

# **ADVERSE HEALTH EFFECTS OF INDOOR MOLDS**

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## ADVERSE HEALTH EFFECTS OF MOLDS

Molds have been viewed as a nuisance to get rid of. Use Tm-100 Enzyme Formulation to clean areas where mildew thrives. FACT: Mold can be deadly as it is a major health threat. It is time to get the facts straight. After a comprehensive review of the scientific review of the literature, I cite a noteworthy publication: Adverse Health Effects of Indoor Molds, by: Luke Curtis, M.S., CIH, School of Public Health, University of Illinois at Chicago, Illinois; Alan Lieberman, M.D., Center for Occupational and Environmental Health, North Charleston, South Carolina; Martha Stark, M.D., Harvard University, Newton Center, Massachusetts; William Rea, M.D., Environmental Health Center, Dallas, Texas; and Marsha Vetter, M.D., Ph.D., Environmental Health Center, Hoffman Estates, Illinois., U.S.A. They state that:

“In recent years, public attention has become increasingly focused on human health concerns linked with mold (fungi) inside homes and workplaces. Indoor airborne mold exposure has been associated with adverse human health effects in multiple organs and body systems, including respiratory, nervous, immune, hematological and dermatological systems. A qualitative systematic literature review was undertaken by the above cited authors in order to examine and appraise the current state of knowledge about indoor mold-linked health effects, and to

summarize the available evidence for the use by health professionals. Physicians, in particular, may encounter patients with common symptoms occurring in particular environments, and understanding the potential for mold-related health effects is key to the complete investigation of those environments. If the physician or healthcare professional views the mold related health effects through the medical model, i.e. symptoms and not causes and does not take into consideration Biologicals (mold, fungi), Chemicals, Nutrition, or Psychological/Emotional factors into consideration, an erroneous diagnostic pattern will emerge. The literature reveals that mold exposure has been associated with adverse human health effects in multiple organs and body systems. Mold acts as a penetrating agent to the body system which lowers the threshold limit value (TLV) of the immune system thereby allowing opportunistic diseases to flourish. The entire body system is vulnerable to the effects of the environment upon the individual. Thus, it is imperative to bring into focus Multiple Chemical Sensitivities (MCS).

Chemical sensitivity is defined as an adverse reaction to ambient toxic chemicals, at levels which are generally accepted as sub-toxic, in our air, food and water. Manifestation of adverse reactions depend on: 1) the tissue or organ involved; 2) the chemical and pharmacologic nature of the toxin; 3) the individual susceptibility of the exposed person (genetic make up, nutritional state, at the time

of exposure); 4) the length of time of the exposure; 5) amount and variety of other body stressors (total load) and synergism at the time of reaction.

To demonstrate cause-and-effect proof of environmental influence on individual's health, one must understand several important principles and facts. These principles involve those of total body load (burden), adaptation (masking, acute toxicological tolerance), bipolarity, and biochemical individuality. Each principal will be discussed separately.

### **TOTAL BODY LOAD (BURDEN)**

This is the patient's total pollutant load of whatever source (usually from air, food and water). The body must cope with this total burden; usually it must be utilized, expelled or compartmentalized. Total body load includes: 1) physical factors (hot, cold, weather changes, positive ions, electromagnetic phenomena, radon; 2) toxic chemicals (inorganics: Pb, Cd, Hg, Al, Br, etc.; organics: pesticides, formaldehydes, phenols, car exhausts, etc.); 3) biological (bacteria, virus, parasites, molds, foods); 4) psychological or emotional factors also significantly affect the patient, confirmed by recent work in psychoneuroimmunology, linking the psyche and the neuro-endocrine and immune systems. Failure to reduce the total body load prior to pollutant challenge will frequently yield inaccurate results. Accordingly we believe it is essential to conduct investigative procedures in controlled environmental circumstances.

### **ADAPTATION (MASKING, ACUTE TOXICOLOGICAL TOLERANCE)**

Induced by the internal or external environment, this is a change in the homeostasis (steady state) of body function with adjustment to a new “set point”. Adaptation is an acute mechanism in which the individual “gets used to” a constant toxic exposure in order to survive, at the same time as suffering a long-term decrease in efficient functioning and perhaps longevity. Selye was among the first to describe this compensatory mechanism. Because of adaptation or tolerance, the patient’s total body load may increase undetected because the perception of a cause-and-effect relationship is lost. With no apparent correlated symptoms, repeated exposures may continue to damage the immune and enzyme detoxification systems. The eventual result of continued toxic exposure over a period of days, weeks, and months to years is end-organ failure. Withdrawal or avoidance of an offending substance for at least four days will aid in reducing the total body load, after which a controlled re-exposure challenge will reproduce cause-and-effect reactions. In these deadapted individuals, there is high reproducibility of these evoked reactions permitting the physician to acquire sound scientific information.

### **BIPOLARITY**

After a toxic exposure, the body initially develops bipolar response, of a stimulatory phase followed by a depressive phase, usually with induction of

immune and enzyme detoxification systems. If the incident is virulent enough, or if substantial size or duration of exposure occurs, the induced enzyme and immune detoxification systems are depleted or depressed by over stimulation and over utilization. An individual may initially experience a stimulatory reaction in the brain, perceiving the inciting substance not as being harmful, but as actually producing an energizing “high”. Therefore, he continues to acquire more exposures. After a period of time, however, is it minutes, months or years, his body’s defenses are adversely over stimulated and he develops disabling depression-exhaustion symptoms. This stimulation and depression-exhaustion pattern has been observed with many pollutant exposures, including ozone. When studying the effects of pollutants upon adapted individuals the stimulatory phase is often missed or misinterpreted as being normal, thus giving faulty data. Studies in the controlled environment involving 16,000 challenges in 2,000 deadapted patients have proven this point repeatedly.

### **BIOCHEMICAL INDIVIDUALITY**

Biochemical individuality is our uniqueness, which largely accounts for individual susceptibility. We have differing quantities and interactions of carbohydrates, fats, proteins, enzymes, vitamins, minerals, and immune parameters with which to respond to environmental factors. One simple example is the noted relationship between low serum magnesium levels and the HLA B35 genotype.

This biochemical individuality allows us to either clear the body of noxious substances, or to collect and contribute to our body burden. Biochemical individuality is dependent upon at least three factors: genetic endowment, the state of the fetus's nutritional health and toxic body burden during pregnancy, and the individual's present toxic body burden and nutritional state at the time of exposure.

Some individuals, for example, are born with significantly lower quantities of specific enzymes (it may be 75%, 50% or even 25% of the norm). Their response to environmental stimuli is often considerably weaker than those born with 100% of the normal detoxifying enzymes and immune parameters. Examples are the babies with phenylketonuria or the individuals with transferase deficiency, who do well until exposed to their environmental triggers, and then damage sets in. There are over 2,000 genetically-transmitted metabolic errors, suggesting that most of the population will have at least one abnormality. Toxic volatile organic chemicals have been shown by Laseter to bioconcentrate in the fetus, increasing the acquired burden in some babies.

It is well known that some individuals acquire their toxic load at work or around their homes. This changes with different seasons and weather conditions, giving variable effects and responses over time. Extreme care must be taken in evaluation of each patient, who may exhibit unique clinical responses due to his specific biochemical individuality. As an example, it is well known that not all patients will

exhibit every reported symptom associated with systemic lupus erythematosus (SLE). Similarly, each patient exposed to the same environmental pollutant will react with his or her unique complex of symptoms. Because this vital fact is misunderstood, many studies are flawed when the wrong signs and symptoms are assessed for that individual.

### **MOLDS IN THE INDOOR ENVIRONMENT**

Physicians and industrial hygienists may be asked to contribute reports to assist the courts in settling suits. In 2002 an estimated 10,000 mold-related cases were pending in US courts. Also in 2002, the insurance industry paid out \$2 billion in mold-related claims in Texas alone.

Fungi (or molds) are ubiquitous in both indoor and outdoor environments and are frequently dispersed by airborne spores. Mold and mold spores require moisture and a food source, such as cellulose or decaying food, to grow. As mold spores swell with water and grow, they elongate, forming balloon-like protuberances (hyphae), which secrete digested enzymes and micotoxins. The fungi then digest the food source to support their growth.

About 100,000 fungal species have already been identified; in fact, fungi are established to comprise an astounding 25% of the world's biomass. Various surveys of homes in North America and Europe have reported that visible mold and/or water damage are common, found in 23 – 98% of all homes examined.



There are no official standards at this time for indoor airborne fungi concentrations. However, indoor fungal levels above a range of 150 – 1,000 colony-forming units per cubic meter of air (cfu m-3) are considered to be sufficient to cause health problems. Numerous reports have documented that indoor air can be contaminated with fungal spore levels well in excess of 1000 cfu m-3. The most common indoor fungal genera collected are Cladosporium, Aspergillus, and penicillium. Alternaria, Stachybotrys, Rhizopus, Mucor, Wallemia, Trichoderma, Chaetium, yeasts, Botrytis, Epicoccum and Fusarium species are often found indoors as well.

### **MOLD-RELATED HEALTH SYMPTOMS**

Patients have been reporting multiple ill health effects linked to exposures to mold. Studies of more than 1600 patients suffering ill effects associated with fungal exposure were presented at one meeting in Dallas in 2003 (21st Annual Symposium of Man and His Environment, Dallas, Texas, 19<sup>th</sup>-22<sup>nd</sup> June 2003).

To cite a few studies: Lieberman examined 48 heavily mold-exposed patients who had the following health problems: muscle and/or joint pain (71%), fatigue/weakness (70%), neurocognitive dysfunction (67%), sinusitis (65%), headache (65%), gastrointestinal problems (58%), shortness of breath (54%), anxiety/depression/irritability (54%), vision problems (42%), chest tightness (42%), insomnia (40%), dizziness (38%), numbness/tingling (35%), laryngitis

(35%), nausea (33%), skin rashes (27%), tremors (25%), and heart palpitations (21%). Rea's study of 150 heavily in-door mold/exposed patients found the following health problems: fatigue (100%), rhinitis (65%), memory loss and other neuropsychiatric problems (46%), respiratory problems (40%), fibromyalgia (29%), irritable bowel syndrome (23%), vasculitis (4.7%), angioedema (4%). These clinical reports suggest that there can be multisystem adverse effects of airborne mold. All reported cases have environmental mold exposure consistent with toxic mold exposure.

### **MECHANISMS OF MOLD-RELATED HEALTH EFFECTS**

Fungi can exert ill health effects by three major mechanisms: allergy, toxicity, and infection.

#### **ALLERGY AND IRRITATION**

At least seventy allergens have been well characterized from spores, vegetative parts and small particles from fungi (0.3 um and smaller). A review of seventeen studies revealed that 6-10% of the general population and 15-50% of atopics had immediate skin sensitivity to fungi. Fungi produced beta glucans, which have irritant properties.

#### **TOXICITY**

Fungi produce a wide variety of toxic chemicals called mycotoxins. Some common mycotoxins include: aflatoxins – very potent carcinogens and

hepatotoxins, produced by some *Aspergillus* species; ochratoxins – nephrotoxic and carcinogenic, produced by some *Aspergillus* and *Penicillium*; sterigmatocystin immunosuppressive and a liver carcinogen produced by *Aspergillus* species, especially *A. versicolor*; trichothecenes – produced primarily by *Stachybotrys* and *Fusarium* species and have been reported to inhibit protein synthesis and cause hemorrhage and vomiting. Fungi also produce beta glucans, which have immunological effects. The smell of molds comes primarily from volatile organic compounds.

Adverse human and animal effects from mycotoxin-contaminated food stuffs have been well recognized since the early 20<sup>th</sup> century, but the pathway of mycotoxin injury through inhalation is questioned. Because it is unethical to conduct controlled studies on humans with inhaled mycotoxin exposure, only controlled animal exposures and human cohort and case-controlled studies can be carried out. The literature reveals that significant amounts of mycotoxins (including ochratoxin, sterigmatocystin and trichothecenes) are present in indoor dust and dust or fungal particles less than 10 $\mu$ m in diameter are respirable, thus allowing absorption of mycotoxins through the lungs.

Patients exposed to indoor *Stachybotrys* have been found to have measurable blood levels of the *Stachybotrys* hemorrhagic toxin stachylysin. Levels of trichothecene mycotoxins in urine have also been found in significantly higher

levels in patients exposed to high indoor fungal levels as opposed to an unexposed control group.

Blood ochratoxin levels have been found to be significantly higher in food industry workers exposed to airborne ochratoxin vs. unexposed controls. These findings support an inhalation pathway for entry of mycotoxins into the body.”

### ENVIROMENTAL STRATEGIES

The scientific studies have demonstrated that human health problems are definitely linked with mold (fungi) inside homes, workplaces, schools, and habitats in general. We must now focus on what to do about it.

When adverse health symptoms first emerge they are usually felt as flu-like symptoms, such as pain in the interconnective tissues (joints), fatigue (a common complaint that after a good night's sleep the person is tired). There are many diverse symptoms which are puzzling, such as sensitivity to odors, tobacco smoke, gasoline vapors, perfume, etc. When these symptoms persist and the individual seeks out a physician or health care professional, and the diagnostic assessment reveals nothing, then the individual should suspect probable environmental causation.

I now bring my own personal experience into focus, as I have 32 years experience with these problems. The first experience occurred in October of 1984. My wife and I purchased a home in a nice suburb of Denver. The home was

several years old and we painted, put in new drapes, carpet, and shower and landscaped the front and back yards. At the time of moving and getting settled in the weather was very mild (Indian summer), the house was open, windows, doors and plenty of fresh air. When winter cold arrived and we turned on the heat, we sealed ourselves in. All of the materials in the house began to outgas releasing chemicals into the indoor air. It is important to note that my wife and I were in excellent health. Our home was built on expansive soil (bentonite which, when wet, exerts tremendous pressure on the foundation, causing the concrete floor to buckle in the middle of the basement floor, releasing mold into the home. We also had burst pipes that flooded the basement. At this point my Wife's symptoms worsened. We went from physician to physician, all specialists in their fields of neurology, endocrinology, ear, nose, throat, etc., and the results were the same – no diagnosis. One physician stated that these symptoms were psychosomatic as the mind tells the body you are sick. The reverse was true as we discovered later. Her case was soma-psychic, the body telling the mind she was sick. After 26 physicians and many months of deteriorating health, my lovely wife weighed 86 pounds, was losing her hair, and could hardly walk. She seemed to be dying before my eyes, I was terrified, helpless and did not know what to do next. My attempts at problem solving this unknown crisis were fruitless. A friend and colleague, Howard Selinger, Ph.D., a Clinical Psychologist, who was helping my

wife, Joan, pointed us in the right direction. He had a patient with similar symptoms who had gone to see an Environmental Physician, Nicholas Nonas, MD. We immediately made an appointment and I carried my wife into his office. The appointment started at 8:30 AM and we were there for 6 hours. Included in the diagnostic assessment was a history of all stressors and traumas experienced by Joan with a complete description of our home, what we used in remodeling and a house history.

At this time I utilized my graduate school experience to invent a strategy for testing mold as this was identified by Dr. Nonas as one of the ubiquitous agents Joan was sensitive to. After consulting with Dr. John Krenetzky, Microbiologist and Dr. George Becker of the Biology Department of Metropolitan State College of Denver, where I was a Professor, they concluded my strategy had merit, which was to put Petri dishes inside my home to test the ambient air for mold. I put 72 plates throughout the house for 72 hours; they were labeled and sealed to identify where the plates had been placed, and taken to the laboratory for identification. The results were startling: there were 29 molds identified such as *Aspergillus*, *Cladosporium*, *Rhizopus*, *Monilia*, etc., 21 of which Joan had severe reactions to when tested by Dr. Nonas. Mold was identified as the invasive agent that lowered Joan's threshold limit value (TLV) of her immune system. We had to move: Joan had multiple health effects associated with fungal exposure such as muscle and

joint pain, fatigue/weakness, neurocognitive dysfunction, sinusitis, headache, gastro-intestinal problems, shortness of breath, anxiety, panic attacks, depression and irritability. My wife said to me, “I am going to be sick for the rest of my life and I release you from your wedding vows and I do not expect you to remain in this Hell.” She gave me the choice and I decided to stay. Dr, Nonas said, “Dr. Delgado, your wife is dying from acute environmental toxic poisoning and has up to 5 years to live.” I asked him if I could do anything to help her and He said “find her a clean place to live, free of mold, chemicals and polluted air and she may thrive”. I began a 54 month research odyssey to find out how to build a non-toxic home. I began with Dr. William Rea, Dr. Theron Randolph, pioneers in Environmental Medicine, NASA, Russia’s Soyuz/Salyut Space Project, China, The Royal Academy of Science, etc., to find non-toxic materials to use in home construction. God was my compass, guide and inspiration. I succeeded, and we built our home which took four years and culminated in a U. S. Patent. Joan is now 95% recovered. After we moved in I noticed she was whistling a tune and there was laughter again. I had my best friend, wife and lover back.

Now, I bring to this group Environmental Strategies to help those who cannot help themselves.

Environmental Crisis Intervention Strategies: When an individual is overcome by mold exposure and adverse health effects take hold, multiple symptoms may occur which are puzzling and frightening in nature. As symptoms continue a primary care physician is seen. If the physician or health care professional views the mold related health effects through the medical model, such as symptoms and not causes and does not take into consideration Biologicals (mold/fungi), Chemicals, Nutrition, or Psychological/Emotional factors into consideration, an erroneous diagnostic pattern may emerge. At this point the patient may have an environmental crisis. “Crisis is a perception of an event or situation as an intolerable difficulty that exceeds the resources and coping mechanisms of the person. Unless the person obtains relief, the crisis has the potential to cause severe affective, cognitive and behavioral malfunctioning.” (Gilliland and James)

Factors Affecting the Patient: As the multiple symptoms continue, the patient must use logic and background knowledge to define the problem. When anxiety is kept within tolerable limits, it can be an effective stimulant to action. It is a normal response to an unknown danger, experienced as discomfort and helps the individual to mobilize their resources in meeting the problem. But, as anxiety increases, perceptual awareness narrows and all perceptions are focused on the difficulty. If a solution is not found, anxiety may become more severe and perceptions narrowed to a crippling degree. The ability to understand what is



happening and to make use of past experiences gives way to concentration on the discomfort itself. The individual becomes unable to recognize their own feelings, the problem, and the situation in which they find themselves. AT this point outside professional help must be sought. Seek out a physician who practices Environmental Medicine (call the American Academy of Environmental Medicine 316-684-5500 for referral to a physician in your area. Then call Bio-Science Environmental Laboratories to get in touch with me at 561-391-5904). The patient at this juncture feels helpless with no choices. Remember, you do have a choice. Choose whether you want to be a victim or a survivor. By choosing the aforementioned steps you are choosing to be a survivor. You have empowered yourself to fight the illness. When you contact me through Bio-Science I will be your anchor and show you how to obtain and Environmental Assessment of your home, car, and work place to identify environmental agents that affect your health. A copy of this assessment must be provided to your physician to enable him to more accurately diagnose your condition.

The family is most important at this time in helping the patient to battle this illness. Have a family conference with spouse, siblings and family members you interact with. Present the medical and environmental documentation to your family and ask for their help. Help yourself by understanding that this illness is real. The fatigue you feel is due to your body's exertion to fight the illness. It is

important to rid the home of environmental agents that impair your health. The person who conducts your environmental assessment will help you to identify mold sources in your home.

## SUMMARY

There is an accumulated weight of evidence linking indoor airborne mold and/or mycotoxin exposures to multisystem adverse human health effects. A history of new neurocognitive symptoms occurring in patients soon after heavy mold exposure, accompanied by objective neuropsychological findings in such patients adds considerably to the weight of evidence from human studies, epidemiological research, and case series.

Health care professionals, building managers, homeowners and the general public need to be much more aware of the potential adverse health effects of high indoor fungal exposures and the need for proper building construction, maintenance, and remediation of dampness to prevent such effects. Potentially, mold related illnesses need to be considered in differential diagnosis (the entire body system is vulnerable to the effects of the environment upon the individual). Thus, it is imperative to bring into focus Multiple Chemical Sensitivities (MCS). Also, careful exposure histories must be taken. Prompt removal from exposure to fungal contamination remains the treatment of choice, with some evidence that

immunotherapy and nutritional support are also useful. Indoor airborne mold particles can be irritative to the respiratory tract, and fungal spores, antigens, volatile organic compounds and mycotoxins can be absorbed through the respiratory route to provoke injury by the mechanisms of allergy, toxicity, and infection. Support systems are vital to the recovery of the patient and must be part of the patient's recovery strategies.

## REFERENCES

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