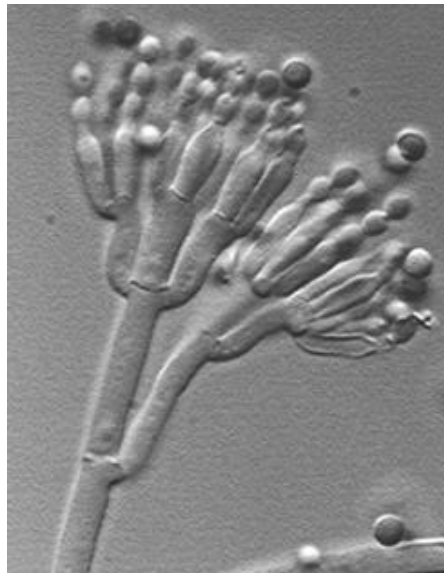


# ***MOLDS & FUNGI IN THE HOME***

## ***RECOMMENDED PROCEDURES FOR PREVENTION AND CLEANING***



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## PREVENTION

First and foremost in dealing with mold/fungi growth is to *prevent* its occurrence. While the total elimination of fungi and molds from the living environment is not possible, there are certain actions that can be taken to substantially reduce the numbers of such organisms. In order for mold/fungi to grow, there are three main ingredients needed. These are:

1. **a favorable temperature** (nearly always exists);
2. **moisture** - standing water or high humidity (commonly exists); and,
3. **the presence of organic matter for food** (very nearly everything - cloth, paper, food crumbs, dust, paint, wood, carpets, even plastics and vinyl floor tiles, etc.).

The main thing to remember in preventing growth is to try to eliminate at least one of these three growth needs.

The following is a list of recommendations and techniques that will help keep an area as free of these organisms as possible.

1. Dust and vacuum **all** surfaces (high and low) frequently. All dusting should be done with a **damp** cloth or by using a commercial dusting or waxing compound. **Never** use a dry cloth, duster or rag as this will only cause the organisms or their spores to become airborne, thereby spreading them around and possibly producing allergic reactions or other adverse health effects. Immediately after dusting and/or cleaning, all cloths used should be washed with a strong bleaching compound or placed in a plastic bag, sealed and thrown away. If storage of the bagged cleaning cloths/materials is necessary, even for a short term, the storage should be in a closed container **outside**. Once the bag containing the cleaning materials is sealed, never reopen it.
2. Keep the area as dry as possible. This especially holds true for high humidity or water use areas such as kitchens, bathrooms, basements and laundry areas. Areas where wetness or moisture accumulates (i.e., around sinks, tubs, window sills, etc.) should be dried immediately after use. All leaking roofs, piping, fixtures, etc. should be repaired or replaced.
3. Remove unused objects that can act as dust collectors. This includes boxes, equipment, old books, clothes, etc. Such objects attract dust and airborne particles, are difficult to clean and can act as a breeding area for microorganisms.
4. Do not allow wet articles such as towels, clothes, shoes, etc. to accumulate anywhere in or outside the area or in washers, dryers, sinks, etc. (even after washing).
5. Do not allow roof or other drainage to accumulate around the perimeter of the area. This moisture can move into the basement, crawlspaces or exterior walls of the area allowing mold/fungi to grow.
6. If growth appears on surfaces in the area, use a disinfectant spray to soak the area, let stand for at least 30 minutes, then use a cloth wetted with the disinfectant to wipe the growth off of the surface. Place the used cloth and other such materials used for the clean up in a sealed plastic bag and dispose of immediately (for more detailed

instructions see the Section on "Cleaning and Disinfection" beginning on page 3).

7. Place plastic covers around mattresses, pillows and box springs to prevent the collection of dust and spores and to prevent moisture from penetrating into the padding. If these articles become wet, they must be **thoroughly** dried and cleaned immediately.

8. Provide for the routine cleaning (at least once every 3 to 5 years) of all heating and ventilation ducts in the area. After cleaning, be cautious in allowing the ducts to be sprayed with a `disinfectant' or `encapsulant'. This is a common practice of duct cleaning companies, but the disinfectant or encapsulant will then be distributed throughout the area by the heating/cooling system. Just have them clean it, preferably with a rotary brush and HEPA vacuum.

Special attention should be paid to the duct work that delivers air from evaporative coolers. The ducting will accumulate dust and organic matter and this, combined with the moisture from the cooler, will produce an ideal growth environment for dust mites and microorganisms (including the bacteria responsible for Legionnaires disease).

9. Evaporative (swamp) coolers should be thoroughly cleaned at least twice during the use season and again when shut down for the winter. It is not generally recommended that any growth inhibitor be used while the unit is in operation. If a growth inhibitor is used, it must be used in accordance with the manufacture's instructions. This is one more example of where the old saying "if a little is good, a lot is better" could make you sick. REMEMBER! what ever you add to the water will be put into the air you breathe (See also item #8).

10. Install High Efficiency Particulate Air (HEPA) or `Electro-static' filters on the heating/air conditioner/ventilation system to remove airborne spores. Change these filters regularly. Prior to removal, spray the old filter with disinfectant and allow to stand for at least 20 minutes. Carefully remove filter, place in plastic bag, seal tightly and dispose of immediately. Clean the filter holder and install new filter according to manufacture's instructions. The installation of this type of filter should be done by experienced ventilation equipment professionals and may require upgrading the fan motors to overcome the resistance to air flow these types of filters produce.

11. Clean humidifiers at least weekly (preferably twice/week) to prevent the growth of microorganisms in the units. Periodic cleaning is preferable to using bacterial/fungicide water treatment in these units. *CAUTION!* - if you use a bacterial/fungicides in humidifiers, you must follow the manufacture's instructions carefully! Remember, what ever you add to the water in the humidifier will be put into the air you breathe.

12. Keep compost, manure, leaf or brush piles, etc. and other such accumulations of organic material well away (at least 100 feet) and down wind of the building. These materials are prime breeding grounds for mold, fungi, yeasts and other allergy producing microorganisms.

13. Routinely make a visual inspection of the building, both inside and outside. Look for exterior cracks in building finishes, particularly stucco, which permit water to enter

the wall. Inside, look for evidence of pipe leaks, such as damp spots beneath kitchen and bathroom sink pipes and damp drywall behind the washing machine. Look for 'tea stains' on ceilings (evidence of a roof leak), and around windows and doors (indicating a poor seal). Address these problems immediately; minor problems become major expenses if left alone.

14. Have a plumber install a back-flow prevention device on your sewer line.
15. In the event of a roof leak, be sure that the roof deck is thoroughly dry and roof insulation is either removed or thoroughly dry before repairing the roof. Moisture trapped in the insulation beneath a new or repaired roof will lead to mold growth.

### **IF LEAVING HOME** (for more than three or four days)

Many major mold/fungi problems occur when an owner is away for an extended period of time. Before leaving home:

1. Turn off the water and electricity serving the hot water heater, the refrigerator's ice machine, and the washing machine. This will minimize damage in the event of a pipe break.
2. Make arrangements for someone to check the home at least every two days, and leave instructions on who to call in the event of a water intrusion event (water pipe break, sewer back-up, etc.)
3. Be sure the dishwasher is turned off. If you have a home humidifier, turn it off. These sources of high humidity can cause as much damage as a pipe break if they malfunction.
4. Turn off and drain the pan in your evaporative cooler (swamp cooler)

If you return home to a water problem, act immediately to obtain professional clean-up assistance. If there is an indication the problem has existed for more than 48 hours, assume there is mold growth and act accordingly. A professional mold specialist can help you determine the appropriate actions to take, but generally:

- Minimize time inside the home, so as to minimize exposure to potential mold spores and/or toxins.
- Be sure that, as part of the clean-up process, any drywall or paneling that has been wetted is removed (as well as the insulation behind it) and the wall cavity behind it is thoroughly dried before a new wall finish is installed.
- In the case of floor finishes, remove and discard wet carpet and the pad beneath it. (Don't dry it first – just get rid of it.) Be sure that tile (of any kind) is thoroughly dried, as water may seep under the tiles.
- If, after the clean-up is complete, you notice a musty or earthy odor in the home, search for the source, as it may indicate mold growth.

## CLEANING AND DISINFECTION

Once you have identified a mold problem, you will want to clean and disinfect the contaminated area, fixtures, materials and/or other objects. Generally, if the problem is limited to an area less than about 3 square feet, there is not a need to call for clean-up assistance. If you are health - compromised, have a respiratory illness, know you are susceptible to allergic reactions to mold, or if the problem area is greater than about 3 square feet, call for assistance rather than attempting clean-up on your own.

### Step 1 - Selecting a Disinfectant

There are a number of disinfectants on the market that may be used to clean up or disinfect contaminated materials and persons. The following is a partial list of some of the more common disinfectants and their use.

#### FOR SURFACES

- |                   |   |
|-------------------|---|
| Chlorine Bleach   | The most commonly used disinfectant, this disinfectant consists of a 5% solution of chlorine in water. Some limitations include discoloration of surfaces to which it is applied; requires 15 minutes or more of contact time (meaning you have to keep the surface wet with the solution); has distinctive odor and may be toxic when used in poorly vented areas; provides no disinfecting residual; is minimally effective against spores without extended contact times (greater than one hour); may not be effective if the material to be disinfected contains high amounts of organic matter or nitrogen compounds; and requires skin and eye protection during use. |
| Hydrogen Peroxide | An inexpensive disinfectant consisting of a 3% solution of hydrogen peroxide and water. Some limitations include discoloration of surfaces to which it is applied; requires 20 minutes or more of contact time; provides no disinfecting residual; may not be effective if the material to be disinfected contains high amounts of organic matter or nitrogen compounds; and requires skin and eye protection during use.   |
| Iodine Solutions  | An excellent disinfectant that provides a disinfecting residual. Some limitations include staining of surfaces to which it is applied; some what more expensive and difficult to obtain compared to other disinfectants; should not be used on surfaces where children may come in contact with the residual, and requires skin and eye protection during use.  |
| Commercial        | There are a large number of commercial products used primarily by hospitals, and restoration companies. These products contain a variety of disinfecting agents (usually phenolic or quaternary ammonia based compounds) in varying concentrations. If these are to be used, the Material Safety Data Sheet (MSDS) should be obtained from the manufacturer and read very carefully. Be sure to follow the personnel protection recommendations very closely. Many of these compounds contain masking odors, such as citrus, and can be a source of irritation if the odor lasts very long or is very strong.   |

Some of these disinfectants can provide a residual that protects from future growth. One should be cautious in using long term disinfectants as they can leave residues that may prove to be irritating to persons who have to be in the area for extended periods.

Household	These compounds are basically the same as the commercial compounds only packaged in small containers and sometimes renamed for household use.
Cleaning Agents	These compounds use ammonia or a form of ammonia as the disinfectant. This compound is only effective against some types of microorganisms and has little or no effect on spores and some other microorganisms.

## FOR PEOPLE

Isopropyl Alcohol	An excellent skin disinfectant to be used before and after a thorough washing with soap and water. <b>Caution:</b> Do not use near or in the eyes, nose or mouth. The primary limitations for this disinfectant are the limited effect on mold/fungal/bacterial spores, some individuals are sensitive to the alcohol, and the lack of its ability to remove some types of soiling materials from the hands. Therefore, it must be used in conjunction with a thorough washing with soap and water. Because of its ability to remove natural protective oils from the skin, the application of protective creams or lotions after use is recommended. <b>Caution:</b> Alcohols are flammable and must be used in well ventilated areas and away from ignition sources (sparks and flames).
Ethyl Alcohol	Basically the same action as isopropyl, but has fewer problems for sensitive people. <b>Caution:</b> Alcohols are flammable and must be used in well ventilated areas and away from ignition sources (sparks and flames).
Disinfectant Soaps	These types of soaps are commonly used in hospitals for surgical preparation, hand washing and patient care. They are very useful and the best choice for routine personnel decontamination procedures where skin contamination is a possibility. The inclusion of the surfactant and skin care products make these the personnel decontamination method of choice.

**WARNING!!!**  
**NEVER, NEVER, NEVER MIX DISINFECTANTS OR CLEANING AGENTS!!!**  
 Either in a container or on the surface you're cleaning!!!  
 The combination can be extremely toxic and possibly fatal - TO YOU!!!

## Step 2 - Cleaning and Disinfecting Procedures

In the event you should find mold/fungi colonies or growth, it is necessary to properly clean and disinfect the area. The process of cleaning and disinfection varies for different surfaces or materials. Don't give up, as mold/fungi are very hardy and may require several repeated attempts before they are controlled. The following methods are suggested for cleaning various type of surfaces and materials in the area: **NOTE:** *if the cumulative size of the mold contaminated area or material is greater than approximately three (3) square feet, you should contact a professional mold cleaning company for clean-up.*

### REMEMBER:

1. Always handle disinfectants while wearing proper gloves and eye protection. After you are done, dispose of all cleaning rags, paper towels and other cleaning materials by placing them into a plastic bag, seal the bag, then place the bag in the garbage.

2. Always test the disinfectant of choice on a small, out of the way area to determine if the disinfectant will discolor or otherwise damage the material being cleaned.

SURFACE	CLEANING PROCEDURE
<p>Water Resistant Surfaces            e.g. walls (some)            counter tops            tubs            sinks            concrete            raw wood            plastics            metal            others</p>	<p>Using a hand sprayer bottle, <b>soak</b> the colony with a chlorine bleaching solution or hydrogen peroxide (use one or the other, <b>never</b> mix the two together). Keep the colony wet with the solution for a minimum of 15 minutes. Clean and wipe dry with a cloth or paper towel.</p> <p>Porous materials such as plasters, bricks, concrete, etc. are extremely difficult to disinfect, as the mold/fungi will grow into the porous materials and can escape all but the most rigorous disinfection procedures and usually will require repeated treatments to be finally effective. Where possible, these materials should be simply removed and disposed of.</p>
<p>Finished Wood Surfaces            e.g. furniture            wall paneling            picture frames            banisters            window sills            etc.</p>	<p>Cleaning and disinfection of these surface can be difficult and often will require refinishing. In the case of wall paneling, often the only solution is replacement of the paneling.</p> <p>First try using a high quality furniture cleaning and waxing compound such as Pledge®. If the growth is surface only and has not penetrated the existing finish, this should remove the growth.</p> <p>If the growth has penetrated the finish, the best method for dealing with finished wood is the use of chlorine bleach or hydrogen peroxide. The item to be cleaned should be tested with each solution in a small area that is hidden or cannot be easily seen. Depending on the results of the test, select the cleaner that produces the desired results with minimum damage to the existing finish. Soak the growth area with the solution and keep wet for a minimum of 15 minutes, then wipe dry. At this point, you will need to determine the need for refinishing of the article.</p>
<p>Cloth (removable)            e.g. draperies            bedding            clothing            throw rugs            others</p>	<p>These articles should be placed into plastic bags, removed from the area and washed or dry cleaned by a professional cleaner.</p>
<p>Cloth (attached)            e.g. upholstery            wall coverings</p>	<p>Cloth attached to furniture is also difficult to clean, as the spores can penetrate deep into the weave or padding of the article. The best procedure is to strip the cloth covering off and recover the article. If this is not desirable, have a professional cleaning company use a HEPA filter vacuum to remove the surface damage and then steam (not hot water) clean these articles. If the mold/fungi has caused discoloration, the professional cleaning company may be able to correct the problem.</p>

SURFACE	CLEANING PROCEDURE
Stuffed Toys	<p>These articles are very difficult to clean, as the spores can penetrate deep into the stuffing of the article. Usually, the best action is to dispose of the article and try to find a replacement. However, often the emotional attachment to these articles makes disposal and replacement less than desirable. If the article must be kept, the best procedure is to strip the stuffing out of the article, wash or dry clean the covering and refill the article with new material.</p>
Paper Products e.g. photos pictures books others	<p>If these items show evidence of mold/fungi growth, there is very little the average person can do to restore these materials without risk of serious damage to the article. The best course of action is to take these items to a professional company that specializes in restoration of such materials. Check with your local museum for information on who they use.</p>
Rugs & Carpets	<p>Rugs and carpets are very difficult to clean and disinfect. The spores and mold/fungi growth can hide deep inside the rug/carpet or in the padding underneath, making it very difficult to clean and disinfect. Also, rugs and carpeting are prone to discoloration when using the common disinfectants. If the rug or carpet is badly stained with mold/fungi growth, often the best solution is to soak the stained areas with a chlorine bleach, remove the entire rug or carpet from the area and dispose of it at the local landfill.</p> <p>For small stains, hydrogen peroxide applied with cotton applicators (Caution: this solution will usually remove some color) followed by a thorough drying out may help.</p> <p>Another procedure that has had some limited success is professional steam cleaning followed by a very thorough drying.</p>
Food Stuffs	<p>Mold/fungi growth on solid containers (not cloth or paper bags, etc.) such as canned goods or other completely sealed containers can be wet wiped with a solution of chlorine bleach or hydrogen peroxide. However, if the containers are opened or there is <b>ANY</b> chance that the containers have been opened, they should be disposed of. <b>Never</b> eat any food stuffs that may have been contaminated with mold/fungi -- and, NO, cooking won't help! Many spores and toxins produced by mold/fungi are not destroyed during cooking.</p>

SURFACE	CLEANING PROCEDURE
Household Pets	<p>Pets in the home can be a significant source of mold spores. Their wanderings into places we rarely or cannot go (indoors and out) exposes them to mold and fungi. The hair on the animals will pick up the spores and transfer them into the home.</p> <p>Caged pets, such as birds and hamsters, are also a significant source of mold. The droppings and urine from these animals provide a nutrient rich source of food for mold and bacteria.</p> <p><i>Do Not Use Disinfectants on Your Pets.</i></p> <p>Routine brushing and bathing of cats and dogs is recommended - contact your veterinarian to determine an acceptable frequency of bathing. Bathing your pet too often may be harmful. Additionally, bedding material or sleeping locations should be cleaned routinely (at least once per week) to prevent buildup of animal transferred microorganisms. Any "accidents" by the pet should be cleaned and dried immediately.</p> <p>Cages and the area around them should be cleaned frequently (twice per week) and disinfected with a disinfectant safe for the pet. Contact your veterinarian for advice on a safe cleaning and disinfection procedure.</p>

Once you have cleaned and disinfected the area or material, you will need to reinspect the area every few days for up to a month to make sure the growth doesn't return. If it returns, repeat the cleaning and reinspection process until there is no sign of reoccurring growth. The reinspection and, if needed, re-cleaning and disinfection is a very necessary step. Many types of microorganisms are extremely persistent and difficult to control. If, after the third or fourth attempt, the growth returns, you should dispose of the article or contact a professional cleaning service to deal with the problem.

**REMEMBER!!**

**Nearly every thing we do as humans produces a growth media for microorganisms.**

**Keep it clean and dry!**

## **MOLDS, FUNGI, YEASTS & FILAMENTOUS BACTERIA AND THEIR HEALTH EFFECTS**

The following is a listing of some common molds, fungi, yeast and filamentous bacteria and the type of health effects associated with those organisms. The list should *not* be considered as definitive, as new health effects and their associated organisms are being added continuously.

*Important Note: the ability of a microorganism to produce a health effect depends on a great many things. These include the duration of exposure, concentration (the amount exposed to), mode of exposure (inhaled, ingested, skin contact, etc.) and the general health or sensitivity of the person exposed (many organism are termed 'opportunistic' - that means they usually produce illnesses in people that are already in poor health).*

*The information contained in the chart below is a "work in-progress" and represents the information available to the author at the time of publication and should not be considered as complete or definitive. Empty spaces mean only that the information that would go in that space was not available or has not be determined.*

*The chart below is for your general information and **not** for self-diagnosis. Finding one or more of the organisms in your home **does not** mean that you will 'catch' the disease listed. In fact, what would be surprising is that you found none of them. Most are quite common and are often found at low levels in homes. If you think you may have contracted a mold/fungi related illness **see your physician immediately.***

If you find one or more of these types of organisms during testing, it is recommended that you contact your physician and an indoor air quality environmental specialist to evaluate your risk.

<b>GENUS (&amp; species)</b>	<b>HEALTH EFFECT</b>	<b>ALLERGEN TYPE 1 or 3</b>	<b>MYCOTOXIN</b>
Absidia	Brain abscess and central nervous system disease	1	
Acremonium	Diseases of the eyes and ears	1 & 3	
Apisporina montagnei		1	
Alternaria alternata		1 & 3	
Actinomadura madurae	Mycetoma - cutaneous and subcutaneous fungal infections characterized by localized, deforming, swollen lesions.		
Actinomyces israelii	Common inhabitant of the nose and throat. Produces Actinomycosis, a chronic suppurative and granulomatous disease characterized by the extension of lesions through tissues to the outside of the body to form draining lesions tracts.		
Actinomyces naeslundii	(see Actinomyces israelii) has also been associated with infections involving the use of IUDs.		

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
<i>Alternaria alternata</i>	Disseminated alternariosis; Hypersensitivity Pneumonitis ; an allergenic agent.	1 & 3	Altenuene Altenuisol Alternariol Alternariol methyl ether Stemphytoxin III Tenuazonic acid
<i>Amanita</i>	Mycotoxin producing fungi; "death angels or destroying angel" mushroom; can produce the mycotoxin on common food products.		
<i>Arthroderma</i>	Arthrodermosis - a cutaneous infection (rare)		
<i>Aspergillus amstelodami</i>		1	Emodin Flavoglaucin
<i>Aspergillus chevalieri</i>			Emodin Flavoglaucin Gliotoxin Xanthocillin X
<i>Aspergillus clavatus</i>	Hypersensitivity pneumonitis ; an allergenic agent. "Malt Worker's Lung".	3	
<i>Aspergillus flavus</i>		1	
<i>Aspergillus fumigatus</i>	Aspergillosis ; an airborne fungi produced in large amounts in maturing compost and other organic materials. Hypersensitivity Pneumonitis ; an allergenic agent.	1 & 3	Endotoxin Ergot alkaloids Fumigaclavines Gliotoxin Fumigatoxin Fumigillin Fumitremorgens Helvolic acid Tryptoquivaline tremorgens Verruculogen
<i>Aspergillus nidulans</i>		1	
<i>Aspergillus niger</i>		1 & 3	Malformin C Oxalic acid
<i>Aspergillus penicillioides</i>		1	
<i>Aspergillus repens</i>		1	
<i>Aspergillus ustus</i>			Austocystins
<i>Aspergillus versicolor</i>		3	Aspercilorin Averufin Cyclopiazonic acid Sterigmatocystin Versicolorin
<i>Aureobasidium pullulans</i>	"Sauna Taker's Disease" - lung disease; a thermophilic microorganism.	1 & 3	

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Basidiobolus haptosporus	Entomophthoromycosis - forms nonulcerating, subcutaneous masses of fungal growth on limbs, trunk, chest, back, hips and thighs. (tropical & subtropical areas)		
Beauveria (not specified)	Beauveriosis - pulmonary infections	1	
Blastomyces dermatitidis	Blastomycosis - a chronic, systemic fungal disease caused by inhalation of fungal spores. Must be treated or can be fatal. Endemic in the U.S., Canada and 14 African countries.		
Botryodiploides	One of the 'Black Fungi' causing cutaneous and subcutaneous infections.		
Botrytis (not specified)	Hypersensitivity pneumonitis ; allergenic fungi ; produces mild to sever allergic responses.	1	
Botrytis cinerea		1 & 3	
Candida albicans	A common skin inhabitant yeast ; produces infection of the skin and nails in compromised individuals. Hypersensitivity Pneumonitis ; an allergenic agent.	3	
Cephalosporium	Cephalosporiosis - a cutaneous infection.		
Cercospora	Cercosporamycosis - a cutaneous infection.		
Chaetomium (not specified)	Hypersensitivity pneumonitis ; allergenic fungi ; produces mild to sever allergic responses.	1	
Cladosporium carrionii	Chromomycosis ; a lesion producing infection of the skin. Hypersensitivity Pneumonitis ; an allergenic agent. A common soil inhabitant.		
Cladosporium cladosporidioides	Corneal mycotic eye infections. Hypersensitivity Pneumonitis ; an allergenic agent.	1	Cladosporin Emodin
Cladosporium herbarum		1	
Cladosporium sphaerospermum		1	
Cladosporium trichoides	Cladosporiosis ; a pathogenic 'black' fungi infecting the central nervous system and the brain. Hypersensitivity Pneumonitis ; an allergenic agent.		

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Cladosporium werneckii	Tinea Nigra - a cosmetic mycotic disease of the skin characterized by brown-to-black, noninflammatory, asymptomatic spot (lesions) on the skin. Most commonly found in tropical regions. Hypersensitivity Pneumonitis ; an allergenic agent.		
Coccidioides immitis	Coccidioidomycosis - an upper respiratory fungal disease. Mostly mild but has become acute and fatal in some cases. Common in the southwest U.S.		
Cochliobolus ("Helminthosporium")		1	
Coprinus	A mushroom forming fungus of concern to heart surgery patients.	1	
Cryptococcus neoformans	Cryptococcosis - a pulmonary infection that can spread to the brain and spine producing Cryptococcal Meningitis. Has no preliminary symptoms in the primary site (lungs). Easily misdiagnosed with brain tumors or other cranial diseases.	3	
Cryptostroma corticale	Maple Bark Disease - an allergenic pulmonary disease. It is considered another form of hypersensitivity pneumonitis.		
Curvularia (not specified)	Curvulariosis - an eye infection. Hypersensitivity Pneumonitis ; an allergenic agent.	1	
Cylindrocarpon	Produces a mycotic infection of the eye.		
Dacrymyces (not specified)		1	
Dermatophilus	Dermatophilosis - a cutaneous infection.		
Didymella exitialis		1	
Drechslera	Drechsleriosis - a pulmonary infection. Hypersensitivity Pneumonitis ; an allergenic agent. This disease has been reported repeatedly as causing infection in compromised patients. Has been reported to have caused infection of the sinuses and meninges with progression to brain abscesses in health individuals (mostly teenagers).		
Emmonsia cresens	Adiaspiromycosis - a lung disease. Also produces cutaneous infections.		
Entomophthora coronata	Entomophthoromycosis - a chronic, inflammatory, fungal disease of subcutaneous tissues, nasal submucosa, pharynx and sinuses.		

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Epicoccum	Hypersensitivity pneumonitis ; fungal allergen.	1	
Epidermophyton floccosum	Dermatophytoses (Ringworm) - a mycotic disease of the skin. One of about 18 fungi (dermatophytes) that cause ringworm in human beings. Highly contagious.	1	
Exophiala werneckii <sup>1</sup>	A `black' fungi producing mild and chronic skin infections.		
Fonsecae compactum	Chromomyxosis - one of four known fungi that cause this disease. A subcutaneous mycotic disease producing lesions that grow and form warty, raised cutaneous lesions resembling the vegetable cauliflower.		
Fonsecae pedrosoi	Chromomyxosis - one of four known fungi that cause this disease. A subcutaneous mycotic disease producing lesions that grow and form warty, raised cutaneous lesions resembling the vegetable cauliflower.		
Fusarium	Fusariosis - infection of the eyes and nails. Hypersensitivity Pneumonitis ; an allergenic agent. Also produces a mycotoxin that can cause Leukopenia (absence of white blood cells in the bloodstream).	1	
Ganoderma applanatum		1	
Geotrichum	Hypersensitivity pneumonitis ; an allergenic agent. A `black' fungi that can produce cutaneous and subcutaneous skin infections.		
Gliocladium (not specified)		1	
Hedersenula	One of the `black' fungi that cause cutaneous and subcutaneous infections of the nails and skin. Usually mild and chronic.		
Histoplasma capsulatum	Hystoplasmosis - a pathogenic infection of the lungs. May follow one of several courses. It may produce a pulmonary disease; establish itself in the lung with no local disease but will travel hematogenously to another body organ or system (such as cryptococcal meningitis); or will infect the lung and then spread through the bloodstream to lymphatic system to other body parts or systems causing systemic fungal disease.		

<sup>1</sup> see Cladosporium werneckii

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Hypholoma fasciculare		1	
Loboa lobi	Lobomycosis - a chronic, localized, subcutaneous fungal disease characterized by either nodular lesions or sometimes by crusty plaques and tumors. Has been reported in both humans and dolphins.		
Lycoperdon gemmatum		3	
Lycoperdon pyriforme		3	
Madurella grisea	Mycetoma - a cutaneous and subcutaneous fungal disease characterized by localized, deforming, swollen pus forming and draining lesions.		
Malassezia furfur <sup>2</sup>	Tinea Versicolor - a mycotic disease characterized by white, brown or fawn-colored, superficial, noninflammatory spots or lesions.		
Merulius lacrymans		1	
Microsporum canis	Causes `ringworm' in both humans and dogs. One of several.		
Monilia	Hypersensitivity Pneumonitis ; an allergenic agent. Common in all regions.		
Mucor	Hypersensitivity Pneumonitis ; an allergenic agent. An opportunistic fungi that can cause infections in patients with decreased resistance due to poor health, medical treatment, cancer, leukemia, etc. Can be fatal.	3	
Mucor hiemalis		1	
Nigrospora	Hypersensitivity Pheumonitis ; an allergenic agent. Also produces cutaneous infections.	1	
Nocardia asteroides	Nocardiosis - primarily a pulmonary (lung) infection agent, but can become systemic, spreading to other parts of the body, especially the central nervous system.		
Nocardia brasiliensis	Nocardiosis - primarily a pulmonary (lung) infection agent, but can become systemic, spreading to other parts of the body, especially the central nervous system.		

<sup>2</sup> see Pityrosporum furfur

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
<i>Nocardia caviae</i>	Nocardiosis - primarily a pulmonary (lung) infection agent, but can become systemic, spreading to other parts of the body, especially the central nervous system.		
<i>Paecilomyces</i> (not specified)	Paecilomycosis - an infection of the heart and/or brain. Also, Hypersensitivity Pneumonitis ; an allergenic agent.	3	Paecilotoxins
<i>Paecilomyces lilacinus</i>		3	Paecilotoxins
<i>Paecilomyces variotii</i>			Byssochlamic acid Variotin
<i>Paracoccidioides brasiliensis</i>	Paracoccidioidomycosis - a systemic fungal disease. The most frequently diagnosed respiratory fungal disease in Latin America. Often confused with tuberculosis. Forms ulcerative lesions in the buccal, nasal and gastrointestinal mucosa.		
<i>Penicillium</i> (not specified)		1 & 3	
<i>Penicillium aurantiogriseum</i>			Penicillic acid Peptide nephrotoxin Viomellein Xanthromegnin
<i>Penicillium brevicompactum</i>			Botryodiplodin Brevianamide A Mycophenolic acid
<i>Penicillium camembertii</i>		1	
<i>Penicillium chrysogenum</i>	Used to produce the antibiotic Penicillin. Hypersensitivity Pneumonitis ; and allergenic agent.	1 & 3	Penicillins Omega-hydroxyemodin Roquefortine C & D Xanthocillin X
<i>Penicillium casei</i>	Hypersensitivity Pneumonitis ; and allergenic agent. Causes Cheese Washer's Disease.	3	
<i>Penicillium citrinum</i>			Citrinin
<i>Penicillium commune</i>			Cyclopiazonic acid Isofumigaclavine A
<i>Penicillium crustosum</i>			Penitrem A Roquefortine C
<i>Penicillium cyclopium</i>		3	
<i>Penicillium decumbens</i>			Decumbin
<i>Penicillium digitatum</i>		1	
<i>Penicillium expansum</i>		1	Chaetoglobosin C Citrinin Patulin Roquefortine C

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Penicillium fellutanum			Citreoviridin Citrinin
Penicillium frequentans	Suberosis - a Hypersensitivity Pneumonitis occurring in workers inhaling cork dust. Cork dust is heavily contaminated with this organism.		
Penicillium glabrum		3	
Penicillium griseofulvum			Cyclopiazonic acid Griesofulvin Patulin Roquefortine C
Penicillium italicum		1	
Penicillium janthinellum			Verruculogen
Penicillium jensenii		3	
Penicillium oxalicum			Secalonic acid D
Penicillium purpurogenum		1	
Penicillium purpurescens			Ochratoxin A
Penicillium roquefortii		1	
Penicillium spinulosum			Penitrem A
Penicillium verrucosum			Ochratoxin A Citrinin
Penicillium viridicatum		1	Penicillic acid Viomellein Xanthomegnin
Pestalozzia (not specified)		1	
Phialophora jeanselmei	Mycetoma - a cutaneous and subcutaneous fungal disease characterized by localized, deforming, swollen pus-forming or abscessed lesions.		
Phialophora verrucosa	Chromomycosis - a subcutaneous mycotic disease that forms warty, cutaneous lesions that are often raised above the skin and resemble the vegetable cauliflower.		
Philemonium	A 'black' fungi causing mild and chronic skin and nail infections.		
Phoma	A 'black' fungi causing mild and chronic skin and nail infections. Hypersensitivity Pneumonitis ; and allergenic agent. Can also produce infections of the eye.		
Phoma glomerata		1	
Phoma violacea		3	
Phragmidium rubi-ideae		1	

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Phytophthora infestans		1	
Piedraia hortae	Black Piedra - Characterized by the growth of hard, black, gritty, fungal nodules around the shafts of the hair. Only the hair on the scalp is infected by black piedra. The infected person may not be aware of the infection.		
Pithomyces	Hypersensitivity Pneumonitis ; and allergenic agent.		
Pityrosporum furfur	Tinea Versicolor - a mycotic disease characterized by white, brown or fawn-colored, superficial, noninflammatory spots or lesions.		
Polyporus squamosus		1	
Pseudoallescheria boydii	Mycetoma - a cutaneous and subcutaneous fungal disease characterized by localized, deforming, swollen pus-forming or abscessed lesions. Has also been reported to cause pulmonary disease in compromised patients.		
Rhinosporidium seeberi	Rhinosporidiosis - a mucocutaneous fungal disease characterized by formation of large polyps, tumor or wartlike lesions, primarily around the eyes and nose. Diagnosis is by microscopy. No patient discomfort unless the lesions place undue pressure on blood vessels or nerves.		
Rhizopus (not specified)	Zygomycosis - an acute and rapidly developing infection of various species of the 'Bread Mold' Rhizopus. The site of infection depends on where the fungus enters the body. Especially a concern to patients with diabetes, severe burns, leukemia, lymphomas, etc. The infection may be cranial, nasal, palatal, paranasal, cutaneous, subcutaneous, orbital, ocular, facial, cerebral, pulmonary, esophageal, or intestinal; it can involve the spinal cord or the stomach; or it can be disseminated. Favors the blood vessels, causing embolization and subsequent necrosis (death) of surrounding tissues. Hypersensitivity Pneumonitis ; and allergenic agent.	3	
Rhizopus Microsporus (var. Rhizopodiformis)		3	
Rhodotorula (not specified)	Rhodotorulosis - causes disseminated disease through the bloodstream (fungemia). A blood-borne yeast.	3	

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Saccharomyces cerevisiae	`Bakers Dermatitis' - causes by constant exposure to baker's yeast. `Disseminated saccharomycosis' ; an opportunistic yeast disease caused by brewer's yeast ; can be fatal.		
Schizophyllum commune	A mushroom forming fungi that has been reported to cause infection of the palate and mouth.		
Scopulariopsis	Has been responsible for pulmonary disease, eye infections and Hypersensitivity Pneumonitis ; an allergenic agent.		
Scopulariopsis brevicaulis		1 & 3	
Sporobolomyces (not specified)		1 & 3	
Sporothrix schenckii	Sporotrichosis - a worldwide subcutaneous fungal disease which is most commonly a chronic infection. Often called the `Rose Bush' disease because it occurs so often among gardeners who raise roses and are exposed to stabs from thorns. The fungus enter the body through trauma or injury, and, if successful against the body's defenses, will multiply and grow toward lymphatic tissues, causing lymph nodes to swell, suppurate (form pus), ulcerate (break through to the skin) and drain. The formation of a train of ulcerations along the lymph nodes is critical to diagnosis.		
Stachybotrys chartarum	Implicated in a cluster of fatal pulmonary hemorrhage/hemosiderosis among infants. NOTE: Stachybotrys often has a germ mycelium that is buried inside water damaged surfaces that may be inaccessible to chlorine.	1	trichothecene mycotoxins (IE: Satratoxin F, Satratoxin G, Satratoxin H, Sporidesmin G, Verrucaridin J, Roridin E.
Stemphylium	Hypersensitivity Pneumonitis ; an allergenic agent.	1	
Stigmina negundis		1	
Streptomyces somaliensis	Actinomycotic Mycetoma - a cutaneous subcutaneous disease characterized by localized, deforming, swollen, pus-forming or abscessed draining lesions.		
Tilletia caries		1	
Tilletiopsis (not specified)		1	
Torula (not specified)		1	

GENUS (& species)	HEALTH EFFECT	ALLERGEN TYPE 1 or 3	MYCOTOXIN
Torulopsis glabrata	Torulopsosis fungemia - a blood-borne infection occurring mostly in compromised patients following gastrointestinal and urinary tract surgery.		
Trichoderma (not specified)	Hypersensitivity Pneumonitis ; an allergenic agent.	1	
Trichoderma harzianum			Gliotoxin Isocyanides T2-toxin Trichodermin
Trichoderma viride			Gliotoxin T2-toxin Trichodermin
Trichophyton concentricum	One of the causative agents of ringworm. This fungi produces lesions that are concentrically arranged rings of inflamed scales scattered over most of the body. Treatment is usually followed by relapse with lesions itching and scaling more than in previous eruptions.		
Trichophyton mentagrophytes	One of the causative agents of ringworm.		
Trichophyton rubrum	Ringworm of the hands and feet. May produce a chronic infection that is difficult to treat and may require long term oral doses of griseofulvin 500 mg/day.	1	
Trichosporon beigelii		3	
Trichosporon cutaneum	White Piedra - characterized by the growth of soft, white-to-light-brown nodules around shafts of the hair. Not only hair on the scalp of the head, but also facial hair (beards and mustache), armpits, and genital area.		
Trichothecium (not specified)		1	
Ustilago (not specified)	Ustilagosis - a cutaneous infection. A known fungus that causes 'smut' in plants.	1	
Ustilago avenae		1	
Ustilago hordei		1	
Ustilago maydis		1	
Walleimia sebi		1	Walleminol

Key:

Allergen: Type 1 - immediate reaction  
Allergen: Type 2 - delayed reaction

**MEDICAL AND IN VITRO**  
**EFFECTS OF MAJOR MYCOTOXINS**  
**OF INDOOR FUNGI**

MYCOTOXIN	EFFECT
Altenuene	cytotoxic
Altenuisol	cytotoxic
Alternariol	cytotoxic acutely toxic teratogenic
Alternariol monomethyl ether	cytotoxic acutely toxic mutagenic
Altertoxins	cytotoxic mutagenic
Austocystins	cytotoxic genotoxic
Botryodiplodin	mutagenic
Brevianamide A	teratogenic
Citreviridin	neurotoxic acutely toxic (oral LD-50 29 mg/kg rat)
Citrinin	nephrotoxic acutely toxic (oral LD-50 110 mg/kg mouse)
Cyclopiazonic acid	mutagenic neurotoxic toxic to internal organs acutely toxic (oral LD-50 36-63 mg/kg in rats 0.25 -0.5 mg/kg in dogs)
Decumbin	cytotoxic acutely toxic (oral LD-50 62 mg/kg in cockerel)
Ergonamine	neurotoxic
Emodin	cytotoxic mutagenic acutely toxic (oral LD-50 3.7 mg/kg in cockerel > 1000 mg/kg in mice)
Flavoglaucin	hepatotoxic
Funigaclavine A,B,C	gastrointestinal toxicity acutely toxic (oral LD-50 150 mg/kg in cockerel)
Fumigatoxin	neurotoxic acutely toxic (oral LD-50 0.15 mg/kg in mice)

MYCOTOXIN	EFFECT
Fumigillin	gastrointestinal and dermal toxicity
Fumitremorgen A,B	neurotoxic
Gliotoxin	immunosuppressive cytotoxic mutagenic acutely toxic (oral LD-50 45-65 mg/kg in rodents and rabbits)
Helvolic acid	hepatotoxic
Malformin C	acutely toxic (oral LD-50 0.9 mg/kg in rats)
Mycophenolic acid	mutagenic immunosuppressive acutely toxic (oral LD-50 450 mg/kg in rats)
Ochratoxin	tumorigenic cytotoxic nephrotoxic hepatotoxic teratogenic immunosuppressive acutely toxic (oral LD-50 20-22 mg/kg in rats)
Omega-hydroxyemodin	mutagenic
Oxalic acid	neurotoxic gastrointestinally toxic
Paecilotoxins	acutely toxic (oral LD-50 5.4-6.3 mg/kg in mice)
Penicillic acid	cytotoxic hepatotoxic acutely toxic (oral LD-50 600 mg/kg in mice)
Penitrem A	neurotoxic
Roquefortine C	neurotoxic
Roridin E	gastrointestinally toxic
Satratoxin G	cytotoxic
Satratoxin H	gastrointestinally toxic acutely toxic (oral LD-50 1.4 mg/kg in mice)
Secalonic acid D	pneumotoxic acutely toxic (oral LD-50 400 mg/kg in mice)
Sporidesmin G	gastrointestinally toxic
Stemphytoxin III	mutagenic

MYCOTOXIN	EFFECT
Sterigmatocystin	nephrotoxic hepatotoxic gastrointestinally toxic carcinogenic acutely toxic (oral LD-50 120 mg/kg in rats)
Tenuazonic acid	cytotoxic teratogenic hepatotoxic nephrotoxic acutely toxic
T2-toxin	cytotoxic genotoxic gastrointestinally and dermally toxic immunosuppressive acutely toxic (oral LD-50 10.5 mg/kg in mice)
Trichodermin	gastrointestinally toxic
Verrucarol	dermally toxic
Verruculogen	neurotoxic acutely toxic (oral LD-50 126.7 mg/kg in mice)
Versicolorin	genotoxic
Viomellein	nephrotoxic hepatotoxic teratogenic
Xanthocillin X	acutely toxic (oral LD-50 40 mg/kg in mice)
Xanthomegnin	hepatotoxic genotoxic

KEY:

- cytotoxic - Attacks the internal structures of living cells
- teratogenic - Toxic to unborne children
- mutagenic - capable of producing gene mutations
- neurotoxic - attacks the body's nervous system
- genotoxic - attacks or modifies DNA
- nephrotoxic - attacks the kidneys
- hepatotoxic - attacks the liver
- immunosuppressive - suppresses the body's immune system
- gastrointestinally toxic - toxic to the digestive track
- dermally toxic - toxic to the skin

## HYPERSENSITIVITY PNEUMONITIS AND ITS AGENTS

DISEASE	AGENT
Humidifier lung	Aureobasidium pullulans Paecilomyces lilacinus Aspergillus fumigatus Acremonium spp. Penicillium spp.
Malt worker's lung	Aspergillus fumigatus Aspergillus clavatus
Sequoiosis	Aureobasidium Graphium
Maple bark disease	Cryptostroma corticale
Woodworker's lung	Alternaria
Cheese washer's lung	Penicillium "casei"
Sauna taker's lung	Aureobasidium
Lycoperdonosis	Lycoperdon (puffball) spores
Compost lung	Aspergillus fumigatus
Paprika splitter's lung	Rhizopus stolonifer
Wood trimmer's disease	Rhizopus rhisopodiformis Aspergillus fumigatus Penicillium spp.
Japanese summer house hypersensitivity	Trichosporon beigelii
Hot-tub lung	Cladosporium
Winegrower's lung	Botrytis cinerea
Woodman's disease	Penicillium spp.
Straw hypersensitivity	Aspergillus versicolor
Citric acid fermentation hypersensitivity	Penicillium spp. Aspergillus fumigatus Aspergillus niger
Shower curtain hypersensitivity	Phoma violacea
Maize grain hypersensitivity	Aspergillus flavus
Suberosis (cork lung)	Penicillium glabrum
Mushroom culture hypersensitivity	Pleurotus ostreatus Pholiota nameko
Oat grain hypersensitivity	Aspergillus fumigatus
Farmer's lung	Aspergillus umbrosus Aspergillus fumigatus
Mouldy wall hypersensitivity	Penicillium spp. Cladosporium spp. Aureobasidium pullulans
Household timber hypersensitivity	Serpula pinastri

DISEASE	AGENT
Sausage worker's lung	Penicillium jensenii
Rabbit farm hypersensitivity	Aspergillus clavatus
Apple store hypersensitivity	Penicillium spp. Alternaria alternata