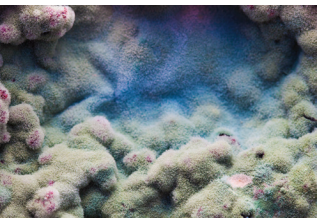
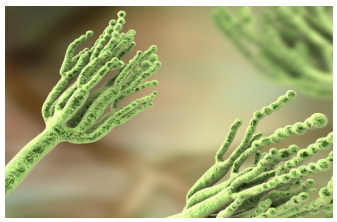
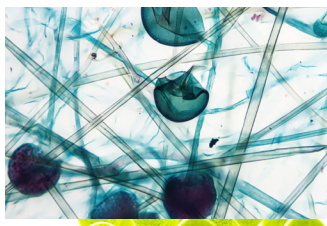
AIRBORNE MOLDS OF ALLERGENIC IMPORTANCE



HollisterStier
Allergy

INTRODUCTION

Molds (fungi) are widespread in nature being found in great numbers in soil and in the air. Increasingly, molds are being recognized as important etiologic agents of human diseases, particularly allergic diseases.

Fungi can be of clinical significance in many types of clinical disorders. Mold spores have been found to be a very important cause of nasal allergy. Respiratory complaints can occur from contact with airborne spores or mycelial fragments. Dermatitis has been attributed to inhalation of fungal material, as well as from absorption from skin colonization or invasion of other tissues. Urticaria, secretory otitis and other complaints have been attributed to mold hypersensitivity. Therefore, it is becoming more and more necessary for the clinician to know and understand the role of molds in disease manifestations.

HollisterStier Allergy has developed this booklet of full color macroscopic and microscopic pictures of fourteen of the most prevalent molds found in the United States. By using the pictures and the descriptions of each mold found on the back of the page, this booklet can be useful as an aid in identification of common airborne molds and their habitat.

INDEX

HollisterStier Allergy

ALTERNARIA TENUIS

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 450X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS:	*Alternaria*
SPECIES:	*tenuis*
SYNONYM:	*Alternaria alternata*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony has a cottony appearance and is grey-green when young, and turns green-black at maturity.

MICROSCOPIC VIEW
The spores are pear-shaped, multicellular, and range from 12 to 50 microns in length. The spores occur in chains with the youngest and smallest spore at the distal end of the chain.

COMMON SOURCE
Grows as a saprophyte or parasite on plants and plant materials. The spores are easily made airborne and can be readily identified in air samples.

ALLERGENIC IMPORTANCE
Considered to be one of the most common causes of symptoms due to allergy to airborne mold spores.

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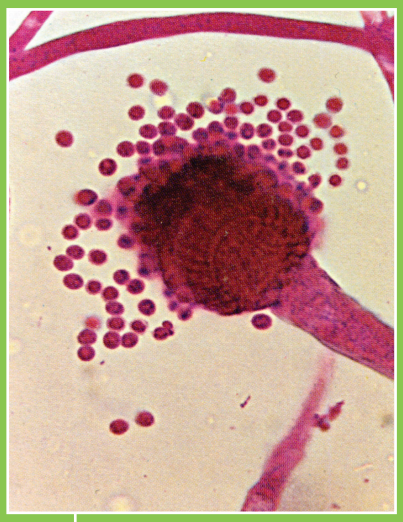
ASPERGILLUS FUMIGATUS

PETRI DISH CULTURE, TOP OF COLONY



MICROSCOPIC STRUCTURE
(MAGNIFICATION 1000X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Moniliaceae
GENUS :	*Aspergillus*
SPECIES:	*fumigatus*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony is yellow-white when young, but rapidly changes to green and finally becomes almost black. Growth is raised with aerial mycelium extending above the colony bearing tremendous numbers of green spores.

MICROSCOPIC VIEW
The conidia are in columnar chains extruded from tubular cells or phialides. The conidia are dark green in mass, globose and approximately 2.5 to 3 microns diameter.

COMMON SOURCE
Aspergillus fumigatus is a common soil fungus. It can also be found growing on almost any substrate. It is frequently found on damp hay, grain, sausage and fruits.

ALLERGENIC IMPORTANCE
Aspergillus fumigatus is the most important species of the *Aspergillus* genus causing respiratory disease in man. It has been incriminated in fungal asthma, pulmonary eosinophilia, saprophytic infections and hypersensitivity alveolitis. The incidence of positive skin test reactions in fungi sensitive patients is lower than is found in the Dematiaceae family.

HollisterStier Allergy

CURVULARIA

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 450X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS :	*Curvularia*
SPECIES:	*spicifera*
SYNONYM:	*Cochliobolus spicifer*

MACROSCOPIC VIEW (Sabouraud Agar)
The colonies are low growing, broadly spreading with a velvet-like surface. The centers of the colonies are grey-brown surrounded by mycelia of a lighter color. The periphery of the colonies are dark.

MICROSCOPIC VIEW
The conidia are borne at the tip or spirally arranged on the conidiophores singly or in clusters of 3 or 4. They are 3 to 5 celled, typically bent or curved, with 1 or 2 of the central cells enlarged. The conidiophores are brown, usually unbranched, and septate.

COMMON SOURCE
Curvularia spicifera is a soil-borne organism and also grows as a saprophyte or parasite on plants and plant material.

ALLERGENIC IMPORTANCE
Curvularia spicifera shows some cross-reactivity and shares some antigens with other members of the family Dematiaceae.

EPICOCCUM

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 450X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Tuberculariaceae
GENUS:	*Epicoccum*
SPECIES:	*nigrum*

MACROSCOPIC VIEW: (Sabouraud)
The colony is reddish-brown in color with a yellow periphery. Surface is rough in appearance due to numerous black sporodochia (fruiting bodies consisting of compact masses of interwoven conidiophores).

MICROSCOPIC VIEW
The conidia are borne singly at the tips of dark, rather short conidiophores. The conidia are globose or ellipsoid, dark, smooth or spiny or knobby, often reticulate on the surface, one celled or divided into more than one cell.

COMMON SOURCE
Epicoccum nigrum is normally a soil organism and can often be found on decaying vegetative material, plant leaves and uncooked fruit.

ALLERGENIC IMPORTANCE
Epicoccum nigrum elicits an allergenic response in a moderate number of mold sensitive patients. *Epicoccum nigrum* sensitive patients appear to have increased symptoms in the late summer and fall.

CEPHALOSPORIUM

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 450X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Moniliaceae
GENUS :	*Cephalosporium*
SPECIES:	*acremonium*
SYNONYM:	*Sarocladium strictum*

MACROSCOPIC VIEW: (Sabouraud Agar)
The colony is round, dense, having a soft woolly appearance. It is white when young and turns very lightly rose-colored as the colony matures.

MICROSCOPIC VIEW
The condiophores arise at right angles from the creeping hyphae as short branches of aerial hyphae, erect, non-septate, not swollen at the tip. The conidia are approximately 1 micron by 4 microns, and are borne at the tip of the conidiophore.

COMMON SOURCE
Cephalosporium acremonium is a common soil inhabitant and has been isolated from dust in textile plants.

ALLERGENIC IMPORTANCE
Cephalosporium acremonium has been incriminated as a causative agent of hypersensitivity pneumonitis. It also can be a cause of immediate type hypersensitivity from the inhalation of its spores. Cephalosporin antibiotics do not cross-react with spores from *Cephalosporium acremonium*.

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 1000X)

FUSARIUM

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Tuberculariaceae
GENUS :	*Fusarium*
SPECIES:	*vasinfectum*
SYNONYM:	*Fusarium oxysporum vasinfectum*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony is low growing and has fine, cobweb-like mycelia. The color is white when young and becomes light pink or salmon colored upon aging.

MICROSCOPIC VIEW
The macroconidia grow in clusters and are crescent shaped with tapering ends. There are one to nine septations per conidia. The mature macroconidia or spores of the various species range from 2-7 x 5-120 microns. Microconidia are also produced in small numbers and are fusiform or lemon-shaped. They are usually one celled but may rarely contain one septation. The lemon-shaped microconidia are 5-6 microns diameter and the fusiform shaped microconidia range from 1-3 x 5-10 microns.

COMMON SOURCE
Fusarium vasinfectum grows as a parasite on green plants such as peas, beans, cotton, tomatoes, corn, sweet potatoes and rice. Many species are also saprophytic forms on decaying plants.

ALLERGENIC IMPORTANCE
Fungus sensitive patients who react to *Fusarium vasinfectum* extracts are found with a frequency similar to members of the Moniliaceae family such as *Aspergillus* and *Penicillium*.

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 1000X)

HORMODENDRUM

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS :	*Hormodendrum*
SPECIES:	*cladosporioides*
SYNONYM:	*Cladosporium cladosporioides*

MACROSCOPIC VIEW (Sabouraud Agar)
The colonies are a dark olive-green with a folded, velvet-like surface. Radial striations run from the center of the colony to the periphery.

MICROSCOPIC VIEW
The spores are elliptical with a smooth to spiny surface and are 3 to 7 microns in length. The spores are formed by budding, and appear as clusters on the end of the conidiophore.

COMMON SOURCE
Decomposing plants, leather, rubber, cloth, paper and wood products. In nature, the spores are released to the atmosphere in great numbers after rains and damp weather.

ALLERGENIC IMPORTANCE
Hormodendrum cladosporioides is the most abundant mold spore identified in air samples and often occurs as heavy showers of spores. *Hormodendrum cladosporioides* ranks second only to *Alternaria tenuis* in the frequency of symptoms from inhalation of spores.

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PENICILLIUM NOTATUM

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 1000X)

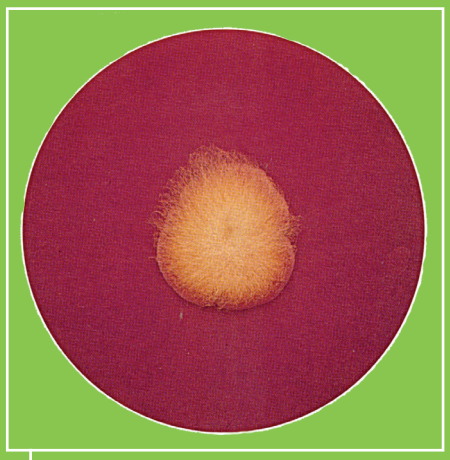
CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Moniliaceae
GENUS :	*Penicillium*
SPECIES:	*notatum*
SYNONYM:	*Penicillium chrysogenum var. chrysogenum*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony is white when young and turns blue-green at maturity. The colony has a compact wool-like appearance with ridges running from the center of the colony to the edge.

MICROSCOPIC VIEW
Conidia or spores are borne in chains which typically form a brush-like head. Conidia are spherical to oval and are 2.6 to 3.2 microns in diameter. Conidia are borne by budding from flask shaped cells which grow in whorls at the tip of the conidiophore.

COMMON SOURCE
Normally a soil inhabitant, but grows readily on fruits, breads, cheese and other foods. Mutant strains are used to produce the antibiotic penicillin.

ALLERGENIC IMPORTANCE
Allergies to the airborne spores and mycelial fragments are less frequent than the members of the Dematiaceae family. Injection of the by-product penicillin often induces an allergic response which may, upon continued usage, induce anaphylactic shock in the patient. However, penicillin is produced from only a few strains of penicillium which occur rarely in normal exposure. The highly purified antibiotics made today do not cross react with the allergens of the spores and mycelia.



PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION: TOP 450X, BOTTOM 100X)

MUCOR

CLASS:	Phycomycetes
ORDER:	Mucorales
FAMILY:	Mucoraceae
GENUS :	*Mucor*
SPECIES:	*racemosus*

MACROSCOPIC VIEW (Modified Sabouraud Agar)
The colony color is pale yellow-brown. On agar plates without inhibitors, colony growth will completely cover a plate in 48 hours. Aerial mycelia form a heavy turf, in excess of ½" high from the surface of the agar. At colony maturity, the sporangia appears to the unaided eye as brown dots at the tips of the aerial mycelia.

MICROSCOPIC VIEW
The upper portion of the photomicrograph is a high magnification of a mature sporangium which has ruptured to liberate the yellow sporangiospores. The sporangium is stained pale pink and shows the point of rupture on the left of the sporangium just above the sporangiophore. The spores are elliptical in shape and 5 to 8 by 6 to 10 microns in size. The lower half of the photograph is a low magnification of an immature sporangium, the sporangiophore and its attachment to the mycelium. The lack of rhizoids opposite the sporangiophore base on the mycelium is a distinguishing characteristic between the genera *Mucor* and *Rhizopus*. The mycelium shows the absence of septa which is a characteristic of the order Mucorales.

COMMON SOURCE
A normal soil inhabitant. Frequently found around barns and barnyards where it grows on animal waste

ALLERGENIC IMPORTANCE
Mucor racemosus is widespread in nature and elicits allergenic response in a moderate number of mold-sensitive patients.

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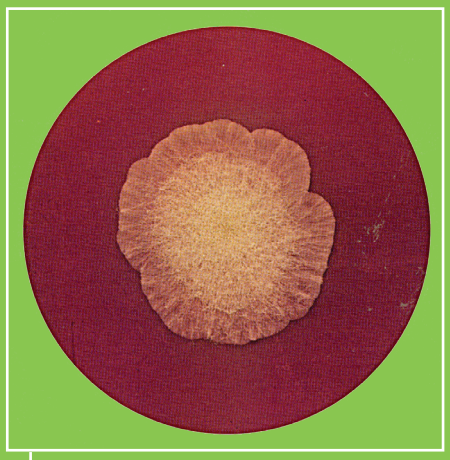
RHIZOPUS



PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION: TOP 450X, BOTTOM 100X)

CLASS:	Phycomycetes
ORDER:	Mucorales
FAMILY:	Mucoraceae
GENUS :	*Rhizopus*
SPECIES:	*nigricans*
SYNONYM:	*Rhizopus stolonifer*

MACROSCOPIC VIEW (Modified Sabouraud Agar)
The colonies are white when young and turn brown or black at maturity. On media without inhibitors, colony growth is very rapid. The mycelium will completely fill a petri dish in 48 hours. Brown or black sporangia at the tips of the aerial mycelia are visible to the unaided eye and appear as black dots.

MICROSCOPIC VIEW
The upper portion of the photomicrograph is a high magnification of two mature sporangia. The spores are plainly visible in the smaller sporangium. The spores are elliptical and are 9 to 12 microns long by 7.5 to 8 microns in diameter. The sporangia which contain the spores are 100 to 350 microns in diameter. The lower portion of the photomicrograph is a low magnification showing the apophyses (swelling at the top of the sporangiophore which is the base of the sporangium), the sporangiophore and the typical rhizoids (root-like structure) at the base of the two sporangiophores. The presence of rhizoids is the main characteristic difference between *Rhizopus nigricans* and *Mucor racemosus*.

COMMON SOURCE
Rhizopus nigricans grows readily on bread, cured meats and root vegetables indoors. It grows on a variety of plants in nature and is very widespread in distribution.

ALLERGENIC IMPORTANCE
Rhizopus nigricans is widespread in nature and elicits allergenic response in a moderate number of mold-sensitive patients.

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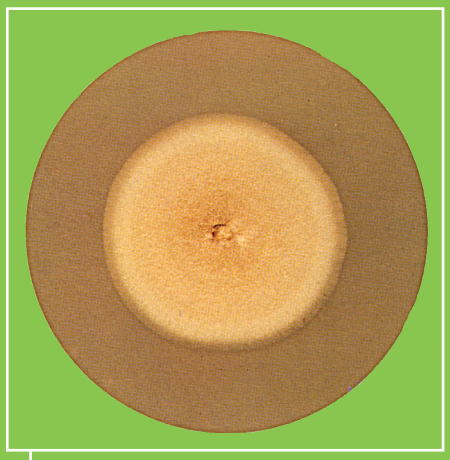
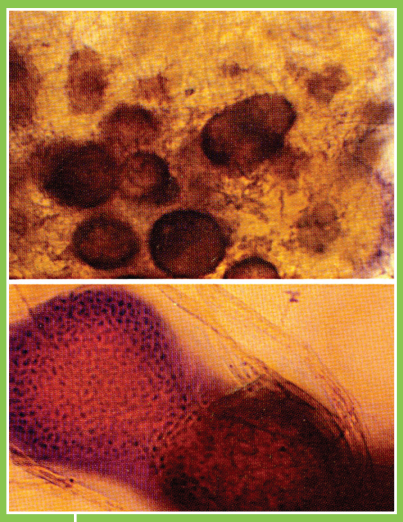
PHOMA



PETRI DISH CULTURE, TOP OF COLONY



MICROSCOPIC STRUCTURE
(MAGNIFICATION: TOP 100X, BOTTOM 450X)

CLASS:	Fungi Imperfecti
ORDER:	Spheropsidales
FAMILY:	Sphaeriodaceae
GENUS :	*Phoma*
SPECIES:	*herbarum*
SYNONYM:	*Phoma exigua var. exigua*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony is low growing, light to dark brown and has a felt-like appearance. Dark brown to black pycnidia (spherical spore producing structures) grow at random on the colony producing a granulated appearance.

MICROSCOPIC VIEW
The upper half of the photomicrograph is a low magnification of several pycnidia. The opening where the spores are extruded from the pycnidium can be seen as a light round area on the pycnidium in the center of the photograph. The lower half of the photomicrograph is a high power view of a pycnidium which has been manually ruptured to liberate the mass of spores. The individual spores are egg shaped to almost spherical and 4 microns by 5 to 7 microns in size. The pycnidia, which contains the spores, may grow as large as 500 microns in diameter.

COMMON SOURCE
Phoma herbarum grows readily on paper products such as books and magazines. It also grows on certain paints and green plants.

ALLERGENIC IMPORTANCE
Extracts of *Phoma herbarum* frequently produce skin reactions in mold-sensitive patients. It is widespread in nature and isolated frequently from air samples.

PULLULARIA PULLULANS

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 450X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS :	*Pullularia*
SPECIES:	*pullulans*
SYNONYMS:	*Aureobasidium pullulans var. pullulans*

MACROSCOPIC VIEW (Sabouraud Agar)
Young colonies are mucoid and yeast-like. No aerial mycelia are produced. The colony is black in the center with a grey mottled zone around the black center. The periphery of the colony is colorless. In old cultures, the entire colony becomes black and has a leather-like appearance.

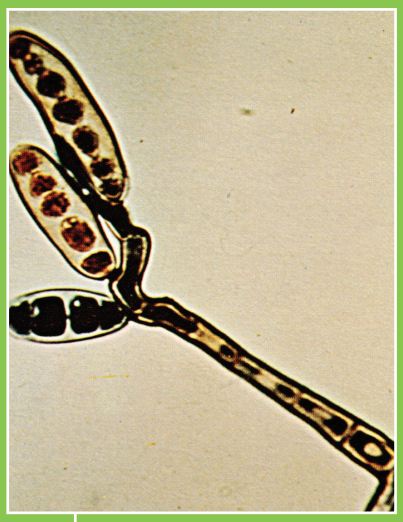
MICROSCOPIC VIEW
The spores appear hyaline and bud from brown. Branching mycelial threads. Upon aging, the mycelial threads divide into isodiametric cells with rounded sides that contain spherical bodies filled with oil. The spores are approximately 1 x 3 microns and the isodiametric cells are approximately 3 x 4 to 5 x 5 microns.

COMMON SOURCE
Pullularia pullulans is normally found in soil but also grows on decaying vegetation, plants and chalking compounds.

ALLERGENIC IMPORTANCE
The clinical significance of *Pullularia pullulans* is somewhat less than other members of the same family. It frequently occurs in large numbers or showers, presumably due to environmental factors.

HELMINTHOSPORIUM

PETRI DISH CULTURE, TOP OF COLONY



MICROSCOPIC STRUCTURE
(MAGNIFICATION 2000X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS :	*Helminthosporium*
SPECIES:	*interseminatum*
SYNONYM:	*Dendryphiella vinosa*

MACROSCOPIC VIEW (Sabouraud Agar)
The colony at maturity is reddish-brown. The growth has a cottony appearance. The reverse side of the colony shows radial striations and is red-brown.

MICROSCOPIC VIEW
The spores are bean-shaped with three to four septa. They are borne terminally or laterally on short conidiophores and are brown in color when unstained. They are 15-23 x 5-7 microns.

COMMON SOURCE
Pathogen or saprophyte on cereal grain plants such as corn, wheat, oats and rye.

ALLERGENIC IMPORTANCE
Helminthosporium interseminatum, along with the other members of the same family, are responsible for the majority of symptoms due to inhalation of mold spores.

STEMPHYLIUM

PETRI DISH CULTURE, TOP OF COLONY

MICROSCOPIC STRUCTURE
(MAGNIFICATION 100X)

CLASS:	Fungi Imperfecti
ORDER:	Moniliales
FAMILY:	Dematiaceae
GENUS :	*Stemphylium*
SPECIES:	*botryosum*
SYNONYM:	*Pleospora tarda*

MACROSCOPIC VIEW (Sabouraud Agar)
Colonies develop white, wool-like mycelia when young. The reverse of the colony is dark grey to black. As the colony reaches maturity, the color changes to a dark olive green or black.

MICROSCOPIC VIEW
The mycelium appears dark amber in color with numerous septations. The spores are brown to black, elliptical, 25 to 40 by 16 to 20 microns in size and contain two to four septations perpendicular to the length of the spore to form two to five compact segments. One or more segments also contain septa parallel to the length of the spore. The spores are borne singly and terminally on very short conidiophores. In some species the conidiophores contain septations and in other species the conidiophores are so short the spores appear to grow directly from the mycelia.

COMMON SOURCE
Grows readily on damp paper, canvas and cotton fabric, as well as decaying plant material.

ALLERGENIC IMPORTANCE
Stemphylium botryosum shows cross-reactivity with *Alternaria tenuis* by skin test. However, *Stemphylium botryosum* is isolated from air samples much less frequently than *Alternaria tenuis*.

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