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## The Impact of Environmental Molds in the Home

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by Anthony Montanaro, MD

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### Introduction

At the recent 60th Annual Meeting of the American College of Allergy, Asthma and Immunology, the initial presentation was undertaken by Elliott Horner, PhD,<sup>[1]</sup> Microbial Laboratory Director at Air Quality Sciences, Inc. in Marietta, Georgia. He pointed out that environmental molds potentially can result in

human illness by the production of allergens, proteases, beta-glucans, and volatile organic compounds. Dr. Horner further emphasized that in order for molds to grow, they require moisture. The temperature tolerance of molds is extremely variable. The ecologic types of molds are those included in the classes of phylloplane, which are molds that can grow on leaf surfaces. These molds include *Cladosporium* and *Alternaria*. Soil-based molds are typified by *Penicillium* and *Aspergillus*. Typical molds found in wood decay include the *Basidiomycetes*. Indoor molds typically include *Alternaria*, *Cladosporium*, and *Epicoccum*, but Dr. Horner pointed out that these are typically from outdoor sources. Dr. Horner pointed out that in interpreting industrial hygiene reports on mold measurements, colonization vs contamination must be determined. When mold contaminates, the mycelial elements will actually penetrate the substrate. The mycelium is connected to the conidiophore, which is the reproductive structure of the mold. The food source for fungal growth in buildings may include cellulose, which can be found in ceiling tile, insulation, sheetrock, as well as wood and dirt.

### Biology of Mold in the Home

Dr. Horner reviewed potential detection methodology for molds. These include the use of direct microscopy or culture-based methods. Dr. Horner stated that use of "settle plates" are no longer considered a reliable methodology. Dr. Horner further noted the importance of taxa identification, which is much more important than the absolute number of colony-forming units. Taxa identification may allow comparisons of indoor vs outdoor taxa.

### Doing an Effective Home Assessment

M. Joseph Fedoruk, MD,<sup>[2]</sup> of Exponent and Associate Clinical Professor at the University of California, Irvine, California, further elaborated on the importance of home inspections when evaluating potential mold contamination. Dr. Fedoruk pointed out that the home inspection industry is essentially unregulated. He noted that many home inspectors for mold contamination, in fact, are qualified only by attending a meeting without any subsequent testing. Dr. Fedoruk noted the importance of visual inspection of potential moisture intrusions, including inspection for the presence of staining or discoloration. He also pointed out that odor detection can be quite important and noted that "if you can smell mold, you have a problem." Dr. Fedoruk also reviewed air testing methodology surface dust analysis and noted that, in many cases, "destructive testing" is necessary. He pointed out that this destructive testing requires actual destruction of walls or floors.

Dr. Fedoruk also highlighted the importance of measuring both indoor and outdoor levels of molds as has previously been noted. He further pointed out that both complaint and noncomplaint areas of homes must be evaluated. He re-emphasized that both direct microscopy as well as culture identification must be undertaken. Dr. Fedoruk also mentioned that a specific number of colony

identification must be undertaken. Dr. Fedoruk also mentioned that a specific number of colony-forming units are rarely of any benefit.

### **Evaluating Patients for Mold Exposure**

Emil J. Bardana, Jr., MD,<sup>[3]</sup> presented the Jean S. Chapman Keynote Lecture on the potential human health effects of mold contamination. Dr. Bardana presented the historical background of mold sensitivity by pointing out that indoor air quality problems had actually begun in approximately 1973, following the oil embargo and subsequent efforts to conserve energy. Subsequently, in 1994, a paradigm shift had occurred in which individuals who had previously been diagnosed with "sick building syndrome" were subsequently informed that they were potentially suffering from "toxic mold syndrome."

Dr. Bardana highlighted the fact that in any well constructed home without evidence of water contamination, significant levels of airborne fungi can be measured. Dr. Bardana noted that these airborne fungi typically reflect outdoor levels of fungi. Furthermore, it was noted that fungi are ubiquitous and, in fact, account for at least 25% of the earth's biomass. Dr. Bardana again emphasized that while there were guidelines for the assessment of mold contamination in homes, there had been no uniformity or agreement of any specific level that could potentially result in human disease. In addition, there has been no established dose-response relationship between mold levels and human disease. Dr. Bardana gave examples of sawmills that had been evaluated that revealed workers without symptoms exposed to 1.5 M cfu/m<sup>3</sup>. In addition, there have been studies of farmers without symptoms who were exposed to 120 M cfu/m<sup>3</sup>.

Dr. Bardana reviewed the 6 types of human responses associated with mold exposure. These responses include:

Potential irritant effect, which at best is mild and transient and may be associated with exposure to beta-1,3 glucans or volatile organic compounds;

Nonspecific respiratory symptoms, which are poorly correlated to airborne fungal levels;

Allergic sensitization, which is usually not considered to be severe and is usually not considered to be a major problem and is more problematic with outdoor exposures;

Fungal infections, which mostly arise from outdoor sources and may occur from exposure to soil-based saprophytic fungi;

Exposure to mycotoxins, which have recently been described. There are currently more than 300 mycotoxins that have been described that are low in molecular weight and nonvolatile in nature. Dr.

Bardana highlighted the fact that all species of fungi are capable of producing mycotoxins; and

Psychogenic effects, which can occur when an individual perceives that he or she is being harmed by the effects of fungal exposure.

These potential health effects of indoor fungal bioaerosol exposures are highlighted in a recent publication.<sup>[4]</sup>

Finally, Dr. Bardana outlined the recent health concerns of individuals exposed to species of *Stachybotrys*. Dr. Bardana reviewed the fact that *Stachybotrys* has been referred to as toxic or "black mold." Dr. Bardana highlighted the fact that there were, in fact, no bona fide reports of human infection in the medical literature. Reports of potential allergic disease have been characterized as being inconclusive. In fact, Dr. Bardana highlighted a recent observation that pointed out that half of blood donors have immunoglobulin (Ig) G antibody to *Stachybotrys*, with 9% of these individuals having evidence of IgE to *Stachybotrys*. Given the ubiquitous nature of *Stachybotrys*, it is not considered to be unusual that one would observe these findings. Dr. Bardana further noted that there have been no reports of allergic alveolitis or sinusitis due to *Stachybotrys*. Although there have been recent concerns regarding the potential of "toxic encephalopathy and *Stachybotrys*," Dr. Bardana pointed out there has been "no scientific link." Dr. Bardana suggested further reading on the potential role of *Stachybotrys* in a recent publication by the American Industrial Hygiene Association.<sup>[5]</sup>

The potential human effects of mold exposure have led to a new legal industry with devastating impact

on the immune insurance industry. A recent example of mold litigation occurred in Texas, where a jury determined that an insurance company acted fraudulently and in bad faith when fixing water damage in a 22-room mansion.<sup>[6]</sup> This particular case resulted in a delay in the repair of what many considered a relatively small innocuous water leak but awarded the homeowner with a multimillion dollar verdict. It is pointed out that the number of mold-related claims in the State of Texas alone rose from 7000 in the year 2000 to 37,000 in the year 2001! These claims were further fueled by the presence of tropical storm Alison, which occurred in June of 2001 and affected the Houston metropolitan area for approximately 2 days, resulting in massive flooding along the Gulf Coast. In Houston alone, there was a 58% increase in claims, representing 2.96 claims for every 1000 households. There have been many high profile lawsuits reported in the press, including that of Johnny Carson's ex-sidekick, Ed McMahon, who brought suit against his insurance company for 20 million dollars in April of 2002 for the death of his dog, which was alleged to have been due to exposures to mycotoxins from *Stachybotrys chartarum*. Sports stars have not been immune from this weight of litigation. Michael Jordan has required that his home in the Washington, DC area at the Ritz-Carlton Hotel have extensive renovation due to the perception of mold-related problems. The celebrity status of some of these claims has resulted in increased hysteria in the general population. The ultimate effect of this hysterical response to suspected phoma-related problems has had a tremendous impact on the insurance industry, with more than 1.3 billion dollars spent in 2002 to settle lawsuits and mold-related damages.<sup>[7]</sup> Unfortunately, the response from the insurance industry has clearly been to settle cases and to attempt to no longer put themselves at risk of covering potential mold-related damages. Recently, the State Farm Mutual Automobile Insurance Company has attempted to eliminate coverage from mold-related damages in 33 states.

There is little doubt that mold can indeed result in human disease. Mold exposure can result in allergic rhinitis, allergic asthma, allergic sinus disease, and pulmonary hypersensitivity pneumonitis. Despite the fact that there is no doubt that mold can result in human disease, aside from these specific incidences, there was very little data to support human disease caused by "mycotoxins." All of the presenters emphasized the need for further research in this area.

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For more information contact:

Alan L. Wozniak, CIAQP  
(800) 422-7873 ext. 802

[iaq@pureaircontrols.com](mailto:iaq@pureaircontrols.com)