mold growth like that makes me quite ill). Records clearly show there are sick workers there, too.

OPEC caused the moldy buildings

One of the most significant undesired side effect of energy-saving construction techniques is toxic mold. Sure, the cost of heating or cooling indoor air is markedly reduced *if fresh* air isn't introduced into already *conditioned* air. We will keep energy costs down by not paying to heat (or cool) new air.

In other words: When the building envelope, which consists of the walls, windows, doors, roof and floors, is able to maintain the gradients of temperature and humidity between the outside air and the indoor treated air, energy consumption is greatly reduced. But the way it is now, we pay the energy costs for HVAC to condition the newly introduced indoor air to equal the air we had before. Eliminating fresh air from the system means living with stale air, and with the enriched habitat it creates for indoor molds. When you add in the medical costs that result from distribution of mold spores through out the building, once they are introduced, it's easy to see that these "energy efficient" buildings aren't necessarily "cost-effi-cient" as well.

Do you remember the energy crisis of the 1970s? Back then, the Middle Eastern sheiks in the Organization of Petroleum Exporting Countries (OPEC) made the decision to cut their crude oil production to increase demand and boost prices. Americans were squeezed for fuel as a result. Long lines and long waits for high-priced gasoline prompted a surge of "energy conservation" and "environmentalism" among politicians who were suddenly demanding we develop alternative sources of energy.

Of course, the energy crisis did produce a lot of lip service about solar energy and energy-efficient automobiles, with a few plugs for hydrogen fuel cells and wind energy. In the end, nothing of substance was done then to develop alternative fuel sources. Alternatives, like sealed, moldy, gas-trapped box buildings, were hardly the answer.

Today, we still are dependent on Saudi oil, (it's *deja vu,* all over again) but what have we learned? For one thing, we have learned how to make toxic buildings.

One lasting feature of our national resolve in the 1970s to solve our dependence on foreign oil was to make buildings so frugal, conserving energy in every way possible. But it is now clear that strategy has had an unintended consequence that's been a real killer: indoor amplified mold growth. Mold toxins hurt us daily in ways that silently and stealthily erode our quality of life. Even worse, the damage usually takes place in the dark, away from public scrutiny, at least until *Mold Warriors* came along.

Tragically, the so-called energy-efficient buildings built since the 1970's (and that we *continue* to build) almost always have oversized insulation capability, windows that are sealed shut, vapor/air barriers of all sorts and

Continued on Page

very limited air turnover . . structural characteristics that are prescriptions now being filled for a public health disaster.

All too often, these structures work to provide a pleasant, unthreatening environment for *fungi*. Without predators, such as other fungi and many bacteria, toxic molds have an ecological situation ripe for explosive expansion of growth. No enemies, ample food, and wonderful growth conditions in a greenhouse called a high rise: we've got our indoor nightmare. We've got a new creature emerging from our polluted environment.

Pollution, after all, is too much of the wrong thing in the wrong place at the wrong time. Put a spoonful of Hershey's chocolate syrup on vanilla ice cream and everyone's happy. Load barrels of the same syrup on a barge, accidentally dump them on a wetland and it's a front-page screamer about the new pollutant.

The solution to pollution? Dilution!

Molds growing in buildings are too much of the wrong thing in the wrong place at the wrong time, but the problem here is simply a lack of fresh outdoor air that could dilute and flush out indoor toxins.

Your Aerosolized Contributions to Indoor Microbes

Although the primary cause of SBS is simply a lack of fresh air that could dilute and flush out indoor biotoxins, we need to remember other negative consequences produced by sealing ourselves inside offices and homes.

We've talked about moisture, the *numero uno* cause of SBS. Take a shower, dry your hair, steam some vegetables or merely exhale, and right away, the water content of the indoor air begins to rise. As you recall, we prefer that indoor humidity remain between 30 and 60 percent. Take too much water out of the air, and the mucus membranes of our airways will dry out too, triggering inevitable increases in sinus and lung congestion. Let the moisture in the air rise to 60 percent and watch the fungal spores wake up.

Of course, closed air circulation can lead to the build-up of *other* bioacrosol health threats. For example, dander from pets, house dust, fumes from the new carpet or the newspaper and computer (they *are* there), all add their volatile components to what we breathe. And some of the worst gases are ones that are odorless.

Even such a simple act as turning on the kitchen exhaust fan while cooking has a surprising drama. As you direct the kitchen air outside, air has to come from somewhere to fill the vacuum. The exhaust fan creates pressure that pushes inside air outside, guaranteeing that the air from the bowels of the basement and whatever is in it will be sucked upwards. Exhaust fans have a motto: Excelsior! Ever upwards, for the dank components of the fungal-enriched basement air rise up the stairs, like dark ghosts, to travel into your breathing passageways.

Will Attic Exhausts Solve the Problems of Stale Air?

Some indoor engineers remove stale air by exhausting it from the attic. Yes, install a whole-house fan (if only they were silent!) that exhausts all the hot air into the attic and out into the cool night. Does that make sense?

The result of this engineering marvel is that indoor air, heaved up by the exhaust fan, gets mixed into a hellish marriage of spores, volatile organic compounds, dust particles and bioaerosols from your worst nightmare, spreads throughout your home. That flood in the basement last spring that gave a mold colony a chance to amplify and manufacture spores, covered with toxins, just contaminated the $40,000 heirloom rug, Grandma's soft sofa and all your clothes.

Horrible? You bet. But it happens every day.

So forget the exhaust fan. What about the ever-present HVAC? Given water intrusion and fungaI growth, eventually some spores will settle in the ducts of the HVAC. Given a ready supply of food and moisture, the fungal growth and spore formation process will continue daily. So instead of the spores coming solely from an area of water intrusion, the spores that poison us can come right out of our air ducts. One day of high humidity and an ineffective HVAC can lead to your building becoming Mold Hall.

These basic biological mechanisms, repeated endlessly throughout our energy-efficient buildings every day, are the agents that cause us to suffer illness caused by exposure to indoor toxigenic fungi.

Fungi are well adapted to grow along the range of temperatures in our homes and workplaces. If a building is more than two stories tall, we can add the "stack effect" to the mold equation. Heat rises, as do air currents from the sub-basement and the basement. So as the air in stacked floors rises, the suspended particles from the sub-floors and basements are distributed upward. The typical office setting will also likely have the added burden of VOCs from copy machines, faxes, and the heated components from computers and other office machines.

But the contamination doesn't end when the workday is over. Soon the janitors arrive to add their air-polluting load of cleaning chemicals, everything from quaternary ammonium compounds (quats) to bleaches, disinfectants and oxidizing agents. Indeed, the air people breathe in a typical commercial building has more than enough entries to start an organic chemistry lab!

The bottom line is clear: we've polluted our indoor environment with compounds and organisms that can make us sick in exchange for saving dollars on the heating and air conditioning bill. Irrational? Wasteful? Injurious to health? Yes to all the above.

We created the toxin formers, set a place for them at the dinner table and asked them to stay for supper.

Have we created a new race of indoor-dwelling, toxin-making fungi that make us sick? Are we the guilty parties changing the pace of evolution?

The challenge presented to public health officials by the surging SBS epidemic is further complicated by the ugly fact that some of the invader-microbes are entirely new on the scene. Increasingly, the microbiological evidence shows that chemical pollution and our modern life-styles are combining to create genetically altered strains of indoor-dwell-ing, toxin-forming fungi and these new life forms are making us sick. Of course, it wouldn't be the first time that humans have contributed heavily to the emergence of disease agents which then emerge from the muck to occupy newly created "niches" in our ecosystem.

Some examples: ***Pfiesteria:***

This algae-like dinoflagellate, nicknamed the "Cell from Hell," made the Baltimore and Washington, DC Six O'clock News throughout the autumn of 1997. The coverage began after blooms of Pfiesteria swarmed into

Continued on Page

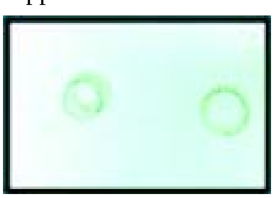
Moldy Buildings . . . Continued from Page

many estuaries of the Chesapeake Bay, especially the Pocomoke (Md.) River, killing millions of fish and making hundreds of people sick.

As you might expect, the first response of politicians in Maryland and Virginia was to deny the problem. Later, when forced to acknowledge the incontrovertible truth that these new toxin-formers caused illness in people, the actual cause of the blooms in the water was misidentified as "excessive levels of nutrients from chicken manure, washed in from local farms."

Ludicrous? I'll say. But it wasn't until 2002 that the actual cause . . environmental chemicals, and not just nutrients, emerged when the Environmental Protection Agency (EPA) reported that *Pfiesteria* wasn't killed by copper (added to chicken feed to prevent spoilage). We helped those dinoflagellates grow by adding dithiocarbamates (DTQ fungicides to the water, too. DTC helps copper kill the predators of the toxin-forming stage of *Pfiesteria* so they can *grow unchecked* (for more on this microbiological mystery story, see my previous books, "Pfiesteria: Crossing Dark Water", and "Desperation Medicine" for an in-depth review of the *Pfiesteria* disaster). When the predators of *Pfiesteria* were wiped out, *Pfiesteria* growth was amplified.

Cylindrospermopsis: These algae didn't appear in the U.S. until 1995, when it was discovered in Florida. These blue-green algae were well known to health officials in Australia and Brazil, where it was already a public health menace. Toxins from a *cylindrosper-mopsis* bloom killed nearly 60 patients at a dialysis center in Brazil, after the reservoir supplying water to the facility treated the water with copper sulfate, killing the algae but releasing a flood of the algae's lethal toxins into the water.



In Florida, the invading algae rapidly took over the lakes in the St. Johns River watershed, including Lake Griffin and Lake Apopka. Why? Because it was no longer killed by the chemicals we'd used in the past. "Cylindro" spawned out of control, without being slowed down by the three factors that limit algae blooms: nitrogen, phosphorus and sunlight. Even more ominously, the Cell From Hell II was resistant to copper and to benomyl, a fungicide widely used in adjacent fields and nurseries.

Aphanomycetes: This mild mannered fungus never harmed a single fish . . not until it mutated in the early 1990s. Almost overnight, the fungus became resistant to copper and who knows what else, killing fish in estuaries from Florida to Virginia. In order to study the fungus, US Geological Survey researchers had to add copper to the lab aquaria, since the other "wild" fungi in water would normally out-compete *Aphanomycetes*. Copper killed the wild-type fungi, but not the *Aphanomycetes.*

Have we altered populations of indoor fungi the same way?

To answer that question, let's take a moment to look at a gallon or two of household paint armed with the latest "mildewcide" in it (they can add it at the local Home Depot). And while we are at it, let's also take a closer look at the new wall coverings that are bacteria and mildew resistant.

At first glance, these advances in wall coverings will save us money on maintenance costs, right? Think again. These new chemical-laced products actually create *additional* work for those who clean office buildings, condominiums or homes after toxic molds adapt to the new environment by transforming themselves into resistant strains no longer killed by the fungicide in the wall covering.

What makes these commercial products so low-maintenance? Agents of natural selection: fungicides, biocides and bactericides. And when the mold starts growing on the fungicide-laced vinyl wallpaper, is it a new strain that's resistant to the chemical that used to kill it? You bet it is.

Benomyl, like other fungicides, was added to commercial paint beginning in the 1970's. Did the use of fungicides by the paint industry create a monster race of resistant organisms, the ones that usually are toxin formers? Or was it the use of fungicides in sunscreens, furniture fabrics and the like that selected for our small group of indoor toxin formers? Fungi are resilient creatures, having survived countless millennia. It should come as no surprise that every time we attack fungi, whether with antifungal medications in a leukemia patient, or simply with plant disease controlling chemicals, some resistant strain of fungus is going to emerge. Maybe the answer to the problem of toxic indoor fungi is to bring in some shovelsful of dirt to use the microbial battle for survival to roust out the reigning fungi. *Nothing* we have done so far to eradicate toxin formers from our buildings has worked, so maybe this idea isn't so far-fetched.

For some perspective, let's go back to the *Pfiesteria* outbreak for a moment. What did it teach us about toxin-form-ers? When we see toxin-formers emerging from chemical induced selective processes, what's usually included is a group of organisms that can laugh at what mankind throws at them, all the while using their toxin weapons to keep the competition at bay.

Example: Dr. Chin Yang has already noticed some fungi resistant to copper in his labs at P and K Microbiology. Other researchers have identified fungi that now grow without restrictions, blooming wildly in cleaning solutions *containing* quaternary ammonium compounds, the same chemicals used to disinfect moldy surfaces!

Perhaps the best example of perverse effects from chemically induced natural selection emerged only recently, after a group of patients became ill following exposure to *Aspergillusfumi-gatus* in a Maryland chicken hatchery.

For years, this hatchery had relied on a fungicide, Clinifarm (enilconazole), specifically approved and labeled by the US Department of Agriculture (USDA) for use in hatcheries to control this *Aspergillus* species. Left unchecked, *Aspergil-lus fumigatus* is a lethal threat for newly hatched chicks.

The enilconazole appeared to do the job, at least for a while. But then some workers at the hatchery began to come to Pocomoke for medical treatment of a newly contracted biotoxin-induced illness. In an effort to help identify the attacker, one savvy patient even brought in a series of Petri dishes, each growing multiple colonies of a black, filamentous fungus. P and K Microbiology definitively identified the wooly Petri beast as Aspergillus fumigatus, and there it was, growing on the Clinifarm, using the fungicide as a source of food! Amazingly, it was living off the chemical meant to kill it. Imagine a human child growing up and flourishing living on a diet of cyanide, arsenic and hemlock.

In short: The fungi had adapted to repetitive use of the same fungicide by mutating and becoming resistant to it. Among a billion organisms are the very rare fungi that have the genes to survive the killing effects of the fungicide. They, survive, breed and give rise to a new race of resistant fungi. They quickly take over the turf vacated by the fungi killed by the selection agent.

Continued on Page

Moldy Buildings . . . Continued from Page

This is the same situation we see in bacteria: if you want to select for the growth of a new strain of a germ, *Staphylococcus aureus*, a common germ found on our skin, for example, keep treating it with the same kind of antibiotic. It won't be too long before the only Staphylococci still growing will be ones *not* killed by the antibiotic. They breed happily, and then spread, until everyone is asking, "Where did the resistant strain of Staph *come* from?"

Obviously, the new *Aspergillus* organism was resistant to the fungicide. As later results confirmed, the organism was toxigenic and had sickened an entire cohort of workers. But where was the proof, in the case of *fumigatus*, that repeated use of a particular fungicide had caused the formation of a fungicide-resistant, toxin-forming species? Unfortunately, no commercial assay is available to look at the effect of enilconazole on fungal growth.

Another example of how health-threat-ening organisms survive our chemical attacks comes from the history of benomyl, another member of the same family of fungicides as enilconazole. The product has a long history of use in fungal research labs. It was used commercially as a systemic fungicide worldwide, but was eventually pulled from the market after allegations that it had caused crop damage. Even before the fungicide was blamed for killing plants, however, resistance of fungi to the fungicide was seen.

Benomyl prevents cell division by interfering with the cell division process in fungi in which replicating chromosomes are separated, providing a full copy of the chromosomes of the fungus to each of the new "daughter" cells (not any different than some drugs widely used to effectively treat breast cancer do). What happens is that the plant "feeds" a dose of benomyl to any fungus trying to digest the plant.

During later cell division, the resulting distortions created by the poisons deprive the daughter cells of the right amount of chromosomal material and they can't live. But occasionally, one of the daughter cells, one that receives less than a lethal dose of deformed chromosomes, can live, reproduce and give rise to new generations of mutant, benomyl-resistant daughter cells. Put them into an environment with benomyl (and that is incredibly common), and the growth of the mutated strain will take off. Natural selection moves quickly when mutations begin.

Indeed the eventual emergence of "selected-for" mutations from this product is so certain that in academic centers, including the National Institutes of Health (NIH), where fungi and yeasts are studied, benomyl is widely used as an agent to cause mutations. Just the other day, in fact, two researchers from the NIH, each ill from mold growing in their condominium in Washington, DC, visited my office for an SBS evaluation. Both said they used benomyl in their genomic research and both confirmed first hand what I had read.

The mutagenic effects of benomyl on fungi are easy to observe. Just pour some of the pesticide into a test-broth with fungi and watch the new fungi "come out of the mud." Labs use benomyl at concentrations of 5-10 parts per billion (ppb) to demonstrate the mutagenic effects, the same levels seen in wall coverings.

What we need now are studies that would conclusively demonstrate the cause and effect relationships between the chemical biocides in our wall preps and the subsequent human illness due to strains of the fungi resistant to the biocides. But the evidence and reasoning I have offered here, based on experience and clear basic science, is not enough to convince the many manufacturers of paints, wall coverings soaps, topical cleansers and other products to stop the use of these additives and end their market pitch for increased sales. Still, even without expensive scientific studies to back my concerns, I ask, "How can we ignore the lessons of biocide use outdoors, creating changes in populations of fungi, when they can logically be applied to changes in populations of indoor fungi?"

The strong possibility that we've been creating mutated species of indoor fungi as a direct result of our efforts to reduce building-costs will loom as a major-and unsolved-public health problem.

Destroying the argument that ubiquitous molds cause illness

During many years of treating patients with SBS, I've become quite familiar with the arguments used by defense lawyers to throw a smokescreen over the key question: "Who's responsible for creating the environment in which mold made this person sick?"

I try to be patient, but when I hear the smokescreen argument from defense apologists in legal cases that suggest that mold anywhere could cause the illness, I struggle to keep from popping a brain vein. The smokescreen is wrong, a deliberate distortion, but no less infuriating every time it shows up. The best way to blow off the smokescreen, of course, is to simply introduce a few basic principles gleaned from a careful study of the ecology of infectious diseases.

Take a quick look at two seemingly reasonable, but thoroughly bogus arguments you might hear from an attorney representing, say, a school in New York State.

Typical bogus argument No. 1: molds are ubiquitous. They are everywhere, so how can a mold, just a little mold growing in a building, be responsible for chronic, debilitating illness and cognitive impairments?

Typical bogus argument No. 2: molds in *outdoor* environments don't hurt anyone, do they? Some of them belong in the same genus as those found *indoors*, but you don't hear about gardeners, lumber workers and mulch workers getting sick. Why aren't those workers sick, the same way that indoor workers are? If mold is everywhere, therefore, the building alone couldn't be the culprit.

To put these arguments to rest, let's talk about "ecology," the branch of science that studies the interactions of organisms in a given environment. We know that there are thousands of genera of fungi, each including many species. We know that these creatures inhabit all kinds of environments. It's impossible to go anywhere or do anything without being exposed to fungi.

But what happens when we take a closer look? If we're observing a particular environment, for example, inside a water-damaged building, we find there are relatively few genera and species existing in that habitat. Why only a few? The answer is "ecology," which tells us that many types of fungi will be excluded from any given environment because the environment doesn't provide ideal growth conditions for them. Toxigenic molds like their indoor weather, balmy, with afternoon showers and plenty of food. Not all outdoor organisms flourish in those conditions. Without seeding of outdoor organisms into newly established indoor populations of fungi, Actinomycetes and coagulase negative Staphylococci bacteria, the indoor organisms lack the same competition for food, moisture cover and reproductive space. There are few predators indoors also. With abundant resources, limited competi-

Continued on Page

Moldy Buildings . . . Continued from Page

tion and ideal conditions for breeding, the indoor populations explode. We call that growth "amplification".

Outdoors, though, the species diversity is huge. The blunt reality is that it's total war between species in an ecosystem. Survival of the fittest (the biggest, baddest, most bodacious, fastest reproducing or the most effective toxin producer), guarantees that the greater diversity of species that are present in a given ecosystem, the more controls are exerted on any runaway species.

Amplified growth, therefore, is controlled by species diversity in an ecosystem.

With this simple principle in mind, let's go back the two bogus arguments from the defense attorney. Are the molds "growing everywhere" growing in an amplified manner? *No*. Are molds growing in soils amplified in the face of thousands of nematodes, bacteria, other fungi and other organisms in each grain of soil? *No.* So, the argument about the ubiquitous fungi causing illness, proven to be false by our repetitive exposure protocols, is not related to the amplified conditions inside water-damaged buildings, with relatively few species of fungi ever found and reported in environmental samples.

When we reduce diversity of wild populations and restrict composition of growing communities to only a few species, as is the case indoors, we guarantee the potential for toxin formation by a few dominant organisms. Why do we rarely see other genera in indoor samples, other than *Alternaria,Cladosporium, Stachybotrys, Penicillium, Aspergillus, Acremonium, Trichoderma* and *Chaetomium?* Why don't we see thousands of species growing indoors? *These few are what we have selected through natural forces to live there!*

So . . what else besides natural selection-inducing populations of toxigenic fungi and reduced flushing of indoor air helps create an unhealthy Mold City?

Construction defects = mold-spawning moisture

Now that we've established that toxic mold can, and does make people sick, it's time to look at the reason in most situations where attorneys send me patients who been injured by SBS. The name of the culprit: water intrusion.

And the cause of the intrusion? In most cases, the mold spawning moisture is a result of construction defects. Sloppy construction, usually fueled by the need to build new homes as quickly as possible, increasing profit-per-unit time, leads the list of sources of indoor moisture.

New house starts continue to drive the U.S. economy, whether the hurriedly mass-produced structures wind up crammed into every buildable square inch in Southern California; Atlanta, Georgia; anywhere in Florida; or in once bucolic locales such as tiny Chester-town, Maryland. Land values drive sales of new ground for construction. Every time you drive past an old farm, surrounded by a string of new homes, you know that the farm was subdivided and sold, lot by lot.

Land that can be used for new construction is valuable, indeed.

Any real estate expert will tell you that, "tear down" of many out-dated buildings is the established practice in older communities, as the land is worth far more than the existing structure. It's easier, and cheaper for the developers to tear down the old structure and put up a new one, recycling the land, than it is to find unbuilt land.

The availability of land for that dream home is far more limited than demand. On Barnegat Bay, N.J., for example, the demand for construction sites remains extraordinary. A postage stamp-sized lot can easily command $400,000 and more. And why not, when the market is jammed with buyers eager to escape metropolitan New York each weekend, year round?

You don't need a realtor' license to understand that when high demand for new housing is high, *the time to complete construction* becomes the most important rate-limiting step controlling profits for developers. "Fast construction" usually means shoddy construction, and that usually means water and mold.

The second most important factor in the profit equation is labor costs. As the demand for skilled labor grows, it gets harder to find enough skilled tradesmen. The pool of skilled workers in any given area is limited. Given the massive demand for masons, roofers, carpenters, plumbers and electricians, among many other tradesmen, hourly wages naturally go up.

Given this reality, is it any wonder that "saving money on labor costs" becomes a developer's goal? An unskilled laborer who can do some plumbing or roofing, for example, but who isn't commanding the high wages of an experienced plumber or roofer, is going to get a lot of jobs.

Guess what? Construction defects occur everywhere, regardless of whether the building is an inexpensive subdivision or a $200 million Miami Beach high-rise. These mistakes are occurring with increasing frequency.

Whether you let the water in via an incorrectly installed picture window on the St. Martin's River in Maryland or by defective HVAC coils in that expensive high rise in Bal Harbor, Florida, when you turn on the HVAC, that one defect can cause the whole structure become to become contaminated.

Judging by the patients I see, it's simple construction mistakes . . loose plumbing connections, inadequate flashing on gables, gapping duct work in crawl-spaces, improperly controlled condensation drains from air handlers and incorrectly installed HVAC equipment, that are the most common errors that lead to water intrusion. With all the concern about building wraps to block air intrusion and vapor barriers to control water movement, we've forgotten that the barrier's effectivness is reduced when 260,000 nails affixing the siding each make a hole!

At the end of the day, the building envelope . . the walls, windows, doors, roof and floors, designed by the architect is only as good as the work done by the $8.00 per hour plumber's apprentice' or a supervisors hurried inspection of the plumbing connections before the walls are sealed up.

Have you noticed that developers are building homes just about everywhere? This lack of buildable land factors increases flaws in design and construction.

Design flaws, independent of cut-rate construction, certainly will ruin the work of even the finest craftsmanship. When a house foundation is cut into the side of a hill, the ground water pressure on the upside of the foundation will create the constant potential for water intrusion through porous materials such as brick, concrete and block. Ground water intrusion into basements, crawlspaces, or any structure below grade is going to happen. Water will flow downhill.

There's no doubt that correcting the flow of ground water takes a lot of land, time and also adds cost. In most cases, when the developer must make a substantial investment in time and materials, and then finds out he has to construct swales or French drains . . special features that limit ground water from

Continued on Page

Moldy Buildings . . . Continued from Page

entering a home, he simply decides not to build them.

Basements . .we call them mold caverns, are often used for living areas, with a recreation room and a wet bar right beside the partition for the washer and dryer. For the homeowner, it's like having a "free room." Add some seepage from the in-ground side of the walkout room, and some more from the carpets on the porous concrete slab, and a little more from the paneling over the porous concrete block wall . . is it any wonder that mold will thrive?

Porous becomes "Poor us."

It gets worse. Without any extra, land per home, where does the HVAC equipment and ductwork usually go? Out of sight in the crawlspace, where no one can see the flexible ductwork sagging in the middle, with water condensing and puddling in the low spots. Just add a few spores to the ducts from the crawlspace, entering through a joint in the ductwork that isn't as tight as it should be, and the contamination is off to the races, using the HVAC as the universal distributor.

And how about the popular "extra room" over the garage? Trust me, it isn't too long before a luxurious master bedroom extends over the concrete slab in the garage below, with water wicking up through the concrete, providing cover for mold growth. The extra room, complete with its Jacuzzi, walk-in closets and bay windows, gets an *un*healthy dose of spores every time a door into the room is opened, creating negative pressure, sucking air and spores from the moisture source below through every air leak in the room above.

Multiply the problem when the extra room was roofed in before the concrete for the slab floor of the garage had a chance to dry out. It takes months for concrete to dry, even if it looks dry to the naked eye. If there is ground water forcing moisture into the slab, the drying not only is slowed, but now the concrete becomes a moisture generator! Where does the moisture go? Straight into the walls.

Could John Q. Public actually be the cause of his own soggy building?

You bet.

Anything made by man will fail eventually. Plumbing fixtures and pipes break. Caulk dries out and flashing corrodes. Sump pumps burn up. Unfortunately, Forces of Nature won't call "time out" to stop the process of deterioration, a process that begins as soon as something man-made is installed. What's the life expectancy of appliances, gutters and flat roofs?

Every time I see a teacher from another flat-roofed school with water intrusion from the leaky roof, the same question comes up: How much would effective roof-maintenance cost the School Board? What will we do differently to take care of our schools when we see the legal, health and learning problems that mold growth creates? How many of the limited public school dollars go to routine maintenance when there isn't enough money to buy new books or fund the art and music teachers?

The real question is: what is acceptable suffering? Is it really an acceptable school "cost" in health to have large numbers of teachers and students regularly ill?

Mold loves it when people cut corners on maintenance.

Just look at the costs of not taking care of water. A simple example: when we built our ponds along the wooded wetlands of the Pocomoke River, we had to install "water control structures." Wetlands construction is tricky, and artificially constructed ponds have a natural tendency to drain, returning the water to Nature.

The storm surge from the occasional torrential rains here can rip out dams. Water will follow any defect in the dam, whether caused by a tree root or a muskrat, eroding the soils of the dams. Instead of watching the ponds wash into the Pocomoke, a lot of routine maintenance is required. Oops, excuse me; time to check the water control structures...

The same idea applies to our homes and buildings. There *never* should be a gutter dumping water into a basement or a condensation pan overflowing *anywhere* in the building. Take 10 minutes to check it out. Are the water control structures in good shape? Is the caulking too old? Are the flashings around windows and over doors intact? Does ground water flood into the basement? If you don't have a checklist for water maintenance chores, now might be a good time to start one.

Mold loves it when people don't take the time to prevent water intrusion

My suggestion, after treating several thousand mold victims: When there's a water emergency that's not the result of lack of preventive maintenance, fix it promptly. Mold growth can be a problem in 48 hours after water intrudes. When a water heater bursts, flooding the office building, hire a cleaning outfit right away. Don't wait for mold to grow only to react with horror two days later when it's too late. Don't wait for an insurance adjuster to give you the go-ahead; get the water under control before the mold begins to make you and your loved ones sick.

Mold loves it when people postpone taking care of immediate water needs.

One more thing about moldy homes and buildings: These days, insurance companies are quick to say, "Not responsible." Instead of arguing about liability, and paying all the remediation and repair fees, not to mention the legal costs, the insurance company usually will have written exclusion for water damage, pollution or mold. Why fight an insurance company's latest approach at cost reduction? Only you will put the needs of the "insured" first. Insurance companies have one goal: Minimizing losses.

Now that we can diagnose and treat mold-induced health problems efficiently in most people, before the cascades of adverse biological effects become irreversible, we should be able to begin reducing the high medical costs associated with mold litigation.

Now that we can identify affected patients as definite mold cases through outreach screening procedures, eliminating prior diagnoses of "ghost illnesses" such as fibrornyalgia or depression, mold-savvy physicians might end up expanding the potential pool of potential litigants, creating a shortage of plaintiff s attorneys.

Somehow, I don't think that shortage will last very long.

This paper was published by Filtration News, courtesy of the author, Dr. Ritchie Shoemaker . . who has published numerous articles in medical journals and other publications on chronic, neurotoxin-mediated illness. Trained as a molecular biologist at Duke University, Dr. Shoemaker used the experience he gained during 20 years of Family Practice to open the window on a frightening new disease threat now emerging from our chemically polluted environment.

This chapter is from his upcoming book, "Mold Warriors"*, to be released in November 15, 2004. Look for* Moldwarriors.com *to be online October 15, 2004. For more information, call 410-957-1550.*

Filtration News is honored to have Dr. Shoemaker on our Editorial Advisory Board.

Continued on Page

Moldy Buildings . . . Continued from Page