Parasitic and Fungal Meningitis

By

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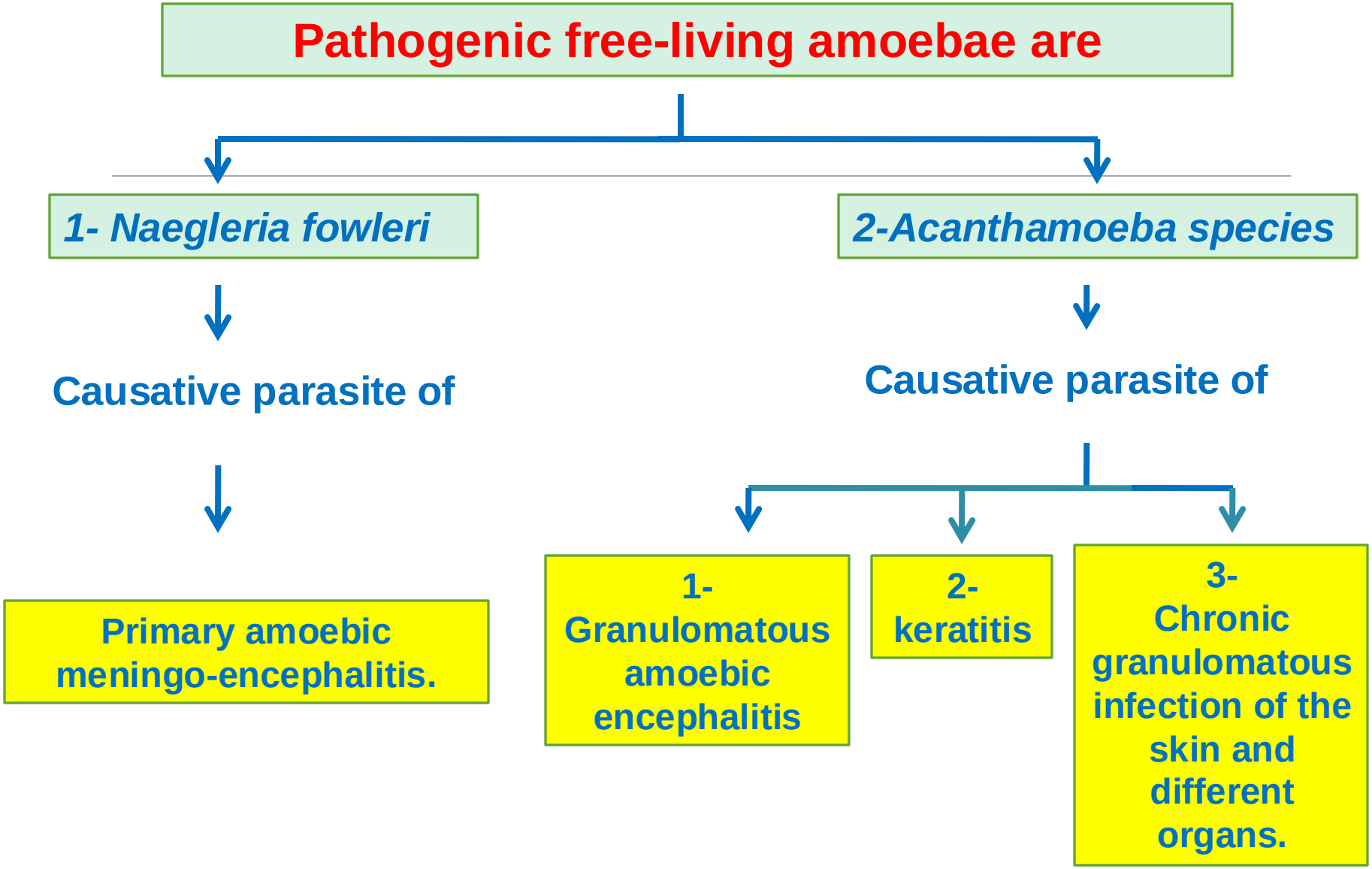
Microbiology and Immunology Department

2024-2025

Pathogenic free-living amoebae

Naegleria fowleri

Acanthamoeba species


Pathogenic free-living amoebae are
1- Naegleria fowleri
2-Acanthamoeba species
Causative parasite of
Causative parasite of
Primary amoebic meningo-encephalitis.
1- Granulomatous amoebic encephalitis
2- keratitis
3- Chronic granulomatous infection of the skin and different organs.

Geographical distribution:

- Cosmopolitan.

- These amoebae are readily found free-living in dust, soil and warm stagnant fresh water (thermophilic) in lakes, ponds, streams and swimming pools. They are facultative parasites.

Naegleria fowleri

Morphology:

- **Trophozoite:** 15–30 µm, has a single nucleus and blunt pseudopodia with rapid movement.

Trophozoite

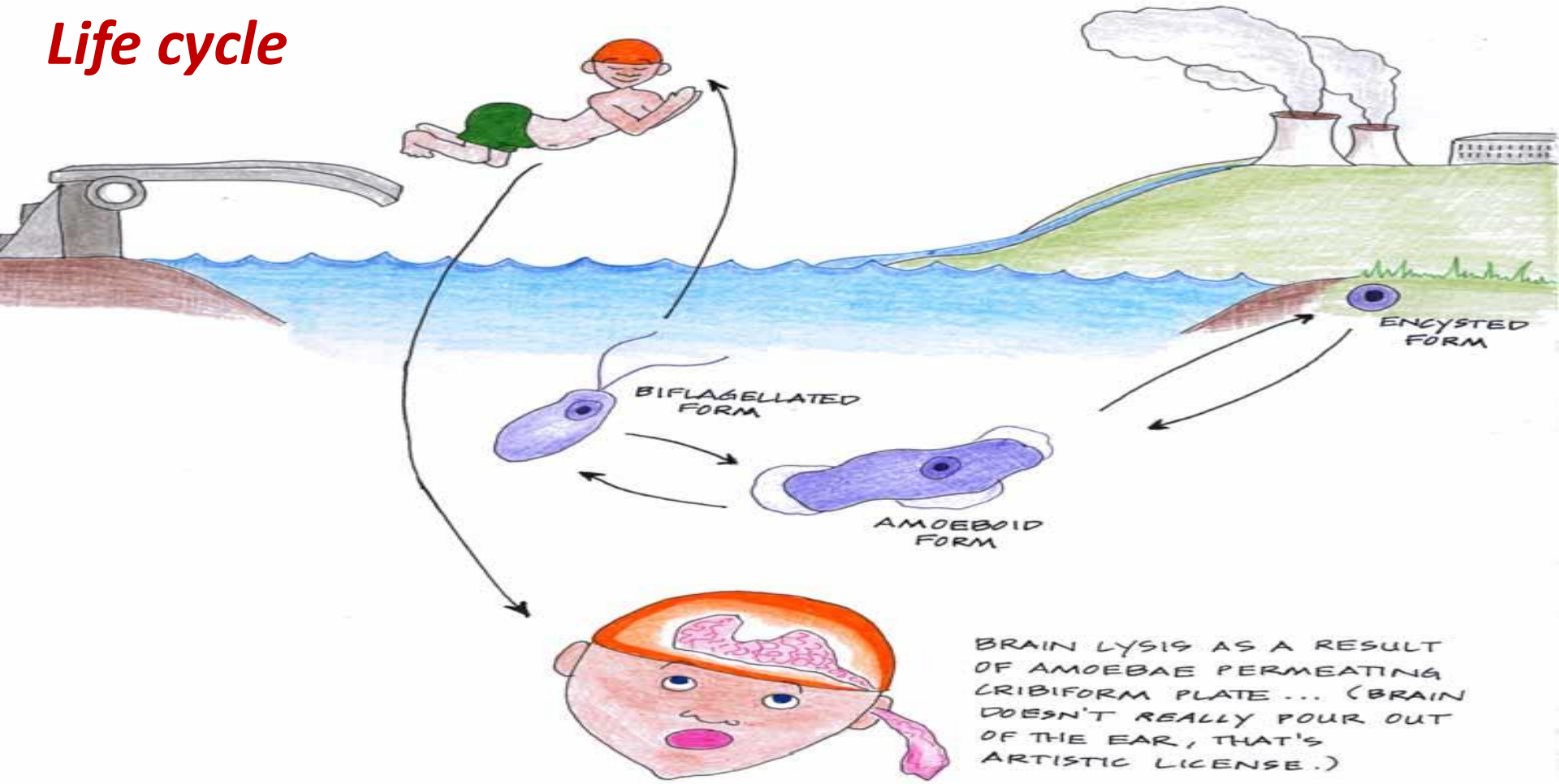
- **Flagellate form:** Pear shaped with two flagella at the anterior end **(occurs only in water).**

Flagellate form in water

- **Cyst:** 10 µm, smooth, round with pores on its wall, has a single nucleus **(occurs in dust not present in tissue).**

Cyst

Life cycle


ENCYSTED FORM
BIFLAGELLATED FORM
AMOEBOID FORM
BRAIN LYSIS AS A RESULT OF AMOEBAE PERMEATING CRIBIFORM PLATE ... (BRAIN DOESN'T REALLY POUR OUT OF THE EAR, THAT'S ARTISTIC LICENSE.)

Life cycle

- **Infection with *Naegleria fowleri trophozoites or flagellate forms* occurs during swimming, diving or bathing in warm fresh water or rarely inhalation of cysts with dust. Cysts and flagellate forms are transformed into trophozoites in the nose. They enter the nose ➲ nasal mucosa ➲ olfactory nerve ➲penetrate cribriform plate➲ to reach the cranial cavity ➲ to the brain.**

Habitat

Host

- **Definitive host**
- **Intermediate host**
- **Reservoir host**

Diagnostic stage

Infective stage

Mode of infection

Life cycle

- **Habitat:** Brain

- **Definitive host:** Man

- **Intermediate host:** No intermediate host

- **Reservoir host:** No reservoir host

- **Diagnostic stage:** Trophozoite

- **Infective stage:** Trophozoite or flagellate form (in contaminated water), or the cyst (in dust)

- **Invasive stage:** Trophozoite.

- **Mode of infection:** 1) Swimming in contaminated water (trophozoite or flagellate form)

2) Rarely inhalation of the cysts in dust

Clinical aspect

- **Disease: Primary amoebic meningo-encephalitis (PAME)**

- **Pathogenesis: penetrate dura matter, lyse and ingest brain tissue causing haemorrhage and necrosis and a typical picture of meningitis**

- **Acute, rapidly fatal within one week**

- **Affects children and young adults.**

- **Early manifestations: altered smell and taste, fever (39-40°C), severe frontal headache, nausea and vomiting.**

- **Later: mental confusion, stiffness of the neck and convulsions followed by coma.**

Laboratory Diagnosis

1-Head CT scanning or MRI

→ signs of increased intracranial pressure may be found.

2-Lumber puncture for CSF analysis

→ The primary diagnostic tool

→ 1- CSF is purulent (no bacteria), ↑ neutrophils, ↑ RBCs, ↑ protein & ↓ glucose level.
2- Trophozoite found in CSF.

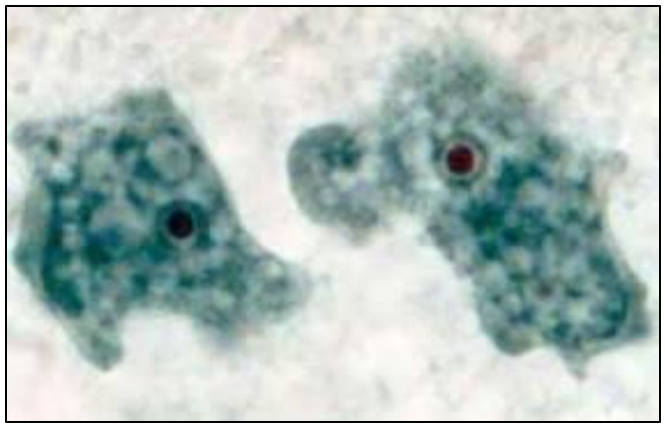
3-Culture of CSF on non-nutrient agar seeded with *E. coli*

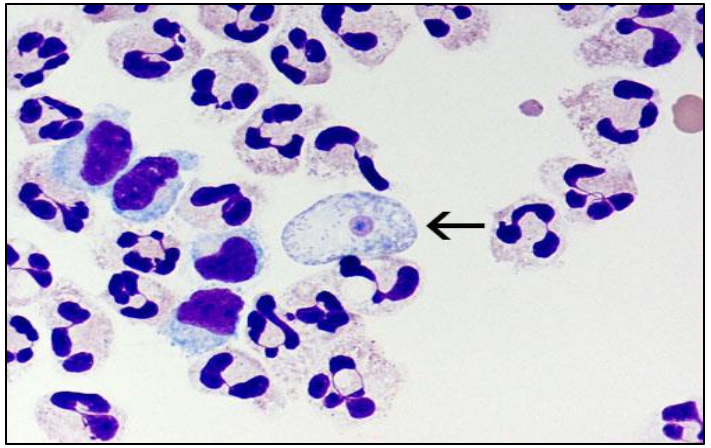
4-Fluorescent antibodies test

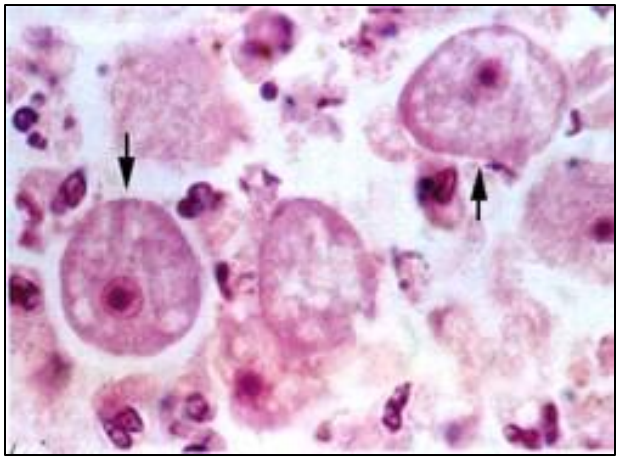
→ Help in detection of the numerous trophozoites in brain tissue

5-PCR

→ sensitive diagnostic test







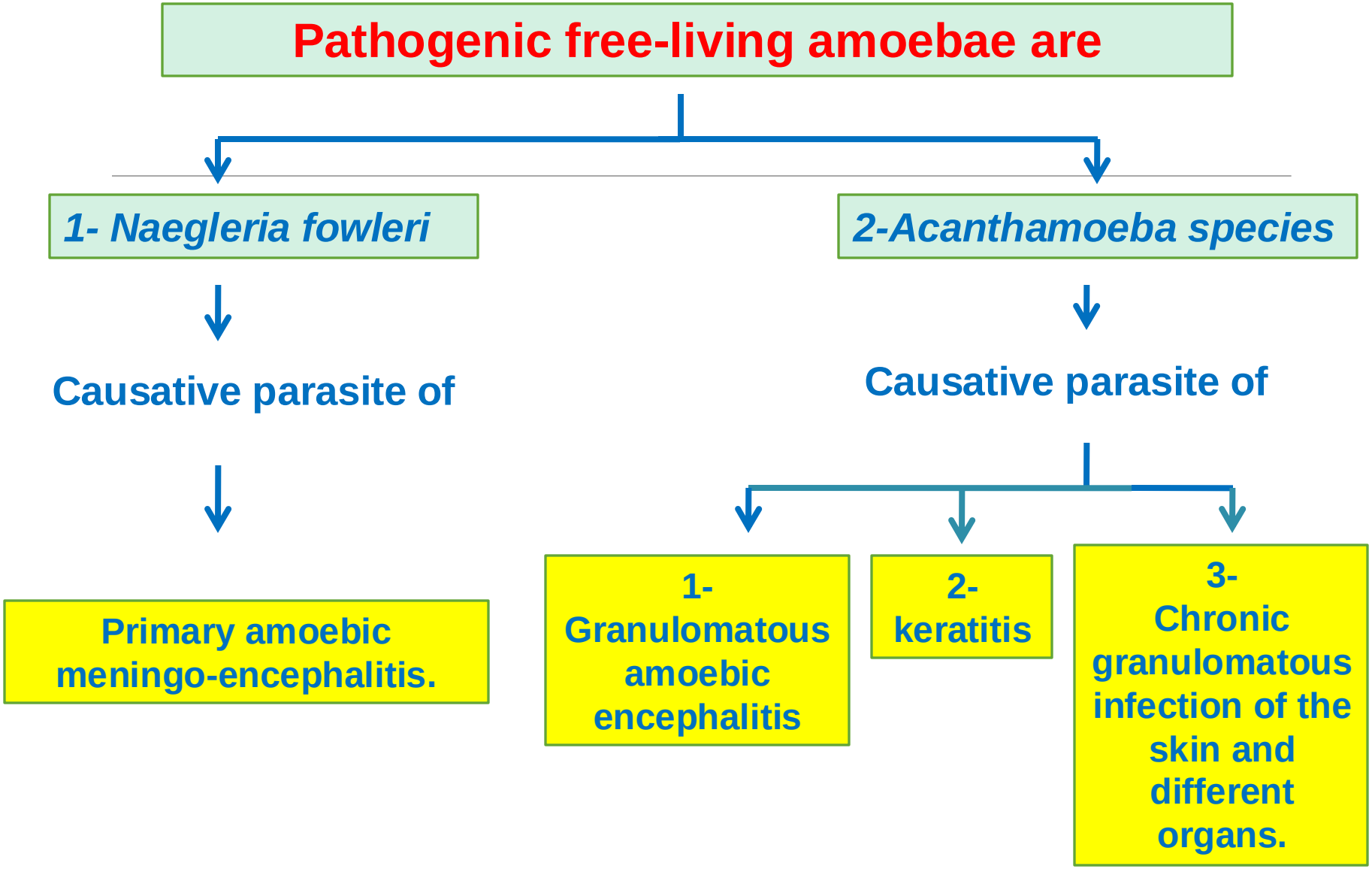
Trophozoites of *Naegleria fowleri*

Treatment

1- Medical:

Amphotericin B IV or intrathecally in severe cases +Miconazole (IV injection).

2- Surgical: Hydrocephalus may necessitate shunting.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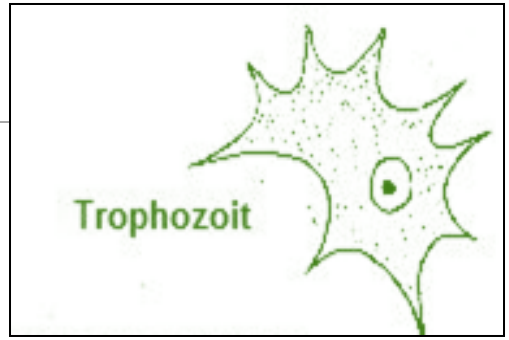
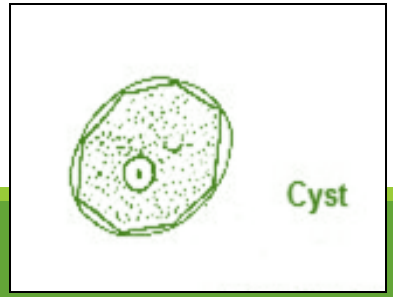
Acanthamoeba

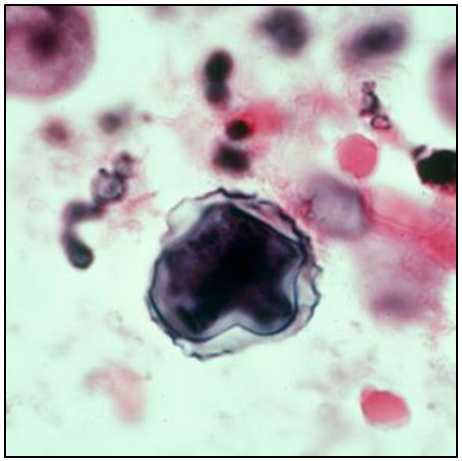


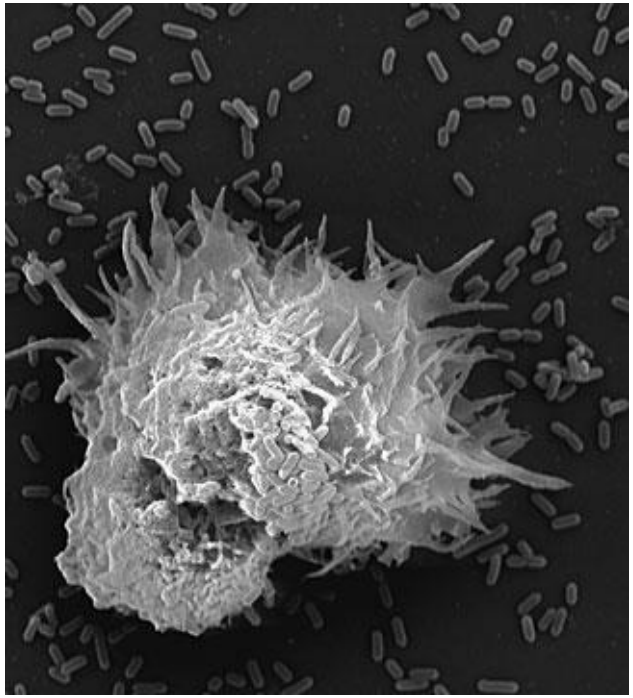
Morphology:

- **Trophozoite:** 10–40 µm, has a single nucleus and spiky pseudopodia with sluggish movement.

- **Cyst:** 15 µm, smooth, double-walled (polygonal inner layer and wrinkled outer layer), has a single nucleus

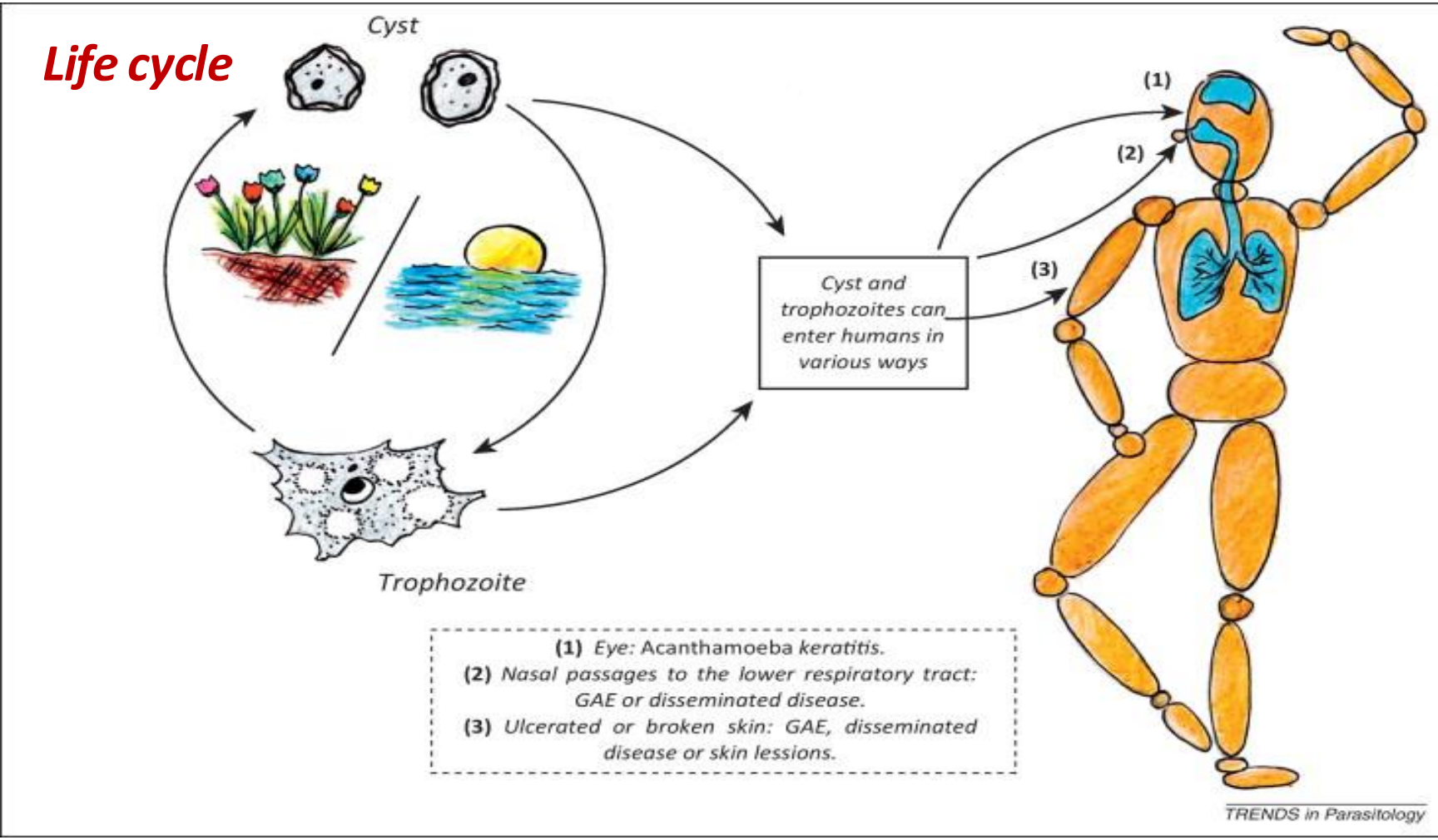






Stages of *Acanthamoeba*

Life cycle


Cyst
Trophozoite
Cyst and trophozoites can enter humans in various ways
(1)
(2)
(3)
(1) Eye: Acanthamoeba keratitis.
(2) Nasal passages to the lower respiratory tract: GAE or disseminated disease.
(3) Ulcerated or broken skin: GAE, disseminated disease or skin lessions.
TRENDS in Parasitology

Habitat

Host

- **Definitive host**
- **Intermediate host**
- **Reservoir host**

Diagnostic stage

Infective stage

Mode of infection

Life cycle

- **Habitat:** Brain and other organs

- **Definitive host:** Man

- **Intermediate host:** No intermediate host

- **Reservoir host:** No reservoir host

- **Diagnostic stage:** Trophozoite and cyst

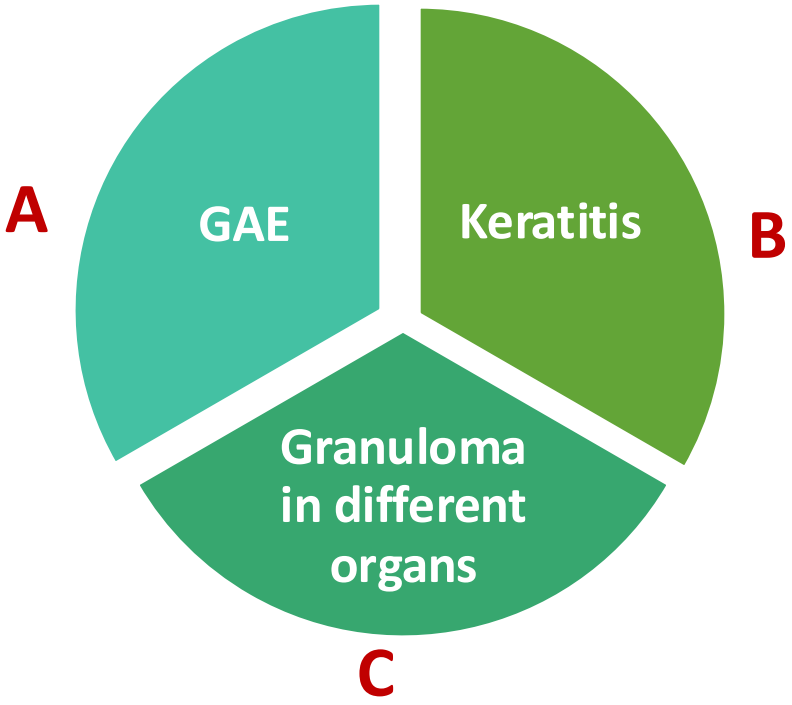
- **Infective stage:** Trophozoite and cyst

- **Mode of infection:** **1- Swimming in infected water or inhalation of dust----- through the nose----blood ------CNS**

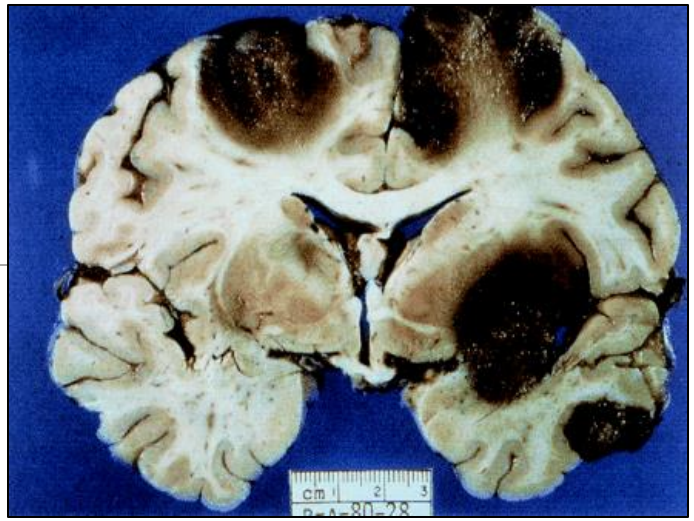
2- The organism enters through skin lesion-----blood-----granuloma

3- Through the eye: contaminated contact lenses, minor trauma or contaminated water

Clinical aspect



Clinical aspect



- Diseases

1. Granulomatous amoebic encephalitis (GAE)

- Chronic, with gradual onset.

- Affects debilitated or immune-suppressed persons **(opportunistic).**

- GAE resembles space-occupying lesions & is manifested by vomiting, headache, diplopia, altered mental state, convulsions & stiffness of the neck

- It is fulminant in severely immune-suppressed patients → acute encephalitis

Clinical aspect

2. Corneal ulcers and keratitis in healthy persons

(may lead to blindness)

3. Chronic granuloma of the skin, lung, liver,……in immunocompromised persons

Diagnosis

A) Clinical: clinical picture and history of swimming in hot fresh water.

B) Laboratory:

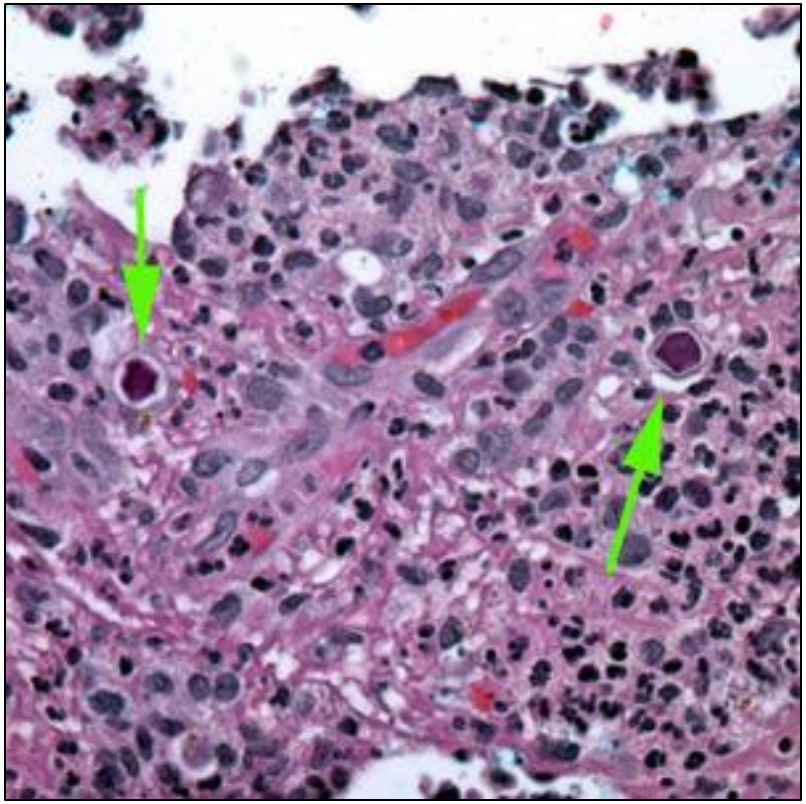
1) CSF examination: very rare to detect trophozoites. ????????

2) Corneal scraping and biopsy from granulomatous lesions detect trophozoites or cysts

3) Culture on non-nutrient agar seeded with *E.coli*

C) Other investigations: CT and MRI of the brain.

D) PCR



Treatment

1. **Amphotericin-B + sulphadiazine**

2. For keratitis: - Topical application of a combined regimen of propamidine, miconazole & neomycine.

- Surgical: Keratoplasty may be required.

Fungal meningitis

CRYPTOCOCCOSIS

Fungal meningitis (Cryptococcosis)

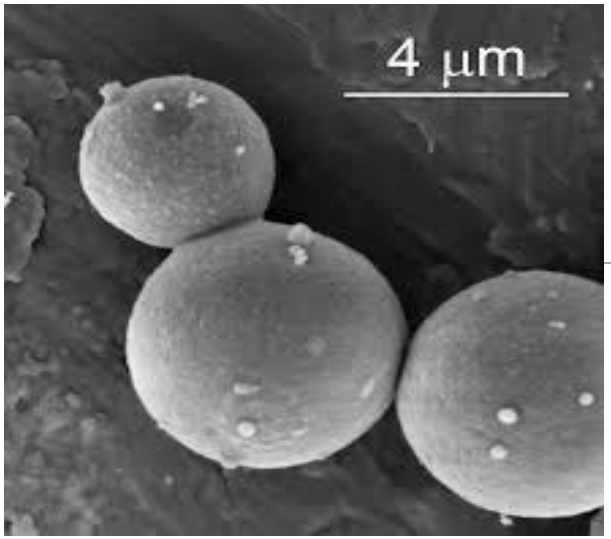
It is a fatal fungal disease caused by *Cryptococcus neoformans*.

❖General characters of *C. neoformans*:

1- Yeast cells, oval in shape with a gelatinous capsule.

2- Found in soil contaminated with the excreta of birds specially pigeons' feces.

3- It is an opportunistic fungus affecting mainly immunosupressed persons specially AIDs patients.


4 μm

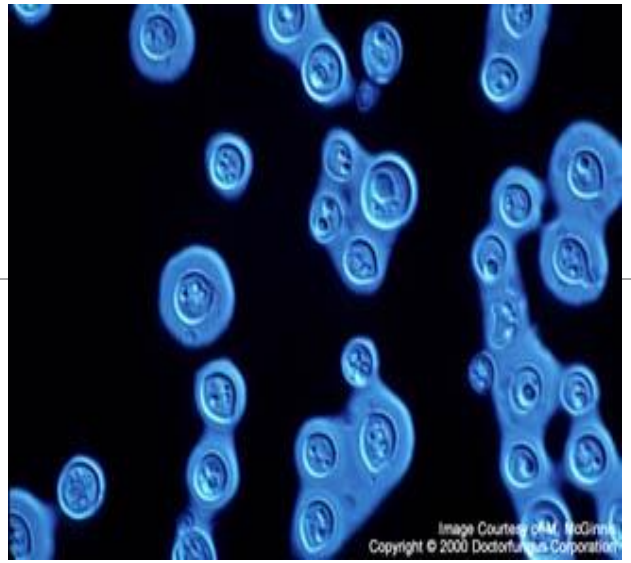


Image Courtesy of M. McGinnis
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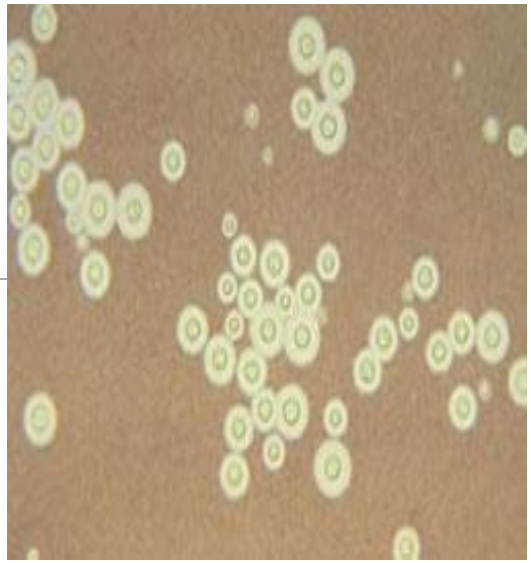

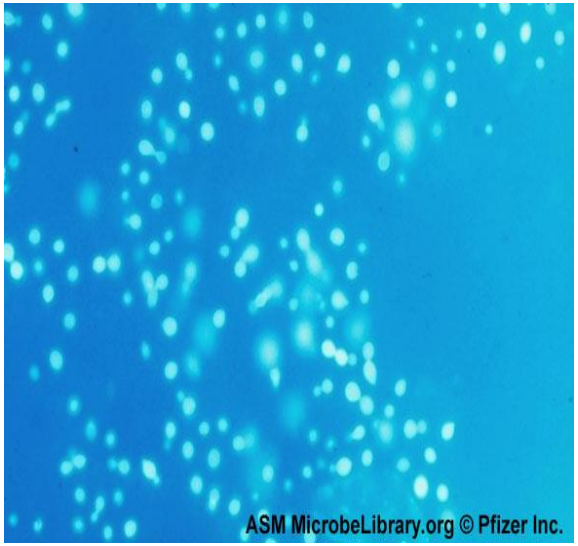
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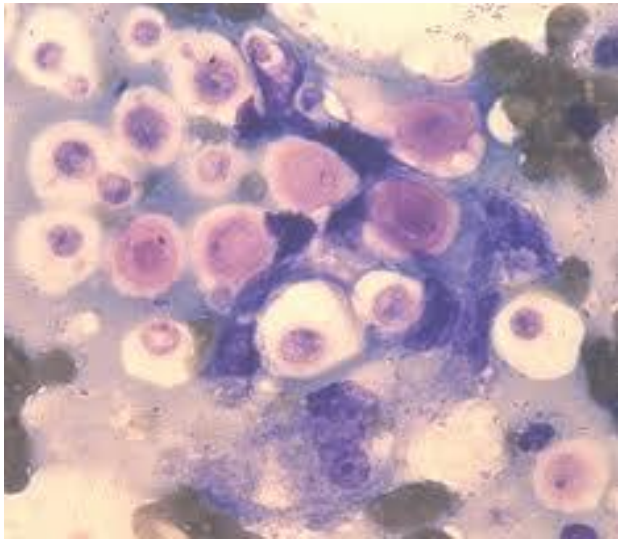

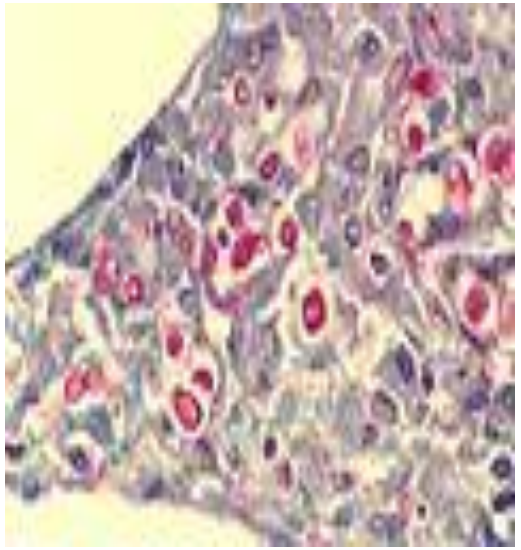

Risk groups

1- Diseases as AIDS, lymphoma, sarcoidosis, liver cirrhosis, lung & heart diseases.

2- Long term corticosteroids therapy.

3- Diabetes.

4- Pregnancy.

Mode of infection

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Infection occurs by inhaling microscopic airborne spores of this fungus that may spread systematically

Clinical pictures

Respiratory symptoms (pneumonia like illness)

Fever, cough, chest pain & dyspnea

Dissemination of the infection mainly with AIDS

To CNS causing meningoencephalitis

- Headache, fever.
- Neck pain.
- Nausea and vomiting.
- Sensitivity to light
- Mental status range from confusion to coma.
- If left untreated, cryptococcal meningoencephalitis may lead to brain damage, hearing loss & hydrocephalus

Diagnosis

Specimens: Sputum, CSF, blood

Microscopic Examination

↓

CSF examination by using India ink showing the oval yeast surrounded by unstained capsule.

Blood or CSF culture on Sabouraud Dextrose Agar (SDA) show mucoid colonies which are urease positive

Detection of *Cryptococcous* antigen in CSF by

↓

Latex agglutination test & ELISA.

↓

Rapid & sensitive methods for diagnosis

PCR

Dipstick test

↓

A new method for detecting *Cryptocoocal* antigen in patient's serum

↓

Rapid (takes 10 minutes), sensitive & inexpensive

Treatment

- **Combination of amphotericin B and flucytosine.**

Test Knowledge

- **Differences between *Naegleria fowleri* and *Acanthamoeba species***
- **How to diagnose a case of *Cryptococcus neoformans* meningitis**


ThankYou