DOWNLOAD PDF PATHOGENIC FUNGI IN HUMANS AND ANIMALS

Chapter 1 : Animal and human parasites and pathogens By OpenStax (Page 9/11) | racedaydvl.com

Fungi as Plant, Animal, and Human Pathogens. From crop and food spoilage to severe infections in animal species, fungal parasites and pathogens are wide spread and difficult to treat.

There are comparatively few species that are pathogenic to animals, especially mammals. According to Hawksworth , there are approximate a little 1. A little more than of these species are known to cause disease in animals, and far fewer of these species will specifically cause disease in people. Many of the latter will only be superficial types of diseases that are more of a cosmetic than a health problem. Thus, there are not many species of fungi that are pathogenic to human that will be fatal. The study of Fungi as animal and human pathogens is medical mycology. There is also such a thing as veterinary mycology, but the types of diseases that are found in your pets often are the same as those that are found in people. Because of the rarity of human diseases caused by Fungi, most people have little, if any, knowledge of such diseases. The diseases of warm-blooded animals caused by fungi are known as mycoses sing. Although such diseases are relatively few, the fungi that cause them have a wide host as well as geographical range. Most of these diseases are not fatal, but once contracted, they may forever be a source of constant irritation and can lead to permanent scaring, which is why they are not such a pretty sight to view. The successful treatment of fungal diseases is more difficult than those caused by bacteria. Because bacteria are prokaryotes, the makeup of their cells are very different than our own eukaryotic cells and pharmaceutical products, such as antibiotics, are able to successfully destroy bacteria without harming our cells, tissues and organs. However, because fungi are eukaryotes, finding a treatment that will kill the fungus and not harm our own cells is more difficult. Thus, most chemical treatments are also toxic us as well as the fungus. The most widely used drug for treating systemic mycosis and other fungal infections that do not respond to other drugs is Amphotericin B. Azole drugs are also widely used, but these only inhibited fungal growth and do not kill the fungus. History on the Theory of Human Diseases The history human diseases tells a story that parallels and overlaps that of plant diseases. Early man viewed disease as a work of demons, and in many tribal societies, the exorcism of demons was the job of the shaman, witch doctor, sorcerer, etc. With the development of agriculture and civilization, more elaborate stories came about. For example, the Greeks tell of the myth about Pandora opening a box given to her by Zeus and releasing a host of plagues on mankind. However, they also created Aesculapius, the god of healing and medicine who had two daughters, Hygeia and Panacea, who were goddesses of health. During the 4th Century B. This is the theory of spontaneous generation, a theory that survived well into the s. As early as B. His Humoral Theory suggested that diseases were the result of disproportionate relationship of body humors or fluids: In order to have good health, each body humor must maintain a certain proportion with the other body fluids. Adjustments were often made by inducing an individual to vomit or to draw out "bad blood" by cutting an artery or vein. Thus, arose the practice of blood letting, which along with hair cuts, shaves and enemas, was carried out in barber shops. Even today, barbershops still utilize the red and white striped pole display as a means of letting the public know that it is a hair cutting establishment. However, meaning of this barbershop symbol has nothing to do with hair cutting. The red strip is to indicate the blood that is bled, the white corresponds to the tourniquet used to dilate the veins. However, because of the dark age that followed, science progressed little until the s. In , Girolamo Fracastoro gave the first description of typhus and suggested that this disease could be contracted from one person to another through direct contact or individuals coming in contact with inanimate objects referred to as fomite, i. In , Francesco Redi, a Florentine scientist, was the first to challenge the idea of spontaneous generation. It was thought that maggots and flies arose spontaneously, from rotting animal flesh. Redi protected the rotted animal flesh from the air and other to sources of visible infection and observed that maggots and flies did not arise from the protected meat. His conclusion was that flies and maggots were present in the unprotected meat, but absent in the protected meat, because it served as a nesting area for the eggs of the flies as well as a food source once the eggs hatched. In , Anton Van Leeuwenhoek became the first person to see and describe various microorganisms. He would continue to describe observations of anything that he could place under the microscope until just before his death in However, the demonstration that fungi could cause disease in people preceded even de Bary. In , Agostino Bassi discovered that a disease of silkworms known as muscardine could be transferred from silk worm to silk worm and was caused by a fungus, Beauvaria bassiana, a species that was later named for Bassi in honor of his discovery. The fungus grows on the silk worm, covering it with white mycelium, eventually killing it. This is a significant problem in the silk industry since one infected silkworm can spread the fungus to all of the other silkworms. It was shortly after that, in , David Gruby demonstrated for the first time that a fungus infection of the scalp, called favus, was caused by a fungus in Rippon, The disease is characterized by thick yellow crusts over the hair follicles. At a time before the use of agar media, Gruby isolated the fungus causing favus, from infected individuals, grew the fungus on slices of potatoes and was able to reproduced the favus disease by carrying out inoculation experiments on healthy tissue. However, that is obviously not the case. Bacterial diseases are by far more well known. There are several reasons for this disparity in knowledge. Relative to bacterial diseases, fungal diseases are infrequent and while some mycoses can be severe to fatal, there have not been epidemics of such diseases as we have found in bacteria. The combination of the severity, frequency and the epidemics that have occurred in bacterial diseases have, undoubtedly, driven the progress in the study of bacterial diseases. Another problem that slowed the progress of fungal diseases, and one that should not be estimated, is the understanding of species concept in fungi. By Sabouraud began publishing large numbers of articles on fungus disorders of the skin which eventually culminated in an enormous contribution to the field of medical mycology. However, Sabouraud had difficulty understanding variations in forms fungi can often exhibit. Some species of fungi can take on several forms, a phenomenon known as pleomorphism. This resulted in hundreds of species being described that would later be determined to represent already published species. Some of these species were based on careful observations where only slight variations in the form of the fungus was thought to represent new species, but some newly described species were also based on inaccurate and incomplete observations. The complication of nomenclature and classification of fungi also slowed progress. This was a problem, at that time, since doctors, were not trained in either mycology nor the systems of naming and classification of organisms. However, with the means of mass producing penicillin in the early s and discovery of other antibiotics, many of the very serious bacterial diseases were being controlled. Although, to some extent, there have are chemical means of controlling some fungal diseases, they are by no means always successful ones. There are a number of diseases that specifically cause human diseases. However, fungi can vary in their host specificity. The majority of most human pathogenic fungi appear to be soil inhabiting species where they live as saprobes, but given the appropriate conditions, i. For example Coprinus cinereus, a common mushroom has been recorded as causing endocarditis Speller and MacIver, , Ustilago maydis, the corn smut is known to cause skin lesions Review by Lacaz, et al. These types of fungi can be more harmful than obligate parasites since a facultative parasite is not dependent on a live organism and have not evolved with any particular host, they aggressively attack their hosts, and there is a greater probability that they will kill their hosts than an obligate parasite. However, normally these types of fungi will not cause human mycoses unless their immune system have somehow become compromised. Coprinus cinereus, from Jason Stajich, http: Schizophyllum commune, from http: We often come in contact with fungi during our everyday routines, some which are potentially pathogenic to human and others not. We may be exposed simply by walking by construction areas where the soil has been disturbed and scattered into the wind by the machinery, we are constantly exposed while we are hiking, jogging, hunting or fishing. During recreation when we injure ourselves, such as with puncture wound, abrasions, burns or even by inhalation of a large number of harmful spores. Fortunately, most of us have an immune system that will protect us from such infections by fungi, but some individuals will contract fungal diseases from such injuries. So, what kind of fungi can be human pathogens? Probably all fungi can potentially be harmful, in this respect, if your immune system has been compromised. Fortunately, for most of us, this is not a problem and the probability of contracting a serious fungal disease is low relative to bacterial or viral diseases. However, in recent years, it has become more of a problem with the rising number of people with compromised immune systems such as people with AIDS, organ transplants, diabetes and treatment for various forms of cancer. Some Fungal Human Pathogens In discussing fungal diseases, the most convenient way of classifying them is to categorize them according to the type of infection that has occurred: Superficial infections, are caused by fungi that attack the skin or its appendages nail, feathers and hair. These fungi are known as dermatophytes. Entry into the body is usually through inhalation of spores or open wounds. Blood circulation or respiratory system may then transmit fungus throughout body and additional infection of internal organ may occur. These fungi, are usually saprotrophic fungi, growing in the soil. A third, Intermediate infection, is sometimes also recognize and is intermediate between the two just discussed. The infection will occur below the skin, but will remain localized Superficial Infections The superficial mycoses are the most well known since they can be readily observed. They commonly occur on the hair, nails and skin of infected individuals. For each type of infection, there can also be a variety of species that may be causing the disease. Thus, we will only have a general discussion on this group of diseases. Ringworm and Related Dermatophytes Ringworm usually occurs on the exposed parts of the body, forming circular growths that may appear darker or lighter than the normal skin color, with symptoms that include skin lesion, rash and itching of the infected area. Ringworm infections are common where conditions are unsanitary and crowded with people and has been known since early historical time. There are indications that ringworm was more prevalent in the recent past than now because of improvements in sanitary conditions and health habits. The two names were eventually combined to "ringworm". Although the actual cause of ringworm was not known until the early s, the practice of segregating infected individuals to prevent spread of the disease indicated that there was knowledge that this disease was contagious and prevalent, and could be passed from person to person was known prior to the cause of infection. It was Gruby that isolated and described one of the ringworm fungi, Trichophyton, meaning "thread plant", and through inoculation on healthy parts of the scalp, was able to reproduce the disease. He also carried out the same experiment with several other human pathogenic fungi and inoculated himself with the pathogen, as well as others. Although this was a great accomplishment, Gruby also had a great deal of luck since, at the time, isolation of specific fungi was not common practice, and this was also 30 years prior to the development of techniques to grow fungi and bacteria in pure culture. According to Ainsworth, more than species of dermatophytes have been proposed and given approximately 1, names, which has caused some confusion in medical mycology. The proliferation in names have come about because different researchers have worked with the same species of a pathogen, in a different place and time, and each were familiar with that particular isolate of that particular species of fungus and probably not too familiar with that isolate.

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Chapter 2 : Pathogenic Fungi in Humans and Animals - CRC Press Book

Exploring breakthroughs in fungal detection and control, this book covers fungal nomenclature, population instability, and phylogeny, as well as investigative research on Peronosporomycetes, Zygomycetes, Filamentous Ascomycetes, Basidiomycetous Yeasts, Endomycetes and Blastomycetes, and Miscellaneous Opportunistic Fungi.

The Plant Health Instructor. Little, and Carol M. A fungus is a eukaryote that digests food externally and absorbs nutrients directly through its cell walls. Most fungi reproduce by spores and have a body thallus composed of microscopic tubular cells called hyphae. Fungi are heterotrophs and, like animals, obtain their carbon and energy from other organisms. Some fungi obtain their nutrients from a living host plant or animal and are called biotrophs ; others obtain their nutrients from dead plants or animals and are called saprotrophs saprophytes, saprobes. Some fungi infect a living host, but kill host cells in order to obtain their nutrients; these are called necrotrophs. Fungi were once considered to be primitive members of the plant kingdom, just slightly more advanced than bacteria. We now know that fungi are not primitive at all. In fact, recent taxonomic treatments such as the Tree of Life Project show that fungi and animals both belong to the group Opisthokonta Fig. Fungi may not be our next of kin, but they are more closely related to animals than they are to plants. We also recognize that organisms traditionally studied as "fungi" belong to three very different unrelated groups: Recent studies have provided support for the recognition of additional phyla, such as Glomeromycota, a group of fungi once placed in Zygomycota that form an association with the roots of most plants Fig. A group of parasitic organisms called Microsporidia that live inside the cells of animals are also now considered to belong in the fungal kingdom Fig. This classification is used in the Dictionary of the Fungi Kirk et al. However, the classification system will undergo additional changes as scientists use new methods to study the fungi. For example, Jones et al. Figure 2 How old are fungi? Fungi are an ancient groupâ€”not as old as bacteria, which fossil evidence suggests may be 3. Mushrooms exquisitely preserved in amber from the Late Cretaceous 94 million years ago tell us that there were mushroom-forming fungi remarkably similar to those that exist today when dinosaurs were roaming the planet Hibbett et al. However, the fungal fossil record is incomplete and provides only a minimum time estimate for when different groups of fungi evolved. Molecular data suggest that fungi are much older than indicated by the fossil record, and may have arisen more than one billion years ago Parfrey et al. How many fungi are there? No one knows for sure how many species of fungi there are on our planet at this point in time, but what is known is that at least 99, species of fungi have been described, and new species are described at the rate of approximately per year Blackwell ; Kirk et al. A conservative estimate of the total number of fungal species thought to exist is 1. To come up with this figure, Hawksworth estimated the known numbers of plant and fungal species from countries in which both plants and fungi have been well-studiedâ€”Great Britain and Ireland, in this caseâ€”and determined there were six fungal species for every native plant species. The total number of plant species worldwide is approximately ,, and if the ratio of fungi to plants in Great Britain is typical of what occurs elsewhere, there should be at least 1. Assuming a relatively constant rate at which new species are described, it will take more than years to catalog and describe all remaining fungi. However, many of these fungi are likely to become extinct before they are ever discovered given current rates of habitat and host loss. These habitats are exceedingly rich in fungal species Hawksworth and Rossman Callan and Carris estimated that an , ha neotropical forest, such as in Costa Rica, could contain over 81, different species of plant parasitic fungiâ€”almost as many as all the known species of fungi! Consider that this estimate was based only on plant parasitic fungi, and did not take into account other ecological groups of fungi such as saprotrophs. What do fungi do? Fungi are involved in a wide range of activitiesâ€”some fungi are decomposers, parasites or pathogens of other organisms, and others are beneficial partners in symbiosis with animals, plants or algae. Fungi associated with animals Fungi have the ability to grow on and in both invertebrate and vertebrate animals. Many fungi can attack insects and nematodes, for example, and may play an important role in keeping populations of these animals under control. Insect-attacking fungi, called "entomopathogens," include a wide range of fungi in phyla Ascomycota, Zygomycota and Chytridiomycota. Some of the best-known and most spectacular entomopathogens belong in the Ascomycota genus Ophiocordyceps and related genera. Paradoxically, humans have been using one of these entomopathogens, Ophiocordyceps sinensis, for thousands of years to treat a wide range of ailments. This fungus is an important component of traditional Asian medicine Fig. Colony collapse disorder of honeybees has been associated with co-infection by a virus and a microsporidian fungus, Nosema ceranae Bromenshenk et al. One group of fungi called Entomophthorales "insect killers" includes a number of highly specialized entomopathogens. A common example is Entomophthora musae, which is often observed forming a ring of white spores discharged around the body of a parasitized fly on panes of glass. Some fungi are specialized parasites of nematodes, rotifers, and other microscopic animals in the soil Barron A common nematode predator is Arthrobotrys oligospora, a fungus that has evolved sticky networks of hyphae for trapping nematodes. Once the nematode is immobilized, the fungus invades and consumes its body. Fortunately, there are relatively few fungal pathogens of vertebratesâ€"only speciesâ€"but some of these fungi can have devastating impacts. Consider the well-publicized frog killer, Batrachochytrium dendrobatidis, a member of phylum Chytridiomycota Berger et al. The frog chytrid is implicated in the widespread decline of frog populations around the world. Fortunately, this is the only chytrid known to parasitize a vertebrate animal and it appears to infect only amphibians. This fungus colonizes the skin on the muzzles, ears and wing membranes of some types of bats, and infected bats exhibit unusual behavior. The bat fungus is associated with declines in bat populations in the northeastern U. As of , white-nose syndrome had been confirmed in 16 states and four Canadian provinces. In humans, there are several different types of fungal infections, or "mycoses. Some fungi are members of the resident microflora in healthy people, but become pathogenic in people with predisposing conditions. For example, Candida species cause annoying yeast infections in the mucosal tissues of many healthy people, but can also cause diseases collectively called candidiasis in babies and immunocompromised individuals. Another group of fungi are inhaled as spores and initiate infection through the lungs. These fungi include Coccidioides immitis coccidioidomycosis, commonly known as valley fever , and Histoplasma capsulatum histoplasmosis. Opportunistic fungal pathogens are normally not associated with humans and other animals, but can cause serious infections in weakened or healthy individuals when inhaled or implanted in wounds. Aspergillus fumigatus, one of the most important of these opportunists, produces small, airborne spores that are frequently inhaled; in some individuals the fungus starts growing invasively, causing a disease known as aspergillosis, especially in immunocompromised individuals. A remarkable discovery was that Pneumocystis carinii, the organism causing pneumonia-like symptoms in immunocompromised patients, is a fungus and not a protozoan as had been thought for decades. Why was this pathogen classified as a protozoan? It does not respond to the common drugs used to treat fungal infections, but does respond to anti-protozoan drugs. This unusual fungus emerged as one of the leading causes of death in AIDS patients in the late twentieth century. Fungi and plants The association of fungi and plants is ancient and involves many different fungi. Plant pathogenic fungi represent a relatively small subset of those fungi that are associated with plants. Most fungi are decomposers, utilizing the remains of plants and other organisms as their food source. Other types of associations that will be discussed here include the role of fungi as decomposers, as beneficial symbionts, and as cryptic plant colonizers called endophytes. Most fungi are associated with plants as saprotrophs and decomposers. These fungi break down organic matter of all kinds, including wood and other types of plant material. Wood is composed primarily of cellulose, hemicellulose, and lignin. Lignin is a complex polymer that is highly resistant to degradation, and it encrusts the more readily degradable cellulose and hemicellulose. Fungi are among the few organisms that can effectively break down wood, and fall into two main typesâ€"brown and white rot fungi. Brown rot fungi selectively degrade the cellulose and hemicellulose in wood, leaving behind the more recalcitrant lignin. The decayed wood is brown in color and tends to form cubical cracks due to the brittle nature of the remaining lignin Fig. Brown rot residues are highly resistant to decomposition and can remain in the soil for up to years. White rot fungi are more common than brown rot fungi; these fungi degrade cellulose, hemicellulose, and lignin at approximately equal rates. The decayed wood is pale in color, light in weight, and has a stringy texture Fig. White rot fungi are the only organisms that can completely degrade lignin. Figure 4 Figure 5 An important group of fungi associated with plants is mycorrhizal fungi. There are seven major types of mycorrhizal associations, the most common of which is the arbuscular mycorrhizae, involving members of phylum Glomeromycota associated with roots of most major groups of plants. Another common type of association is ectomycorrhizae formed between forest trees and members of phyla Basidiomycota and Ascomycota. In this association, the fungus forms hyphae around host root cortical cellsâ€”the "Hartig net"â€" and a sheath of hyphae around the host roots called a "mantle. A valuable group of ectomycorrhizal fungi are truffles, members of phylum Ascomycota that form underground fruiting bodies. Figure 6 Lichens are examples of a symbiotic association involving a fungus and green algae or less frequently Cyanobacteria. The lichen thallus is composed mostly of fungal hyphae, usually with the alga or cyanobacterium confined to discrete areas of the thallus. In lichens, reproductive structures of the fungus are often conspicuous, for example disc- or cup-like structures called apothecia Fig. The fungus obtains carbohydrates produced by photosynthesis from the algae or cyanobacteria, and in return provides its partner s with protection from desiccation and ultraviolet light. Lichens grow in a wide range of habitats on nearly every continent. Figure 7 Some fungi are hidden inside their plant hosts; these are endophytes , defined by their presence inside asymptomatic plants. All plants in natural ecosystems probably have some type of symbiotic association with endophytic fungi Rodriguez et al. Endophytic fungi have been shown to confer stress tolerance to their host plant, for example, to disease, herbivory, drought, heat, salt and metals. The clavicipitaceous endophytes in the genus Neotyphodium phylum Ascomycota are among the best studied. These fungi produce alkaloid compounds that protect the grass host from insects that would otherwise feed on them; endophyte-infected turfgrass seed is sold commercially for seeding lawns and other types of grassy recreational areas. Unfortunately, livestock such as sheep, cattle, llamas and horses also are negatively affected by toxins produced by endophytes when they eat infected grass. Afflicted animals develop symptoms including tremors and jerky or uncoordinated movements. Plant pathogenic fungi are parasites, but not all plant parasitic fungi are pathogens. What is the difference between a parasite and a pathogen? In this sense, endophytic fungi discussed in the preceding paragraph are plant parasites because they live in intimate association with plants and depend on them for nutrition.

Chapter 3 : Fungi pathogenic for humans and animals (in three parts). Part A. Biology.

Pathogenic fungi have an enormous impact on human health. Most people are aware of some of the superficial infections caused by fungi. These include skin and nail infections such as athlete's foot and ringworm, predominantly caused by dermatophytes (Trichophyton, Microsporum and Epidermophyton species).

Blastomycetes and Endomycetes Kevin C. Hazen and Susan A. Schell Miscellaneous Opportunistic Fungi: Mauves sur Huisne, France Kevin C. Department of Medical Mycology, St. The categories may be subdivided e. Populations within a given species that have some characteristics in common may be set apart as tribes or varieties or some other subset designation. The delineation of the zoopathogen Ajellomyces capsulatus, anamorph: Histoplasma capsulatum, goes as follows 1: Basidiomycota Mitosporic Fungia Kingdom: Protista a This group of anamorphic fungiâ€"which lack any known teleomorphic stageâ€"was at one time collected into a phylum Deuteromycota, but this term, still used for convenience in some arrangements see, e. Fungi, Straminipila, and Protoctista 3. The bulk of this book is devoted to the members of the kingdom Fungi. Also included, however, is a consideration of the zoopathogenic members of the kingdoms Straminipila and Protoctista. The phyla to be considered in this book are listed in Table 1. Opinions on the nomenclature of hierarchal groups vary somewhat among taxonomists. For example, the terms Mycota and Fungi have both been used to designate the kingdom to which most of the human pathogens belong 4. Likewise, at one time mycologists used the term division instead of phylum 2 but more recently the word phylum has been widely adopted in fungal taxonomy. Authors in this book have used one term or the other as alternative words for the two highest hierarchal categories. I have let stand whichever usage the author chooses for these categories. Bennett 2 and on fundamental mycology by O. A glossary of terms employed in this introduction will be found at the end of the chapter. Introduction 3 contain animal pathogens zoopathogens and are covered in this book. The decisions on coverage within these groups have been left up to the authors selected. Chytridiomycota This phylum comprises those members of the kingdom Fungi that produce motile cells in their life cycles 3. Only some examples of pathogens are included in this brief sketch of the phylum. For complete coverage of the biology and hostâ€"parasite relations among the zoopathogenic chytrids, see Chap. These chytrids are commensals of the rumen and cecum of herbivores 3. Important pathogens of mosquitoes and other insects Coelomomyces spp. The pathogenic species of the two genera indicated are listed in Chap. The genera Olpidium, Endochytrium, Rhizophydium, and Phlyctochytrium variously contain important pathogens of nematodes, rotifers, and amphibians. Table 2 The Phylum Chytridiomycota Phylum: For a more complete treatment of this phylum, see Table 1 of Chap. The members of this order are diverse ecologically, being found in soil and water, and include plant and fungal parasites. This order consists of but a few mostly saprophytic species. Zygomycota The phylum Zygomycota Table 3 contains those fungi that produce zygospores as a result of sexual reproduction and consists of two classes: There are two orders in the class Zygomycetesâ€"Mucorales and Entomophthorales, both of which contain human and animal pathogens. The Mucorales generally produce nonseptate hyphae, while the Entomophthorales are usually septated. The members of this order are grouped into six families of agents of disease. This family contains the genera Rhizopus, Absidia, Apophysomyces, Mucor, and Rhizomucor, all of which are important pathogens. These fungi reproduce asexually by means of sporangia containing sporangiospores. The Phylum Zygomycota Phylum: One species, Syncephalastrum racemosum, has been reported in clinical materials. Asexual reproduction in this family is different from that of other members of the Mucorales. Sporangiospore-containing merosporangia are produced on vesicles formed at the tips of sporangiophores. The sporangiospores are arranged in a row within the cylindrical merosporangium 4. Fungi thought to be species of Mortierella have been isolated from human infections. One species, Saksenaea vasiformis, is an important pathogen. Single or multispored sporangiola formed at the tips of branched sporangiophores characterize members of this family. Cokeromyces recurvatus is an uncommon pathogenic species within the family. In the genus Cunninghamella single-spore sporangiola are formed on swollen, round vesicles that occur on the tips of branched or unbranched sporangiophores. The family contains at least one important pathogen, C. The zygospores of members of this order are similar to those of the Mucorales, but differ in morphological detail. The asexual spores are called conidia, though with some species they appear to be monospored sporangia 2. The families within the order Entomophthorales are shown in Table 3. Only the hostâ€”parasite relations of the families are given here. The additional biologic bases for family separations are given in Chap. The family Basidiobolaceae comprises species that are commensals of amphibians and reptiles, and parasites in vertebrates. The human pathogen Basidiobolus ranorum is found in this family. The family Entomophthoraceae contains pathogens of insects and other arthropods. The family Completoriaceae has no animal parasites, but certain species are obligate intracellular parasites of fern gametophytes. The genus contains at least two human pathogens, C. The family Meristacraceae contains obligate parasites of nematodes and tardigrades. Obligate pathogens of mites and other insects are found in this family. Ascomycota This phylum is made up of fungi that reproduce sexually by means of ascospores contained in an ascus. The morphology and arrangement of ascospores within the ascus and the morphology of an ascus-bearing structure ascoma , when present, is one approach to the hierarchal arrangement of ascomycetes. The group is divided into two classes: Molecular phylogeny studies have allowed associations to be realized even when a known teleomorph for a given anamorph has not been revealed. Some of these associations are suggested throughout the coverage in this section. Ascomata are not formed. Ascospores are of various shapes. Asci are formed singly or in chains. This family contains those yeasts that reproduce by budding blastoconidia. The colonies are accordingly mainly unicellular, though some species produce pseudohyphae. This family includes the genus Dipodascus, which produces a Geotrichum anamorph with arthroconidia. The order consists of four families. The members of these families produce ascomata called cleistothecia, the peridium of which is composed of a loose network of hyphae 2. The term gymnothecium is sometimes applied to this type of cleistothecium. This family comprises parasites known as the dermatophytes ringworm fungi and saprophytes that are morphologically similar. The family is represented by the single genus Arthroderma, whose asexual states are in the genera Microsporum and Trichophyton. An additional member of the group known only in its conidial state is Epidermophyton. Two important systemic patho- Introduction 7 gens of humans are found in this family: Ajellomyces capsulatus anamorph, Histoplasma capsulatum and A. In addition, one rare pathogen, Ajellomyces crescens anamorph, Emmonsia crescens , belongs in this family. A relationship to the Onygenaceae is inferred for other important human pathogens, such as Coccidioides immitis and Paracoccidioides brasiliensis. Emmonsia parva, a pathogen of small mammals, is also thought to belong in the family. Several other pathogens and saprophytes contaminants of clinical materials are found in the family. The anamorphic forms of the latter are placed in the genera Chrysosporium and Malbranchia. A number of uncommon pathogens and saprophytes encountered as contaminants in clinical materials are found in these two families. This order contains a number of cleistothecial fungi whose anamorphs are usually phialidically formed conidia. The most important family is the Trichocomaceae see Chap. There are a number of species in these asexual genera that are not known to produce a sexual state. The other families in the order Eurotiales Table 4 contain only rare causes of disease. A perithecium is the ascoma of the sexual state of members of this order. The members of this order produce cleistothecial ascomata. The order comprises six families. This order, which produces ascomata that are cleistothecia or perithecia, contains a single family of pathogens, Microascaceae, which houses the important agent of mycetoma, Pseudallescheria boydii anamorph, Scedosporium apiospermum , and common clinical isolates in the anamorphic genus Scopulariopsis. The ascoma of this order is a perithecium. This order Introduction 9 contains many important opportunistic pathogens of humans and common clinical contaminants.

Chapter 4 : Types of Fungal Diseases | Fungal Diseases | CDC

The major object of the ï¬•rst edition of Fungi Pathogenic for Humans and Animals was a thorough review of the basic biology, host-parasite interactions, and current method of detection and characterization of the zoopathogenic fungi.

This article has been cited by other articles in PMC. Similar Fungi, Different Hosts Fungi occupy every inhabitable ecological niche on earth [1]. Environmental requirements vary, from species with very specific ones to species that can live under a broad range of conditions. Pathogenic fungi are those species that occupy and derive nutrients from living organisms. Some fungal pathogens completely depend on their host, while others can prosper in additional environments. Fungal host restrictions also vary considerably, from single-host-specific species to broad-host-range pathogens that can cause disease in a large number of different hosts. An extreme example is the genus Fusarium, with species that cause diseases in thousands of plant species as well as in animals, including humans [2]. Thus, while plants and animals present very different environments hosts in the case of pathogens , the fungi that attack them are phylogenetically closely related. The same pathogenicity principles might therefore be used by animal and plant pathogens, albeit with some variation. Different Terminology, Common Strategies Pathogens are often described by the nature of their relationship with their hosts. At one extreme are species that are entirely dependent on their host to complete their life cycle often called obligate parasites. At the other are opportunistic species, which live as saprobes on dead organic matter, but can also invade living organisms often called facultative pathogens. In between lies an array of combinations ranging in their degree of host dependency and ability to cause disease. Another way to categorize pathogens is according to their pathogenic lifestyle and disease characteristics. In this case, different terminology is used for plant and animal pathogens: Fungi that cause disease in animals are usually described according to the type of disease they cause, e. Therefore, we tend to think about fungal pathogens of plants and animals in different terms and treat them separately. Yet, as already noted, fungi attacking animals or plants are actually closely related. For example, pH-lowering molecules, such as oxalic acid, are virulence factors against plant, animal, and insect hosts [5] â€” [7]. This warrants revisiting the terminology and the way in which we think about fungal pathogens of animals and plants.

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Chapter 5 : Pathogenic Fungi In Humans And Animals - PDF Free Download

It offers methods to identify zoopathogenic fungi, analyze reports of putative pathogens, develop methods for detection, isolation, and characterization of pathogenic fungi, evaluate emerging strain-typing techniques, target molecules for diagnostic tests, and examine the patterns and mechanisms of genetic variation.

Neurospora Fungi cause a spectrum of diseases in humans ranging from comparatively innocuous superficial skin diseases caused by dermatophytes to invasive life-threatening infections caused by species such as Candida albicans, or Cryptococcus neoformans. Due to the opportunistic nature of most invasive mycoses, fungal pathogenicity has proven difficult to define. However the application of new genomic and other molecular techniques in recent years has revolutionized the field revealing fascinating new insights into the mechanisms of fungal pathogenesis. In this book a panel of high profile authors critically reviews the most important research to provide a timely overview. The extensive reference sections in each chapter positively encourage readers to pursue the subject in greater detail. The book is divided into two sections: The first six chapters review the transformative effect of applying state-of-the-art tools and innovative approaches to research, particularly in the area of comparative biology. The second section consists of eight chapters, each dedicated to the molecular and cellular biology of a major fungal pathogen of humans: These chapters provide a timely snapshot of the current state of research. This volume is an essential reference for students, researchers and clinicians with an interest in fungal pathogenesis. This is a carefully edited and well-produced reference work that deserves to be widely available in laboratories exploring the molecular biology and pathogenicity mechanisms of human pathogenic fungi" from IMA Fungus 5: It is also a useful source of information for undergraduates as well as researchers. Understanding Fungal Pathogenesis with High-throughput Sequencing Vincent Bruno The invention of massively parallel DNA sequencing and the subsequent development of RNA-seq, ChIP-seq and microbiome sequencing have radically changed the landscape of molecular and systems biology by allowing researchers to address biological problems with a sensitivity and scope that was not previously possible. This chapter discusses how each of these high-throughput sequencing HTS -based approaches is being used to address biological questions within the field of human fungal pathogenesis. As the cost of sequencing becomes more affordable, the amount of sequence depth coverage that will be attainable will increase significantly allowing researchers to apply these genomic techniques to more in vivo models and clinical samples for which a great deal of coverage is required. Integrated approaches, which combine multiple HTS-based experiments, will provide necessary insight into the complex interactions between the host, microbiota and fungal pathogens. Fitzpatrick Recent advances in next generation sequencing techniques have dramatically increased the availability of genomic data. Due to their relatively small genome size and importance as human and crop pathogens, over one hundred fungal genomes have been completely sequenced and published to date. This number is expected to increase dramatically over the coming years with individual institutions sequencing their own fungi of interest and the initiation of an ambitious project to sequence neglected fungal genomes https: Currently a significant proportion of the available genomes are human pathogens as well as closely related non-pathogenic species. This type of data allows us to perform comparative genomic analyses between pathogenic and non-pathogenic species in an effort to uncover molecular mechanisms related to disease. The following chapter will discuss a selection of key comparative genomic analyses that have been performed on a number of the most common human pathogens and also illustrate how complete fungal genomes have helped us understand some of the mechanisms that have shaped fungal evolution. Brakhage Recent technical advancements in biotechnology unlocked a new fascinating period of research. High-throughput data can be obtained within biomolecular experiments with reasonable efforts and costs. This enables the investigation of the host-fungal interactions at a system-wide level. The bottleneck in the experiment workflow has shifted from obtaining the data to its proper analysis. The analysis of high-throughput data can be described by the operational protocol of data-driven systems biology. The protocol includes experimental design, data pre-processing, feature selection, computational modeling, and biological evaluation. Throughout this procedure, data need to be analyzed within the corresponding biological context. The goal of the analysis pipeline is to obtain model variables and parameters in order to make new hypotheses for further experiments. The intertwined nature of the host-pathogen interaction is also reflected in the complex data analysis where first experiences are currently gathered and new methods developed. Pressing challenges are the integration of different levels of omics-data, i. Advances in systems biology are expected to help translate in vivo knowledge about fungal infections into clinical applications. Transcriptomic Analyses of Host Cell-Fungus Interactions Elaine Bignell The contribution of host activities to positive, and negative, outcomes of fungal disease is increasingly recognised. Technological advances are permitting scientists to unravel gene-by-gene the complexities of the host-pathogen interaction, an objective which will remain a crucial component of infectious disease research for the foreseeable future, and will likely yield a new generation of immunotherapeutic antifungal entities. The fungal host-pathogen interaction includes a remarkable array of behaviours from pathogen-mediated killing of host cells, to intracellular occupancy and lytic expulsion, behaviours which drive the outcomes of disease by governing pathogen replication, immune evasion, survival, and dissemination. This chapter will explore the fruits of transcriptomic analyses of fungal host-pathogen interactions. MacCallum Fungal infection is a major cause of morbidity and mortality, with most infections caused by dermatophytes, Candida species, Aspergillus species, Cryptococcus neoformans and Pneumocystis jirovecii. Whilst dermatophytes can be considered primary pathogens, the majority of fungal infections are caused by opportunistic fungal species. Candida infections tend to originate from commensal sources, but Aspergillus, Cryptococcus and Pneumocystis infections are acquired from the environment. Mortality associated with these infections remains high, partially due to difficulties in diagnosis, but also due to limited therapeutic choices. In order to facilitate development of these badly needed diagnostics and antifungal agents, a greater understanding of fungal pathogenesis is required. Animal models provide opportunities to investigate fungal disease initiation and progression and to evaluate novel antifungal agents. Animal models of dermatophyte, Candida, Aspergillus, Cryptococcus and Pneumocystis infections are described and their contribution to our current understanding of these important fungal infections discussed. Richardson and Julian R. Naglik The three major opportunistic fungal pathogens of humans are Candida albicans, Aspergillus fumigatus and Cryptococcus neoformans. These pathogens primarily infect immunocompromised individuals either as a result of immunodeficiency e. This highlights the importance of host immune defences in controlling or preventing fungal infections. In health, these fungal pathogens initially interact with mucosal surfaces which may lead to colonisation and establishment of commensalism, but in the immunocompromised these fungi can cause serious superficial infections and may disseminate to cause life-threatening systemic infections. To combat these fungal infections, the host utilises vast communication network of cells, proteins and chemical signals distributed in blood and tissues, which constitute innate and adaptive immunity. In this chapter we will review how the host recognises these fungi, the events induced by fungal cells, and the host immune defences that ultimately resolve the infections during health. The overview will primarily target C. A Molecular Update on the Pathogenesis of Candidiasis Duncan Wilson and Bernhard Hube In contrast to most of the human pathogenic fungi described in this book, pathogenic species of the genus Candida do not normally exist in ecological niches such as soil or compost. Instead, these fungi have evolved in close association with warm-blooded animals, such as humans. For most people, at most times, these yeasts exist as harmless members of the microbiome. However, some species are capable of causing devastating infections in their human hosts. In this chapter we summarise and discuss important recent developments that have been made in our understanding of the molecular basis of Candida pathogenicity, with an emphasis on the dominant pathogenic species, Candida albicans. Virulence Characteristics of Aspergillus fumigatus Rebecca A. New diagnostic strategies are emerging based on detection of secreted low molecular mass metabolites. Drug treatments, which interfere with membrane biosynthesis and integrity, as well as cell wall function, are available to treat infection with A. No single characteristic appears to confer complete virulence on A. These attributes include a robust cell wall, small hydrophobic conidia and biofilm architecture; resistance to oxidative stress, hypoxia and iron starvation; secondary metabolite biosynthesis and secretion, as well as thermotolerance and an ability to secrete degradative enzymes for nutrient uptake. Attenuation of the efficiency of these survival strategies offers possibilities for the development of new classes of antifungal drugs. Cordero and Oscar Zaragoza Cryptococcus neoformans is a cosmopolitan pathogen of major concern among HIV-infected patients and has a significant incidence in developing countries. Cryptococcus neoformans blastoconidia or desiccated spores are inhaled and can cause pneumonia and meningitis in immunodeficient individuals, being fatal if not treated. Its sibling species Cryptococcus gattii is more restricted to tropical areas and infects mainly immunocompetent individuals. Our current understanding of the virulence determinants that facilitate Cryptococcus to cause infection, particularly its polysaccharide capsule and melanin accumulation, as well as other traits that confer adaptation to the host will be reviewed in this chapter. Dermatophytes as Saprophytes and Pathogens Michel Monod, Bernard Mignon and Peter Staib Dermatophytes infect the stratum corneum, nails and hair and are the most common agents of superficial mycoses in humans and animals. At present the genome of seven species has been sequenced. They are enriched for particular families of genes encoding secreted proteases, fungal specific kinases and proteins containing the LysM domain that is known to bind chitin. Different tools were recently developed to improve genetic analyses of dermatophytes, including efficient systems for targeted gene inactivation, gene silencing and broad transcriptional profiling techniques. Unexpectedly, gene expression profiles in the skin and hair of infected guinea pigs were found to be very different from those during in vitro growth using hard keratin as a substrate. Instead of the major in vitro expressed protease genes, others were found to only be activated in the skin of infected animals. In other words, the expression of putative virulence genes in dermatophytoses is more complex than previously assumed and likely depends on the site and type of infection. Further broad transcriptional profiling approaches during infections will give new insights into the pathogenic mechanisms of dermatophytes. Pathogenesis Mechanisms of Histoplasma capsulatum Chad A. Rappleye The dimorphic fungal pathogen Histoplasma capsulatum causes respiratory and systemic disease in both immunocompromised and immunocompetent individuals. In mammalian hosts, Histoplasma grows as pathogenic yeasts which survive and replicate within phagocytes. Genetic studies have Identified a signaling kinase and 3 transcription factors factors that regulate the thermally-induced yeast-phase differentiation process. The mechanisms that facilitate Histoplasma pathogenesis summarized in Figure In addition, Histoplasma yeasts secrete several novel factors with undefined functions but which are likely linked to pathogenesis by virtue of their specific expression only by pathogenic-phase cells and their extracellular localization. Together, these mechanisms enable Histoplasma yeasts to successfully establish infections in spite of fully functional immune defences of the host. Blastomyces dermatitidis and Blastomycosis Gregory M. Gauthier The etiologic agent of blastomycosis, Blastomyces dermatitidis, belongs to a group of ascomycete fungi that exhibit thermal dimorphism. In the yeast form, B. Diagnosis of blastomycosis requires a high degree of clinical suspicion coupled with the use of culture and non-culture diagnostics. Treatment requires the use of polyene or azole antifungals. In addition, the prevalence of PCP is increasing in non-HIV patients with suppressed immune status, following the use of potent immunosuppressive therapies. Our understanding of Pneumocystis is based on immunosuppressed animal models. Investigations of the Pneumocystis life cycle, pathogenesis, and host immune response provide attractive targets for the development of novel anti-Pneumocystis agents. Sulfamethoxazole-trimethoprim remains the first line regimen for treatment and prophylaxis of PCP. Many aspects of Pneumocystis biology remain unanswered or controversial, such as respiratory colonization, mode of transmission, clinical significance of mutations to currently available anti-Pneumocystis agents, and prophylaxis and therapy in non-HIV immunocompromised patients. There is a critical need to continue investigating this unique medically important pathogenic fungus in order to allow us to develop more effective strategies to prevent and treat Pneumocystis infection. Studies have reported different degrees of pathogenicity and virulence among the members of this genus and provided evidence of variation in host susceptibility to infection. This chapter provides information on the current knowledge of the virulence of the genus Paracoccidioides.

Chapter 6 : Chapter Fungi as pathogens of animals, including humans

Fungi that are pathogens are usually plant pathogenic Fungi. There are comparatively few species that are pathogenic to animals, especially mammals. According to Hawksworth (), there are approximate a little million described species of fungi.

Plant diseases have ruined crops, bringing widespread famine. Most plant pathogens are fungi that cause tissue decay and eventual death of the host [link]. In addition to destroying plant tissue directly, some plant pathogens spoil crops by producing potent toxins. Fungi are also responsible for food spoilage and the rotting of stored crops. For example, the fungus Claviceps purpurea causes ergot, a disease of cereal crops especially of rye. In animals, the disease is referred to as ergotism. The most common signs and symptoms are convulsions, hallucination, gangrene, and loss of milk in cattle. The active ingredient of ergot is lysergic acid, which is a precursor of the drug LSD. Smuts, rusts, and powdery or downy mildew are other examples of common fungal pathogens that affect crops. Some fungal pathogens include a green mold on grapefruit, b fungus on grapes, c powdery mildew on a zinnia, and d stem rust on a sheaf of barley. Controlled infection of grapes by Botrytis is used to produce strong and much-prized dessert wines. Periodically, harvests of nuts and grains are tainted by aflatoxins, leading to massive recall of produce, sometimes ruining producers, and causing food shortages in developing countries. Animal and human parasites and pathogens Fungi can affect animals, including humans, in several ways. Fungi attack animals directly by colonizing and destroying tissues. Humans and other animals can be poisoned by eating toxic mushrooms or foods contaminated by fungi. In addition, individuals who display hypersensitivity to molds and spores develop strong and dangerous allergic reactions. Fungal infections are generally very difficult to treat because, unlike bacteria, fungi are eukaryotes. Antibiotics only target prokaryotic cells, whereas compounds that kill fungi also adversely affect the eukaryotic animal host. They are usually visible on the skin of the animal. Fungi that cause the superficial mycoses of the epidermis, hair, and nails rarely spread to the underlying tissue [link]. These conditions are usually treated with over-the-counter topical creams and powders, and are easily cleared. More persistent, superficial mycoses may require prescription oral medications.

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Chapter 7 : Introduction to Fungi

For instance, analyses of human-pathogenic fungi generally rely on cell lines and experimental animal models, in contrast to plant pathogens, which can be studied directly on their hosts. Many more fungal species infect plants than animals, and thus, more plant-fungus systems than animal-fungus systems are studied.

The most prevalent mycoses are caused by fungi that are either members of the normal human microbiota, such as species of Candida and Malassezia, or ubiquitous, exogenous fungi that are highly adapted for survival on the human host, such as species of Aspergillus and Cryptococcus. This article will summarise the aetiology, risk factors and clinical manifestations of the most common mycoses. Strategies for their diagnoses include traditional methods of microscopy and culture, as well as the detection of fungal antigens and antifungal antibodies, fungal deoxyribonucleic acid and structural components. Because both infectious fungi and their human hosts are eukaryotes, they share many cellular processes and macromolecules. Consequently, it is difficult to identify targets for antifungal drugs that do not inflict collateral damage on the patients. Key Concepts Superficial and cutaneous mycoses are among the most common of all communicable diseases. Geophilic and zoophilic dermatophytes usually cause acute, inflammatory lesions that respond to topical treatment within weeks and rarely recur. Conversely, anthropophilic dermatophytes tend to cause relatively mild, chronic lesions that may require months or years of treatment and frequently relapse. Subcutaneous mycoses may be caused by dozens of environmental moulds associated with vegetation and soil. These fungi are usually acquired by contamination of minor wounds. The infections are generally chronic and rarely spread to deeper tissues. The endemic mycoses coccidioidomycosis, histoplasmosis, blastomycosis and paracoccidioidomycosis are caused by dimorphic environmental moulds and associated with distinct geographic regions. Opportunistic mycoses are caused by globally distributed fungi that are either members of the human microbiota or ubiquitous environmental fungi. These mycoses have the highest global mortality. Innate immune responses e. Effective treatment of invasive mycoses relies on rapid identification of the fungus, administration of the appropriate antifungal drug and management of any underlying disease or condition. Yeast cells of Candida species. Microscopic appearance of the short hyphae and spherical cells of Malassezia causing pityriasis versicolor. Cutaneous and subcutaneous phaeohyphomycosis due to Alternaria. Paronychia due to Candida species. Hyphae of Aspergillus fumigatus identified after subsequent culture in the sputum of a patient with acute pulmonary aspergillosis. Typical appearance of vegetative hyphae produced by moulds, whether in culture or tissue, causing an infection. Hyphae of Aspergillus fumigatus identified after subsequent culture in a histopathological section of lung tissue from a patient with pulmonary aspergillosis. References Ampel NM New perspectives on coccidioidomycosis. Proceedings of the American Thoracic Society 7: New England Journal of Medicine Cushion MT Pneumocystis: Trends in Microbiology Clinical Microbiology Reviews Denning DW, Pleuvry A and Cole DC Global burden of allergic bronchopulmonary aspergillosis with asthma and its complication chronic pulmonary aspergillosis in adults. Clinical Infectious Diseases From Human Pathogen to Model Yeast, pp. Kauffman CA Histoplasmosis: Clinical Infectious Diseases 61 Clinical Microbiology Reviews 8: Mitchell TG Population genetics of pathogenic fungi in humans and other animals. Xu J ed Microbial Population Genetics. Therapeutics and Clinical Risk Management 2: Seminars in Respiratory and Critical Care Medicine Journal of Clinical Microbiology Pediatric Infectious Disease Journal A Guide to Identification. Mitchell TG Medical mycology.

Chapter 8 : Plant pathology - Wikipedia

Fungal diseases are often caused by fungi that are common in the environment. Fungi live outdoors in soil and on plants and trees as well as on many indoor surfaces and on human skin. Most fungi are not dangerous, but some types can be harmful to health.

Chapter 9 : Fungi pathogenic for humans and animals (in three parts). Part B. Pathogenicity and detection:

Thus, while plants and animals present very different environments (hosts in the case of pathogens), the fungi that attack them are phylogenetically closely related. The same pathogenicity principles might therefore be used by animal and plant pathogens, albeit with some variation.