R34.4

RINGWORM FUNGI

In CULTURE -

They present a MYCELIUM of branching septate hyphae, having a diameter averaging 4.0 to 5.0 micra, resembling the mycelium of many common saprophytes.

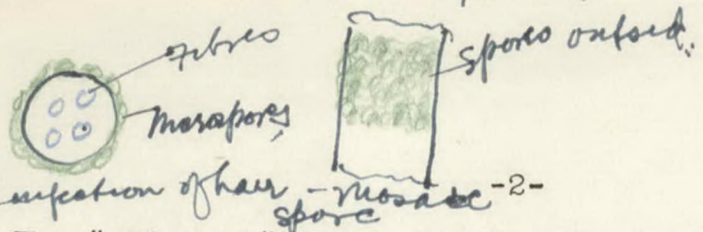
SPORES - CHLAMYDOSPORES, in which protoplasm with food reserve accumlates in one segment which then becomes separated by cross walls from the remainder of the hypha and develops a thick resistant cell wall. Chlamydospores may be terminal, lateral or intercalary (in the continuity of a hypha) on the hyphae. The hyphae giving rise to chlamydospores become denuded of their protoplasm and degenerate but the resistant chlamydospore remains attached and, under favourable conditions, germinates and reproduces a young mycelium. The chlamydospore may be developed by any species and in some species (particularly those having "glabrous" colonies) is almost the only means of reproduction by spores in culture.

ALEURIOSPORES - these are smaller spores (3.0 to 4.0 micra by 2.0 to 3.0 micra) developed as lateral or terminal buds or intercalary, which have much the same morphological significance as the chlamydospore. They are separated from the parent hypha by septa and appear as bright highly refractile bodies attached to the exhausted mycelium. They remain attached (like the chlamydospores) and, if freed by violence, they show a tag of the parent hypha attached to their more flattened end. In some species their production is scanty and they appear as lateral bodies along the length of an exhausted hypha, but in certain species they are produced in great numbers and form clusters (en grappe conidienne) about the terminations of the hyphae. When very numerous, they give to the surface of the ringworm colony a powdery or chalky appearance (gypseum group of ringworm fungi).

SPINDLE BODIES - (pluri-septato fuseau) are large spindle-shaped or fusiform spores usually divided by one or numerous septa into two or more cells. They vary greatly in size but may be 50.0 to 80.0 micra long by 7.0 to 14.0 micra in width. They may contain a single cell or up to five or seven cells. Sometimes they terminate in a long filament-like structure. The surface may be smooth or ornamented by tubercles or spines. These and other characters vary with the species of ringworm fungus. The spindle-body is the characteristic spore form of the ringworm fungi and has given rise to the name "Closterosporeae" for the sub-family. Spindle-bodies do not occur on all ringworm fungi; they are always absent from those species which develop glabrous (smooth or waxy) colonies. They are borne laterally or terminally on the hyphae and, in certain species, develop in clusters or "bouquets".

ARTHROSPORES - (mycelial spores) are formed by the segmentation of the terminal portions of hyphae with more or less separation of the cubical segments forming chains of cubical or rounded spores. Arthrospores in culture are found chiefly in species forming glabrous cultures. In parasitic life they are the only kind of spores formed and are found in all species.

the only way to identify fungi is the by use of the first culture in which it is grown.



The "clinical" types forming the basis of Sabouraud's classification:

(1) MICROSPORUM - The basal portion of the infected hairs is surrounded by a sheath of closely aggregated small spores extending a few mm. above the mouth of the follicle. The spores are 2 to 3 micra in diameter, rather polyhedral from reciprocal pressure and are arranged in a "mosaic" pattern and not in chains.

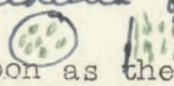
Infection reaches the hair follicles from the surrounding skin. Hyphae emerge from epidermis at mouth of follicle and pass down between hair and follicular wall. There is an aggregation of mycelium at the follicular mouth and from this large hyphae pass down on the surface of the hair; some passing between the scales of the cuticle reach the interior of the hair where they branch repeatedly, ending in a brushwork of fine branches; "Adamson's fringe" at the junction of hair bulb and shaft. Most of the large hyphae, however, remain on the surface of the hair where they break up, by fission in two planes into the small spores referred to above. Some of the interior fibres reach the surface again and contribute to the maintenance of the external spore sheath.

The effect of Microsporum is to destroy the cuticle of the hair rendering the hair brittle so that it breaks off a few mm. above the follicle. The fungal sheath on the exposed part of the hair is due to the growth of the infected hair: the course of growth of the fungus is always downwards, towards the hair bulb.

Microsporum infection covers large areas of the scalp; usually the whole scalp, The surface is covered by grey scales surrounding broken grey hairs 3 to 5 mm. long.
Young children susceptible up to 15 years, at which age the infection resolves spontaneously. Adults are not susceptible.
It is a human parasite and it rarely attacke the glabrous skin.

(2) TRICHOPHYTON - (Endotrichophyton and Ectotrichophyton). The distinguishing character is the presence in infected hairs of an intrapilary mycelium composed of large rounded or cubical spores arranged in chains. In the Microides group the spores are small.

The mode of invasion of the hair is very similar to that given for Microsporum. All infection is inside the hair and not outside as Microsporum the medulla of hair is destroyed and you can not get part of hair to examine no external sheath.



ENDOTHRIX GROUP - As soon as the invasion of the hair is accomplished the external mycelium disappears so that the infection becomes purely intrapilary. The medulla of the hair is destroyed and its place taken by chains of large cubical or ovoid spores. Hairs infected by Trichophyton Sabouraudi tend to break off flush with the mouth of the follicle leaving small bald areas stippled with black dots marking the mouths of the follicles. In infection by Tri.crateriformis (Tri.tonsurans) the spores are more cubical and form what Sabouraud called a "resistant mycelium". The infected hairs occur in very small parches with healthy hairs in between. These infected patches are often scaly and short distorted hairs containing the fungus may be found embedded in the scales.

The endothrix species are human parasites and are found on children, adults being insusceptible. Resolution takes place at adolescence but infection of the finger nails may persist throughout adult life.

Glabrous skin, nails and beard area may be infected.

NEO-ENDOTHRIX GROUP - Similar to pure endothrix but on an occasional hair the primitive extra-pilary sheath of fungus still persists.
The few species found on man have been, apparently, from animal sources of infection.

ECTOTHRIX GROUP — External + internal infection.

MEGASPORES - Hair condition similar to that seen in ENDOTHRIX infections but there is always an external spore sheath present as well as the intrapilary spores. The intrapilary mycelium causes more destruction than the external sheath.

MICROIDES - Invasion of interior of hair is much less than in megaspores but the external sheath is more abundant and consists of small spores about the size of those of Microsporum, but the spores of microids are arranged in chains and not in a mosaic. The effect on the hair is rather similar to that caused by microsporum.

Ringworm parasites of animals may infect human adults. Severe inflammatory and pustular ringworm infections in man are usually caused by fungi from animals. "Kerion", "Sycosis", "Agminate Folliculitis" etc.

(3) ACHORION - The cause of favus.
Infection starts in neighbourhood of hair follicle but the mycelium tends to remain under the horny layer as it invades the follicular wall. The yellow mycelium of Achorion Schönleini accumulates at the mouth of the follicle forming a cone with apex towards the base of the follicle; the infected hair, which is only slightly invaded by mycelium, forming an axial structure in the mass of mycelium and epithelium. Favic shield or button and favic cup. Removal of the favic plug leaves a moist glistening surface, of the deeper layers of the epithelium. Invasion may reach the dermis and scarring from favic lesions with a linear form of baldness may result.
Favus may attack the glabrous skin or the nails.
A. Schönleini is a strictly human parasite and although infection takes place in childhood the disease may persist throughout adult life.
The name Achorion was applied to A. Schönleini because of the supposed absence of a cell wall in certain forms of the mycelium. Sabouraud uses the generic name Achorion for all fungi causing favus in animals although few of these fungi present any of the features of A. Schönleini. The colonies of A. Schönleini in culture are cerebriform and waxy-looking, and Sabouraud has applied the name "faviform" to this kind of colony, so that we find faviform cultures amongst the Trichophytons which never cause favus.

EPIDERMOPHYTON Lang 1879.

Ringworm fungi which never attack hairs but cause disease of the glabrous skin, in moist areas chiefly. under mammary
Scales taken from the periphery of the lesion show an abundance of filaments 4-5 micra in diameter, formed of quadrangular cells disposed end to end and easily dissociated. The filaments are disposed horizontally in the layers of the horny stratum of the epidermis. The hair is not invaded, nor (in uncomplicated cases) does suppuration occur.

Intertrigo between the toes, "Athletes' Foot" "Dhobies' Itch".

The fungus, introduced from infected feet, can live saprophytically on the algal slime on moist wood or stonework on bathroom floors, etc; hence infections common in tropics causing, in males, dhobies' itch. In England and America not uncommon in schools and amongst athletes - swimming and shower baths - causing athletes' foot and dhobies' itch in males and foot infections in females. May attack other parts, as axillae, buttocks, inframammary crease or even the face and scalp. causes disability

ENDODERMOPHYTON Cast 1909.

Never attack hairs but grow deeply in the skin below the more superficial strata, giving rise to a lesion of concentric circles consisting of the "lifted up" free margins of scales imbricated outwards - the tropical skin disease known as "Tokelau Disease" or tinea imbricata. May spread all over body and, like Epidermophyton, may attack persons of any age.

In lesions an abundance of mycelium in a network of hyphae and chains of cubical or rounded mycelial-spores, rather irregular in size.
In culture glabrous colonies. Aleuries and spindle bodies never formed but only arthrospores and chlamydospores.

Ringworm fungi recovered from the blood stream in head infections, etc.

Mycids - Evidence of hypersensitization of skin, may be a generalized rash or a local lesion may be caused anywhere by applying fungus (ringworm) material without causing a local infection. Fairly common as a "hydrocistoma-like" condition of hands in cases of epidermophytosis of feet.

Sabouraud's Proof Medium:

Maltose brute de Chanut	40 grms.
Peptone granulee de Chassaing	10 "
Agar	18 "
Water	1000 "

Sabouraud's Preserving Medium:

Peptone granulee de Chassaing	30 grms.
Agar	18 "
Water	1000 "

Pleomorphism - changes taking place when fungi are grown on culture - loss of spore forming - tending to be woolly - Due to growth in sugar medium long and also high temperature -
Preserving Medium. 3% Peptone + Agar -

Three Divisions of the FUNGACEAE

Division I. MYXOMYCETES: (Slime fungi)
The vegetative body a multinucleate naked plasmodium.

Division II. SCHIZOMYCETES: (Bacteria)
Vegetative body a single walled cell, nucleus absent or not of the form typical in the other fungi; reproduction by fission.

Division III. EUMYCETES: (True fungi)
Not as above; vegetative body usually filamentous, reproduction by various means.

Eumycetes: The vegetative body consists of a more or less branched filament of apical growth forming the mycelium. The thallus may also exist as independent singly cells.
The mycelium may be septate or continuous.
The cells consist of masses of protoplasm, the protoplasts, bearing vacuoles and are more or less rich in oils, acids, gums, alkaloids, sugars, resins, colouring matter etc.
The protoplast bears one, or in some fungi two, or more nuclei.
The cell wall is composed of fungous cellulose and varies with species and age; it may contain cellulose, callose and pectose, and is usually more difficult to stain than that of the bacterial cell.

The Classes of the Eumycetes

Class I. PHYCOMYCETES: Mycelium continuous (non-septate) in the vegetative stage.

Class II. ASCOMYCETES: Mycelium septate. Spores in Asci.

Class III. BASIDIOMYCETES: Mycelium septate. Spores in Basidia (Of little or no interest in animal pathology)

Group of FUNGI IMPERFECTI: Not as above. Sexual (perfect) form of reproduction not known. Reproduce by various conidial forms. Many probably heterothallic types which have become separated.
Nearly all of the fungi pathogenic to man and animals fall within this group.

Class of PHYCOMYCETES:

Distinguished by syphon-like hyphae, unicellular and multinucleate, suggesting the algae of the family Siphonaceae. Hence the Phycomycetes (alga and fungus) are called algal-fungi. Although absence of transverse septa in the hyphae is used as a fundamental characteristic, yet in the formation of reproductive organs transverse septa cut off these organs from the rest of the vegetative mycelium. (Transverse septa are found frequently in some genera, including Mucor.) Sexual spores, as well as asexual, are usually produced.

Sub-classes of the Phycomycetes:

(1) Oömycetes, in which sexual spores, when present, are heterogamous.

(2) Zygomycetes, in which sexual spores are isogamous, (formed by the union of morphologically similar gametes). Zygospores.

Subclass Zygomycetes:

Orders: (1) MUCORALES. Asexual spores multiple in the sporangium.

Order of the MUCORALES:

Mycelium profusely developed, filamentous, richly branched, when young continuous (not septate), in age sometimes provided with transverse septa, terrestrial, usually saprophytic, in some species parasitic. Aerial mycelium usually prominent. Thick-walled Chlamydospores not infrequently formed in mycelium Sporangia borne on specialized Sporangiophores which may be simple or branched. The sporangia are many spored but may be accompnaied by or replaced by small forms, Sporangiola, which contain a few or only one spore, as in Thamnidium. Sexual reproduction by conjugation of similar Gametangia (isogamy) resulting in formation of a thick-walled Zygospore. The zygospore, after a period of maturation, germinates by a germ tube which usually bears a single large apical sporangium, the germ sporangium.

A great many of the Mucorales are HETEROTHALLIC (including Mucor mucedo, Rhizopus nigricans, Phycomyces nitens, Absidia cerulea etc.) but a few are homothallic (as Sporodinia grandis, all species of Zygorhynchus, Absidia spinosa and a few species of Mucor).

Germination of Zygospores

In homothallic species such as Sporodinia grandis all the spores of the germ sporangium develop homothallic mycelia.

In the heterothallic species Mucor mucedo all of the spores of the germ sporangium are of the same sign: either + or -

In the heterothallic Phycomyces nitens the germ sporangium contains both + and - spores and sometimes a few which give rise to homothallic mycelia, but these are sexually instable and their progeny tend to segregate again into + and -

Family of MUCORACEAE

Asexual spores in typical sporangia, although in some genera few-spored.

Sporangium with COLUMELLA; Zygospores naked or thinly covered with outgrowths of the suspensor.

Sub-family MUCOREAE

Sporangial membrane thin and fugaceous throughout. Sporangia all similar.

Of this sub-family the genera Absidia, Rhizopus, Phycomyces, Zygorhynchis and Mucor are of interest to us and are described briefly on another sheet.

The SPORANGIUM and the formation of the SPORANGIOSPORES

The sporangium is usually pyriform to globose in shape. The COLUMELLA is a septum delimiting the sporangium and is usually strongly convex. It is laid down along a prominent cleavage plane in the cytoplasm and is not the result of invagination of the top of the sporangiophore into the sporangium. Other cleavage planes run progressively in all directions, arising from the columella, and sporangial wall and finally cut the protoplasm into small usually uninucleate pieces. These developing specialised walls become sporangiospores.

Genus MUCOR Micheli 1729.

Mycelium developed profusely both in and on the substratum, lacking definite rhizoids and stolons; sporangiophores not fasciculate, arising singly from the mycelium, erect, simple or somewhat branched in a monopodial or sympodial manner; all the branches terminated by sporangia; SPORANGIA large, globose, many spored; sporangial wall evanescent in most species, not cutinized, more or less incrusted with crystals of calcium oxalate; COLUMELLA always present, various in shape; SPORANGIOSPORES globose to ellipsoidal, with a thin, smooth wall; ZYGOSPORES borne on the mycelium; suspensors lacking outgrowths; copulating branches lying end to end, forming a straight line, not having the tongs-like aspect seen in certain other genera; terminal or intercalary, smooth, hyaline CHLAMYDOSPORES found in some species.

Mucor mucedo Linné

SPORANGIOPHORES erect, colourless membrane and almost colourless contents, forming a thick silver grey sward, usually unbranched, 2 to 15 mm. long by 30 to 40 μ thick. Non-septate. SPORANGIA large, globose, 100 μ to 200 μ in diameter, yellowish at first, then becoming dark grey or blackish brown, occasionally with greenish shimmer, wall spiny (oxalate crystals). Sporangial wall quickly disrupts releasing the contained spores and leaving a fringe or collar at the base of the columella.

COLUMELLA high, cylindrical, bell-shaped or globose 70 μ to 140 μ high by 50 μ to 80 μ wide, with smooth colourless membrane.

SPORANGIOSPORES cylindrical or ellipsoidal, uniform in shape (rather barrel shaped) but variable in size in the same sporangium, 6 μ to 12 μ long by 3 μ to 6 μ wide, with smooth colourless membrane.

ZYGOSPORES are heterothallic as a rule, 90 μ to 250 μ in diameter, exospore black with thick projecting tubercles, endospores colourless, contents colourless.

Mucor mucedo has been found in less than 4 per cent. of cases of otomycosis externa in man. It causes a mucorine disease of bees, and is one of the fungi found in the condition known as "whiskers" on cold storage meat.

Class of ASCOMYCETES

Characterized by the formation of ASCI containing from one to many ASCOSPORES, usually 4 or 8 or some multiple of 4. These spores usually result from a sexual conjugation of cells which may be heterogamic (or at least morphologically dissimilar) or isogamic (morphologically similar). In many species the conjugation is complete, in others only vestigial, and in some entirely absent (some Endomyces and other yeasts) - the nature of the spore formation being inferred from analogy to more perfect forms in the same group of fungi. However, a constant number of spores enclosed within a common membrane is usually accepted as a sign of an ascus.

The Ascomycetes to be dealt with in this course fall into two sub-classes:

(A) In which asci are formed within an ascigerous organ or ascocarp, which, if a closed structure, is called a PERITHECIUM (as in Aspergillus). These are within the sub-class of EUASCOMYCETES.

(B) Asci naked, separated or scattered (as in the yeasts), This is the sub-class of PROTOASCOMYCETES.

The sub-class of Euascomycetes includes some 16,000 species, most of which are saprophytes, but many are parasites on plants and a very few on animals.

Of the twelve orders of the Euascomycetes, the order of ASPERGILLALES is characterized by a perithecium, sessile, solitary and free or embedded in the stroma, in which the contained asci are arranged at various levels and not in one plane.

The family of ASPERCILLACEAE

The perithecium (which is not seen in many known species) is small and rather spherical, and its asci contain usually eight ascospores. Conidia are produced in great abundance.

The genera of this family to be dealt with are ASPERGILLUS and PENICILLIUM, which with the genus SCOPULARIOPSIS are also included amongst the Fungi Imperfecti, because very many species are not known in the perithecial stage.

The genus ASPERGILLUS

MYCELIUM of septate branching hyphae; colourless or brightly coloured, sometimes producing SCLEROTIA; thick walled hyaline cells (FOOT-CELLS) may be seen giving origin to conidiophores which rise perpendicularly to the long axis of the foot-cell.

CONIDIOPHORES may be septate or unseptate, enlarging into elliptical, hemispherical or globose VESICLES bearing STERIGMATA, primary or both primary and secondary.

CONIDIA varying in colour, shape, size and markings are catenulate.

PERITHECIA found in certain species only (unknown in most species) are thin walled, producing ASCI and ASCOSPORES within a few weeks.

SCLEROTIA (a sclerotium is a solid body formed of a compact mass of sterile hyphae, in a dormant state) found regularly in some species and perhaps not in others closely related, mostly globose or subglobose, commonly composed of thick-walled cells apparently filled with food material.

Formation of the PERITHECIUM and ASCOSPORES in Aspergillus glaucus

The end of a mycelial hypha becomes coiled into a fairly close spiral (like the worm of a still). This spiral, the Archicarp, may be divided into three parts: the apical segment is the Tricogyne or receptive part, the next segment is the female organ proper or Ascogonium and basal or proximal segment is called the "stalk of the archicarp". The male organ or Antheridium forms the apical segment of a separate hypha springing from the mycelium near the archicarp, the lower part of this hypha is called the "stalk of the antheridium". The male hypha arches over the apex of the archicarp and the antheridium fuses with the tricogyne or directly with the ascogonium.

Sterile hyphae spring up chiefly from the "stalks" of the two organs, and branching and intertwining form a false tissue which completely encloses the sexual organs, branches then grow in between the coils of the archicarp to form a filling or nutritive (?) tissue.

The fertilized ascogonium becomes septate and develops small outgrowths which penetrate into the false tissue. The ends of these outgrowths are cut off by septa and form the ASCI. The young ascus at first has two nuclei, these fuse to form a definitive nucleus of the ascus, and then, by division, the eight ascospores are formed. The peripheral protoplasm (epiplasm) of the ascus not used up in the formation of the ascospores serves for the nourishment of the ascospores during maturation. The "filling tissue" or paraphyses is compressed by the growing asci.

ASPERGILLUS

The Aspergilli are divided primarily into species groups according to characteristic colours: thus the Aspergillus niger group)black); A.candidus group (white); A.terreus (brown); A.flavus-oryzae (green-yellow); A.fumigatus (blue-green or grey-green); A.glaucus (green) etc.

Colour may be distributed in various parts of the colony as in the mycelial bed, the stalks and the sporing heads, or it may be extracellular (in the substratum). In A.niger, although the whole colony may appear black, the mycelial bed is colourless or yellowish and the black colour is in the upper part of the stalk, the vesicle, sterigmata and conidia. In A.flavus-oryzae the green colour is in the conidial wall. In A.flavipes the yellow colour is in the stalks only, the heads being white. Colours may be affected by the reaction of environment - in A.flavus-oryzae the conidia are green in an acid environment and yellow in an alkaline one (this colour change can be induced at will by use of acetic acid or ammonia vapours).

For scheme of examination of aspergillus colony see other sheet.

Measurements of an Aspergillus species:

Aspergillus flavus-oryzae (to be examined in practical class):
Stalks - 0.4-0.7 or even 1.0 mm. long, arising separately from the substratum, and 5 μ to 15 μ thick.
Vesicle - 10, 30 or 40 μ in diameter.
Heads - very large, stellate to columnar.
Sterigmata - Primary 7 to 10 μ by 3 to 4 μ , Secondary 7 to 10 μ by 2.5 to 3.5 μ.
Conidia - pyriform to globose, 2 by 3 μ to 5 by 6 μ ..

The parts of the conidial apparatus differ very greatly in size in different groups of Aspergilli.

Importance of the Aspergilli

In animal pathology - A.fumigatus, A.flavus-oryzae and a few other species are pathogenic, causing otomycosis externa, and some affections of the upper air passages in man. Pinta (skin affection) is caused by various species. A.nidulans said to be a cause of mycetoma and this species and others are alleged to cause a form of splenomegaly (mycotic splenomegaly). In birds, A.fumigatus (and occasionally other species) causes a rapidly fatal disease of the lungs and air system generally.

Aspergilli may cause deterioration of foodstuffs and other perishable materials, but are not so important in this respect as the Penicillia.

Aspergilli are of great importance in industry and are a source of a great many different enzymes (about 11 in A.niger alone.)
CITRIC ACID, from refined sucrose, fermentation by A.niger, cheapest commercial source.
OXALIC ACID, intermediate product in fermentation by A.niger, A.ochraceous, etc.
GLUTONIC ACID, produced along with citric and oxalic acids by A.niger.
FUMARIC ACID, A.fumaricus, TANNASE, A.niger and others.
KOJI and CHINESE SAUCE, A.flavus-oryzae, etc. TAKA DIASTASE A.niger, A.flavus-oryzae, etc. Fermentation of Coffee beans A.ochraceous.

The genus PENICILLIUM

green – yellow white – reddish

The vegetative MYCELIUM is as in Aspergillus, abundant, and may be entirely submerged or more or less free, usually colourless or, with the substratum, coloured by products of metabolism, hyphal walls are never brown or dark. The COLONIES are commonly green, yellow-green, blue-green, grey-green, whitish or yellowish or even purple or red. In ageing cultures (alkaline reaction) the spore masses are often brown (having changed from green). The CONIDIOPHORES arise as branches from the vegetative mycelium but not from differentiated foot-cells (as in Aspergillus). The CONIDIAL APPARATUS or PENICILLUS has a brush-like structure (skeleton hand) formed of dichotomous parallel branches of the conidiophore bearing at their apices verticils of STERIGMATA (conidia-forming cells) which bear the single unbranched chains of CONIDIA each cut off as a cylindrical segment from the tubular apex of the sterigmata. In most species the verticils of sterigmata (like the secondary sterigmata of Aspergillus) arise from verticils of short branches of the conidiophore which, when differentiated, are called METULAE (corresponding to primary sterigmata of Aspergillus). The CONIDIA are cylindrical to oval or globose, smooth or roughened, colourless or variously coloured but never black.

PERITHECIUM and SCLEROTION, known only in certain species.

Importance of Penicillia

Of little or no importance in human pathology.

Common causes of damage to perishable materials such as rubber, paper, tobacco, leather etc. Rot of fruits, especially citrus fruits, bulbs and tubers, nuts, grain, eggs etc.

Active fermenting properties give them some interest in chemical industry. Used in maturation of cheeses - Camembert and Roquefort. Source of penicillin, a substance having a bacteriostatic action on the Neisseria and used in treatment of gonococcal infections of the eye.

smaller than aspergilla –
Spoorung structure – branching
Common even normal skin in the tropics. Should not be regarded as pathogenic

The genus SCOPULARIOPSIS — never green - dark brown-black

Formerly included in genus Penicillium.

The COLONIES are never green. Aerial hyphae are partly in trailing and anastomosing ropes or bundles (funiculose). CONIDIOPHORES are usually very short or wanting, commonly arising from the hyphal "ropes". CONIDIAL APPARATUS is penicillus-like or may consist of varying aggregations of branches and sterigmata, occasionally sterigmata arise directly from the aerial hyphae. STERIGMATA are more or less specialized, long and tapering gradually towards the conidium-bearing apex. CONIDIA are large and more or less conical towards the apex and truncated at the base which is surrounded by a thickened ring enclosing a basal germinal pore, the walls are thickened and often variously marked or roughened.

Importance of Scopulariopsis

In human pathology Scop. brevicaulis and other species have been recovered from infections of the nails and skin and from otomycosis externa. In the literature these species are often referred to as Penicillium.

Scopulariopsis, growing at a high temperature in vegetable compost heaps completes the decomposition initiated by Penicillium, it can destroy cellulose and even resinous wood.

All species of Scopulariopsis possess the power of breaking down arsenical compounds with the liberation of ARSENE (arsenuretted hydrogen) which is an additional point of difference from Penicillium. Growing in thick layers of damp wall paper coloured with arsenical pigment or pasted with adhesive preserved with arsenic, Scopulariopsis can liberate sufficient gaseous arsenic to lead to deposits of arsenic in the tissues of persons breathing the air of the room.

May be means of liberation of arsenic

FUNGI IMPERFECTI

In comparatively few instances amongst the many thousands of species of fungi are all the different spore forms belonging to the species known. In very many cases the lower or conidial forms are known without any higher spore form (ascigerous, basidial or sexual form) being known to be genetically connected with them, probably, reasoning by analogy, these conidial forms constitute part of the life cycle of some fungus which embraces also a higher form of spore. It is also probable that in many cases the conidial form, though it does not now possess any higher spore form, did in its not remote phylogeny, possess such forms; indeed that all of them are phylogenetically related to fungi which produced one of the higher types of spores.

From analogy it is probable that most of these fungi are Ascomycetes. The whole group of forms, which is characterized by the imperfection of our knowledge of them, is classed as the Fungi Imperfecti.

They are, in a temporary way, divided into orders, families, genera and species with full knowledge of the fact that future research will result in many changes.

The three genera just dealt with - Aspergillus, Penicillium and Scopulariopsis belong to both the Ascomycetes and the Fungi Imperfecti for, although certain species are known in the ascigerous state the great majority are known only in the imperfect (conidial) form.

Nearly all fungi pathogenic for man belong to the Fungi Imperfecti, including the fungi causing ringworm, sporotrichosis, various forms of blastomycosis, mycetoma etc.