

Microbe of the Month

Breaking The Chain of Infection

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**FEATURED
THIS
MONTH:**

FUNGAL SKIN and NAIL INFECTIONS

Opportunistic pathogens prone to treatment failure and resistance

10-minute read + QUIZ

Hello readers!

Microbe of the Month aims to provide a concise clinical resource to help you keep up to date about healthcare associated pathogens of everyday importance, as well as vital facts and clinical guidelines relevant to **Infection Control** and **Antimicrobial Stewardship (AMS)**, in an easy-to-read and understand format.

There is a quick quiz at the end of the newsletter to test your grasp of the content – please use this newsletter as a teaching tool in your workplace and start an ‘infectious dialogue’ about topical issues in infection control!

“Being able to identify, treat and educate patients about the most common foot problems is key to keeping them ambulatory and, in the ‘at risk’ populous, preventing disaster.”¹

More than 20% of the world’s population suffers from fungal disease^{1,2} ranging from superficial skin, nail and mucous membrane infections to invasive and life-threatening fungal infections such as Cryptococcal meningitis and *Candida auris* (the latter will be featured in the **November** issue of **Microbe of the Month**).

Yeasts and fungi thrive under moist environmental conditions, and immunocompromised individuals (e.g., the elderly, cancer patients, recipients of steroid and broad-spectrum antibiotic therapy, etc.) are susceptible to infections caused by these opportunistic pathogens.

Diabetics are especially at risk of developing secondary complications, foot ulceration, paronychia, cellulitis and an increased risk of lower limb amputation.^{1,3}

Key words: yeasts, moulds, differential diagnosis, intertrigo, onychomycosis, paronychia, Wood’s lamp, systemic vs. topical therapy.

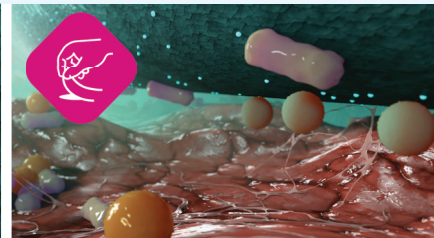
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IS THERE A DIFFERENCE BETWEEN YEASTS AND FUNGI?

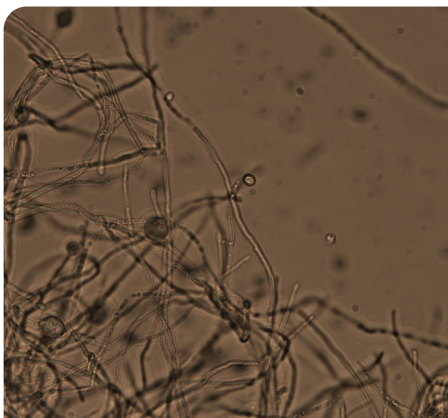
In a nutshell, YES! Basic insights into the structure and proliferation of these microorganisms are quite important to understand how and why they cause different types of infection, and are helpful in their diagnosis and treatment.



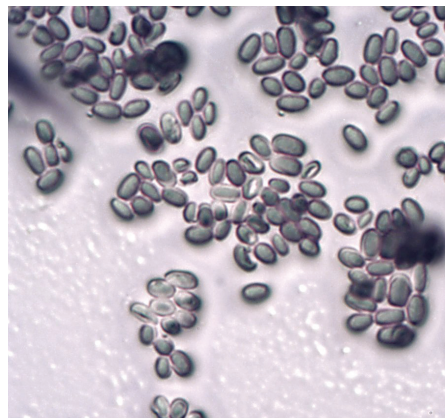
BASIC MYCOLOGY ²

Both yeasts and fungi belong to the kingdom of fungi. The main difference is in their structure and how they proliferate (reproduce). Fungi are **eukaryotic** microorganisms (cells or organisms which possess a clearly defined nucleus). **Fungi can occur as yeasts, moulds, or as a combination of both forms.** Some fungi are capable of causing superficial, cutaneous, subcutaneous, systemic or allergic diseases.

Yeasts are microscopic fungi consisting of solitary cells that reproduce by '**budding**'. Moulds, in contrast, grow in branch-like filaments or extensions known as **hyphae**.



Some moulds and fungi grow rapidly by forming branch-like filaments known as 'hyphae'.

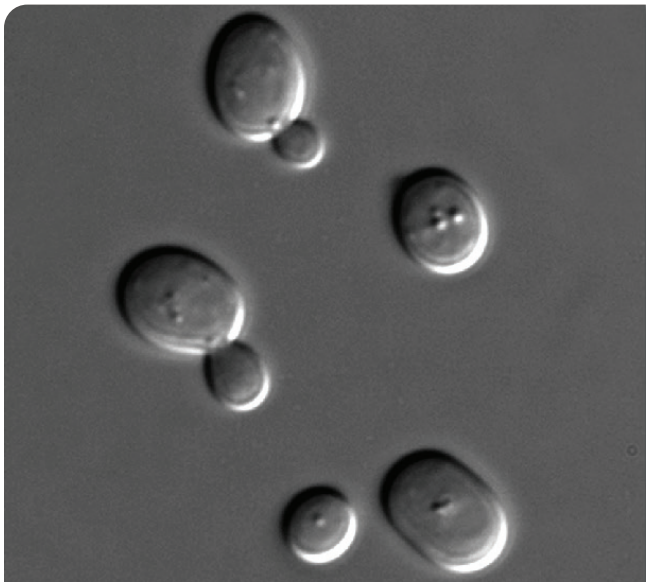


Moulds and fungi reproduce through the production of spores which can remain viable in the environment for months to years.

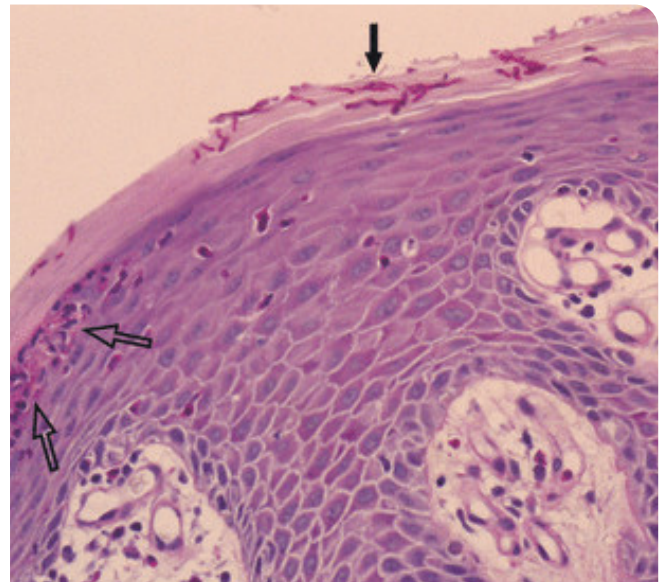


Moulds cultured on a petri dish – the vivid colours are from the pigments in the spores, which are used for reproduction.

Their cell walls are made up of a fibrous polysaccharide substance called 'chitin', and because they feed upon dead organic matter – in this case, **the horny, outer layer of the skin** (termed the '*stratum corneum*'), or the hair and nails of humans and animals – they are referred to as '**dermatophytes**' (from the Greek '*dermatos*' for skin, and '*phyton*' for plant).



Yeasts reproduce by 'budding'
(e.g., '*Candida albicans*').



Skin biopsy demonstrating *Candida* fungal pseudohyphae in the stratum corneum (epidermis).



COMMON INFECTIONS CAUSED

Some yeasts are parasitic pathogens – a common example is ***Candida albicans***, which causes foot and nail infections (particularly in diabetics). ***Candida albicans*** infection of the mouth and vagina is commonly called 'thrush', because of the white yeast plaques that it forms on the surface of these mucous membranes.

Fungal dermatophytes also cause superficial skin infections such as 'ringworm' and 'athlete's foot' in humans and animals – *Microsporum*, *Trichophyton* and *Epidermophyton* are most commonly implicated.^{3,4}



Tinea corporis with an active border and central clearing

The lesions appear as round, red, scaly patches with well-defined, raised edges, often with a central clearing, and are very itchy.



Facial ringworm

It may be misdiagnosed as contact dermatitis, psoriasis, discoid Lupus, etc., and will be aggravated by treatment with topical steroid creams.



Tinea capitis

(Ringworm of the scalp)

Children from ages 3 to 7 are most commonly infected with *tinea capitis*. (Note: Ringworm of the scalp should be treated with systemic anti-fungal agents.)

- **Tinea cruris** (“jock itch”) occurs more commonly in men than women and is made worse by sweat, friction and tight clothing. Frequently, the feet are also involved (i.e., ‘athlete’s foot’). It is believed that the feet are first infected from contact with the ground. The fungal spores are then carried to the groin from scratching or from putting on underwear. The infection frequently extends from the groin to the perianal skin and gluteal cleft. The appearance of the rash is red, scaly and pustular, and is usually very itchy.

Note: It is important to differentiate *Tinea cruris* from other similar dermal conditions, such as intertriginous *Candidiasis*, *erythrasma* or *psoriasis*.



Differential diagnosis?

Intertrigo (also known as ‘intertriginous dermatitis’) is an inflammatory condition of the skin folds, caused or aggravated by heat, moisture, maceration, friction and lack of air circulation. This condition is frequently complicated by secondary infection – most commonly with *Candida* species – however, **bacterial, viral or other fungal microorganisms may also be implicated**. Intertrigo commonly affects the axilla, perineum, the skin creases below the breasts, and abdominal folds. Less commonly, it may affect the neck creases (e.g., from the copious saliva of teething infants) and interdigital areas (e.g., wearing gloves or occlusive footwear for long periods).

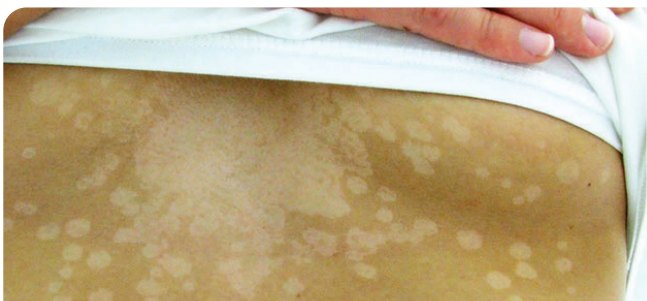


Tinea cruris – also referred to as “jock itch”.



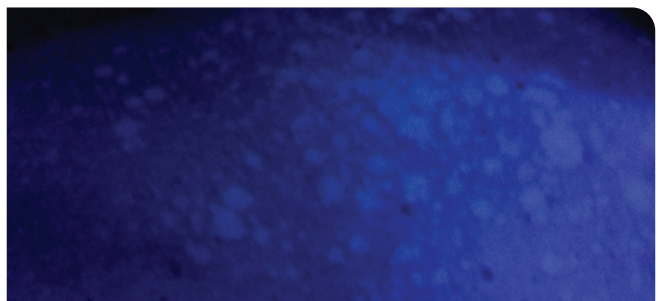
Intertrigo in the skin fold underneath the breast.

- **Tinea versicolor** infection is common in young adults and is caused by *Pityrosporon orbiculare*. Tan, brown or white, very slightly scaling lesions (which tend to coalesce), are seen on the chest, neck, abdomen, and occasionally on the face. ^{4,5}



Tinea versicolor

This condition is often only noticed in summer because the lesions do not tan - they appear as white ‘sunspots’. ⁴



Wood’s lamp examination

A source of long wave ultraviolet light. It is used to detect the fluorescence in fungal skin and hair infections, which is a feature of some dermatophytes. ^{4,5}

■ Athlete's foot – 'Tinea pedis'

Contrary to the name, tinea pedis does not solely affect athletes. **Tinea pedis** affects more men than women and is uncommon in children. The primary method of incubation and transmission is when people go barefoot in a moist communal environment, such as a changing room or shower, and then put on their shoes. Infected skin 'squames' (flat, keratinised dead skin cells), which are continually shed from the horny, outermost layer of the skin, spread the fungal spores.

The infection can be seen between the toes and may spread to the sole of the foot in a 'moccasin' pattern. The lesions may be accompanied by peeling, maceration (peeling due to moisture) and itching. In severe cases, the infection may progress into a 'vesiculobullous pattern' in which small, fluid-filled blisters are present.³



Clinical significance?

Another implication of tinea pedis is **onychomycosis** of the toenails – especially in older adults or individuals with **peripheral vascular disease, diabetes mellitus, or after nail trauma**.

The nails become thick, discoloured and brittle, and often *onycholysis* (painless separation of the nail from the nail bed) occurs.^{3,4}



Athlete's foot – *Tinea pedis*



Moist inter-digital 'athlete's foot'



Moccasin-type 'athlete's foot'



FUNGAL NAIL INFECTIONS – 'ONYCHOMYCOSIS'

Fungal nail infections are more common in toenails than fingernails, and cause the nail to become discoloured (yellow or brown), thickened and more likely to crumble and break. Fungal nail infections are caused by many different types of fungi (yeasts or moulds) which live in the environment.

A small crack or an injury to the nail or the surrounding skin (for example, during a pedicure, especially where cleaning and disinfection of the equipment and infection control precautions are poor) permits ingress of these fungi and the development of infection. A fungal nail infection is not usually painful unless it becomes severe, and may also be accompanied by 'athlete's foot'.^{1,3,5}



Fungal fingernail infections are usually cured more quickly and effectively than toenail infections.

Mild infections affecting one or two nails may respond to topical anti-fungal medications; however, an effective cure usually requires oral anti-fungal medication taken for several months. ¹⁻⁴



Chronic **paronychia** (inflammation around the nail) starts near the cuticle.

The nail fold is swollen and red. White, yellow, green or black marks appear on the nail and spread. The nail may lift off its bed and may be tender under pressure. ¹⁻⁴



HOW IS THE DIAGNOSIS OF FUNGAL SKIN AND NAIL INFECTIONS MADE? ¹⁻⁵

- ✓ Examination and a detailed history will usually highlight likely risk factors for the infection.
- ✓ The affected area should be cleaned with a 70% alcohol swab prior to sampling.
- ✓ Clippings should be taken from crumbling tissue at the end of the infected nail, or the debris can be scooped out from under the nail (put the scrapings into a folded piece of tissue paper and place inside an envelope, which may prevent secondary bacterial contamination in a humid environment). ³
- ✓ For skin scrapings, use a scalpel from the advancing edge of the lesion – skin flakes >5mm² are needed for microscopy.
- ✓ All specimens should be sent to the **mycology section** of the pathology laboratory.
- ✓ **NB!** Previous treatment may reduce the chance of successfully growing the fungus in a culture, so it is advisable to take the nail clippings or skin scrapings before any treatment is commenced.
- ✓ Examination of nail clippings with a periodic acid-Schiff (PAS) stain can confirm the diagnosis of a fungal nail infection within 48 hours.
- ✓ Note: Since there are so many different types of fungi, and because moulds and yeasts require different treatment, laboratory culture is advisable where there is the possibility of a differential diagnosis (e.g., psoriasis). However, fungal cultures take time for definitive identification. I.e., growth may be seen after about five days, but can take up to four weeks before a sample can be deemed as "no growth." Therefore, if laboratory facilities permit, matrix-assisted laser desorption ionization time of flight (MALDI-TOF) is one of the most accurate methodologies for identifying yeasts. ^{2,4,5}



Supply the correct answer!

Question 1. _____ is an inflammatory condition of the skin folds, caused or aggravated by heat, moisture, maceration, friction and lack of air circulation.

Question 2. Fungal fingernail infections are usually cured more quickly and effectively than toenail infections. TRUE / FALSE?

Question 3. Ringworm of the scalp is caused by *Tinea capitis*, which requires _____ anti-fungal therapy.

Question 4. A _____ _____ is a source of long wave ultraviolet light used to detect fluorescence in some fungal skin and hair infections.

Question 5. Since there are so many different types of fungi, and because moulds and yeasts require different treatment, laboratory culture is advisable. TRUE / FALSE?

ANSWERS: 1. Intertrigo 2. True 3. Systemic 4. Wood's Lamp 5. True



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