



ACTINOMYCETES & NOCARDIA

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ACTINOMYCETES

Transitional forms between bacteria & fungi

Resemble bacteria:

- Thin
- Muramic acid cell wall
- Prokaryotic nuclei
- Susceptible to antibacterials

Resemble fungi:

- Mycelial network of branching filaments



- Higher bacteria with superficial resemblance to fungi

Related to mycobacteria & corynebacteria

Gram +ve,

Non Motile,

Non Sporing,

Non Capsulated

Filaments break up → bacillary & coccoid



3 medically important genera

- Actinomyces – anaerobic/microaerophilic
non acidfast
- Nocardia – aerobic, acid fast (weakly)
- Streptomyces – aerobic, non acidfast



HISTORY

- Bollinger (1887) from 'lumpy jaw' of cattle
- Wolf & Israel (1891) from human lesions
- "Ray fungus" – ray like appearance in granules from lesions



Human pathogen

- *A. israelii*- most common
- *A. eriksoni*
- *A. naeslundii*
- *A. odontolyticus*
- *A. meyeri*
- *A. viscosus*

In cattle

- *A. bovis*



ACTINOMYCOSIS

- Chronic granulomatous infection
- Indurated swellings in connective tissue
- Suppurates, discharge of sulphur granules
- Multiple sinuses



PATHOGENESIS

- Endogenous infection – actinomyces are commensals of mouth, intestine, vagina
- Trauma, FB, poor oral hygiene → invasion
- Accompanied by other bacteria



CLINICAL DISEASE

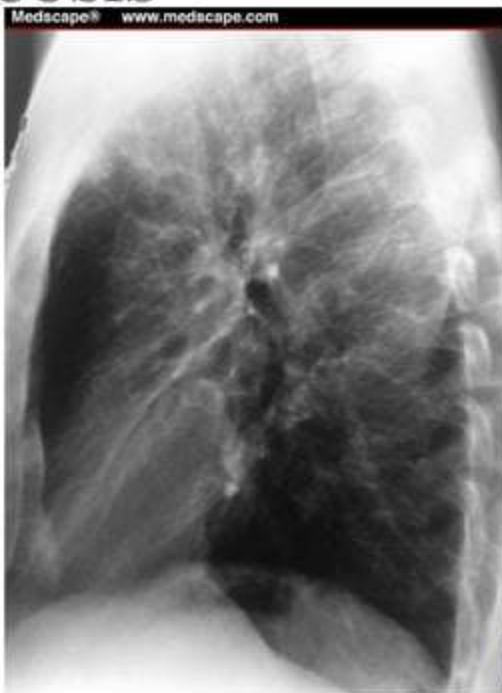
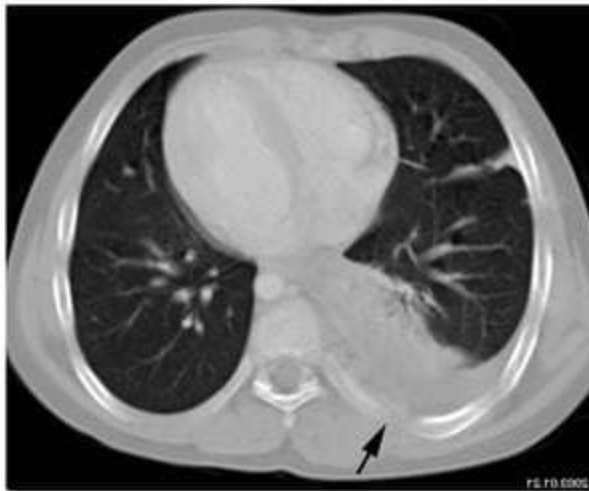
- Cervicofacial – cheek & submaxillary
discharge from lower jaw
- Thoracic – lungs, pleura, pericardium
Discharge thro' chest wall
- Abdominal – ileocaecal, abdominal wall,
Spread to liver
- Pelvic – intrauterine devices



CERVICOFACIAL ACTINOMYCOSIS



THORACIC ACTINOMYCOSIS



CLINICAL DISEASE

Actinomyces are also responsible for

- Gingivitis, periodontitis
- Sublingual plaques, root caries
- Spread to CNS from primary focus
- Actinomycotic Mycetoma - tumour with multiple discharging sinuses, mainly foot



LAB. DIAGNOSIS

Specimen –

pus, sputum, tissue biopsy

Methods –

microscopy, culture, IF & HPE



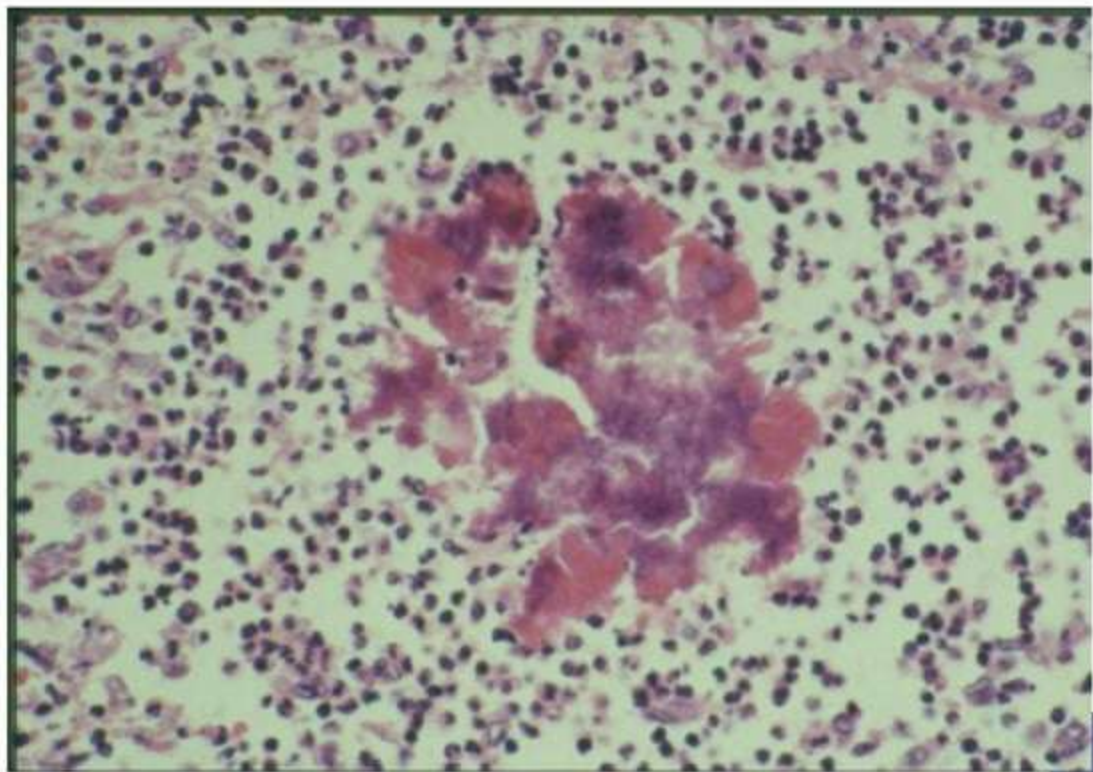
Microscopy:

- Dilute with saline, shake, allow to settle - Sulphur granules sediment
- Sediments pipetted out
- Crushed b/w slides and examined
- Applying gauze pads on discharge



SULPHUR GRANULES IN ACTINOMYCOSIS

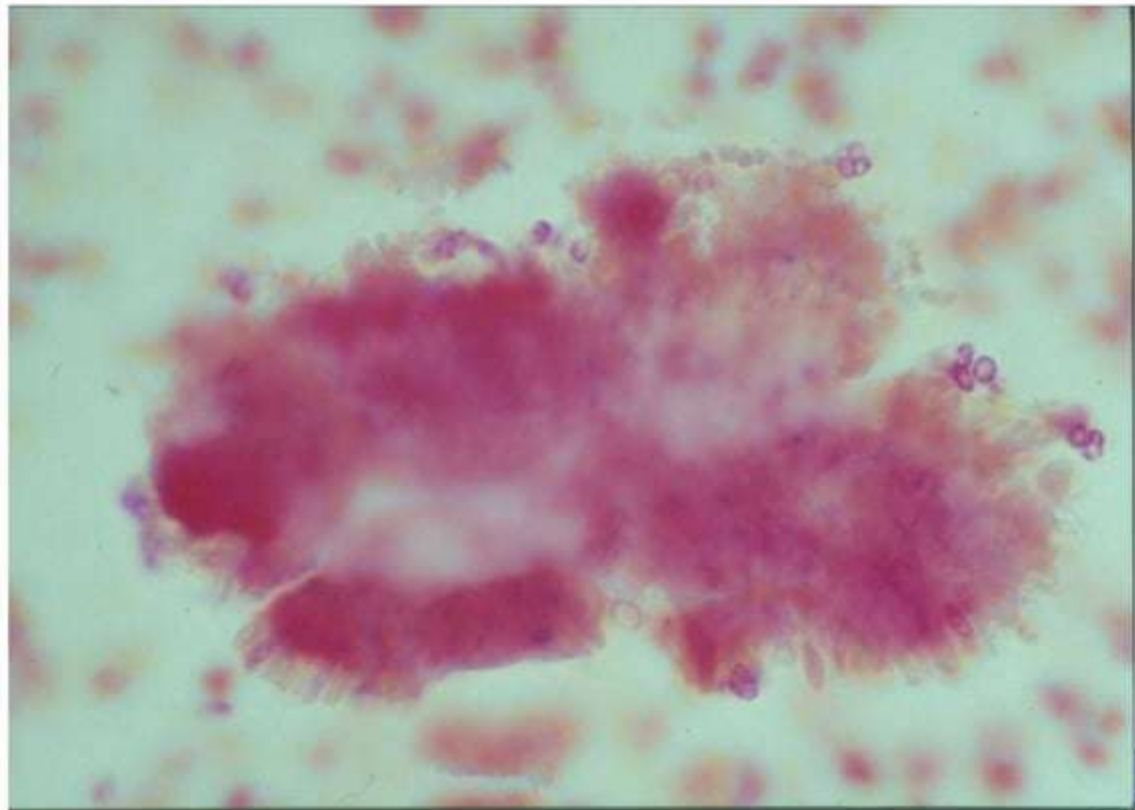


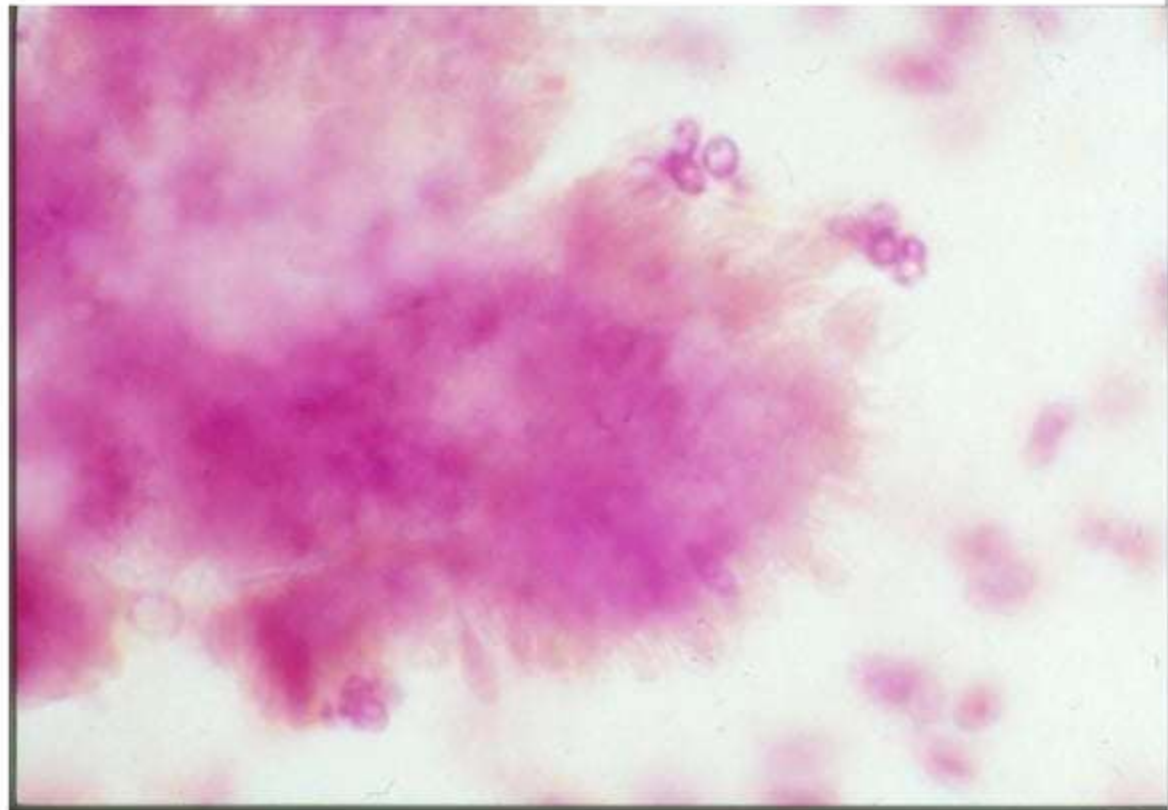


Sulphur granules :

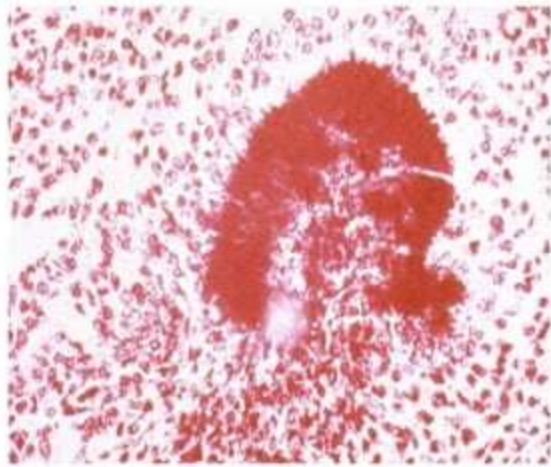
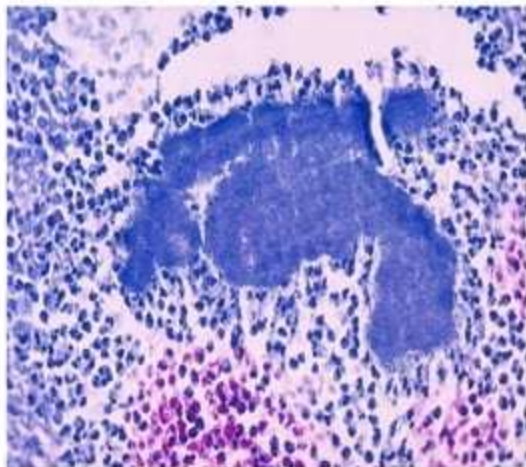
- Minor specks to 5 mm in size
- Macroscopic bacterial colonies
- Crushed betn. slides & then gram stained
- Central gram +ve mycelial clump
- peripheral gram -ve radiating clubs
- sun ray appearance
- Clubs are Ag-Ab complexes







STAINING



Histopathologic changes due to the gram-positive organism, *Actinomyces israelii*. Using a modified Fite-Faraco stain, a "sulphur granule" is shown in the middle of the image.

These granules actually represent colonies of *A. israelii*, a gram-positive, anaerobic filamentous bacteria

Culture:

- Pus / granules washed in saline aseptically
- Crushed with sterile glass rod

Inoculated into:

- Thioglycolate broth
- Brain-heart infusion agar
- Incubate anaerobically



- In broth- fluffy balls at bottom (*A. israelii*)
 - uniform turbidity (*A. bovis*)
- On agar- small spidery colonies in 48-72hrs
 - larger & heaped up in 10 days
- Isolates identified by gram stain, biochem. tests & confirmed by fluorescent Ab tests



CULTURAL CHARACTERISTICS



Immunofluorescence:

- Sulphur granules & mycelia in tissue sections using fluorescent specific antisera

HPE:

- Central mycelial mass
- Peripheral pus cells & chronic inflam. cells



EPIDEMIOLOGY

- World wide
- Common in rural areas, agricultural workers
- Young males (10-30yrs)
- 60% cervicofacial, 20% abdominal
- Pelvic actinomycosis in female (IUCD)



TREATMENT

- Large doses of antibiotics for prolonged periods (months)
- Penicillins & tetracyclines
- Surgical drainage



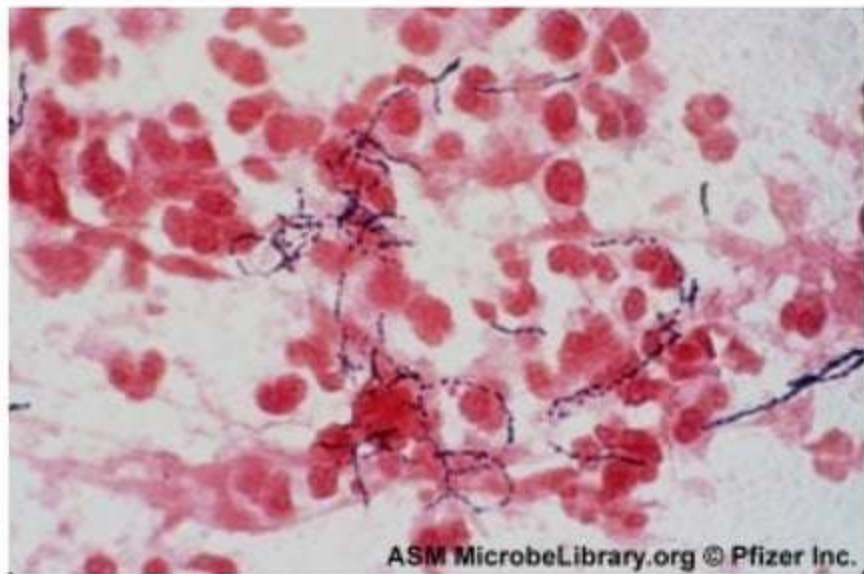
NOCARDIA

Nocard first described

- Gram +ve
- Aerobic
- Acid fast (weakly – 1% H₂SO₄))
(actinomyces are anaerobic, non AF)
- N. asteroides, N. brasiliensis, N. caviae
- Exogenous inf. - Nocardia are found in soil



GRAM STAIN- NOCARDIA



CLINICAL FEATURES

Cutaneous, S/C, systemic lesions

- Cutaneous – abscess, cellulitis, lymphatic
- S/C – actinomycotic mycetoma
- Systemic- immunodeficient (N. asteroides)
- Primary as pneumonia, lung abscess or TB like illness
- Metastatic in brain, kidney etc



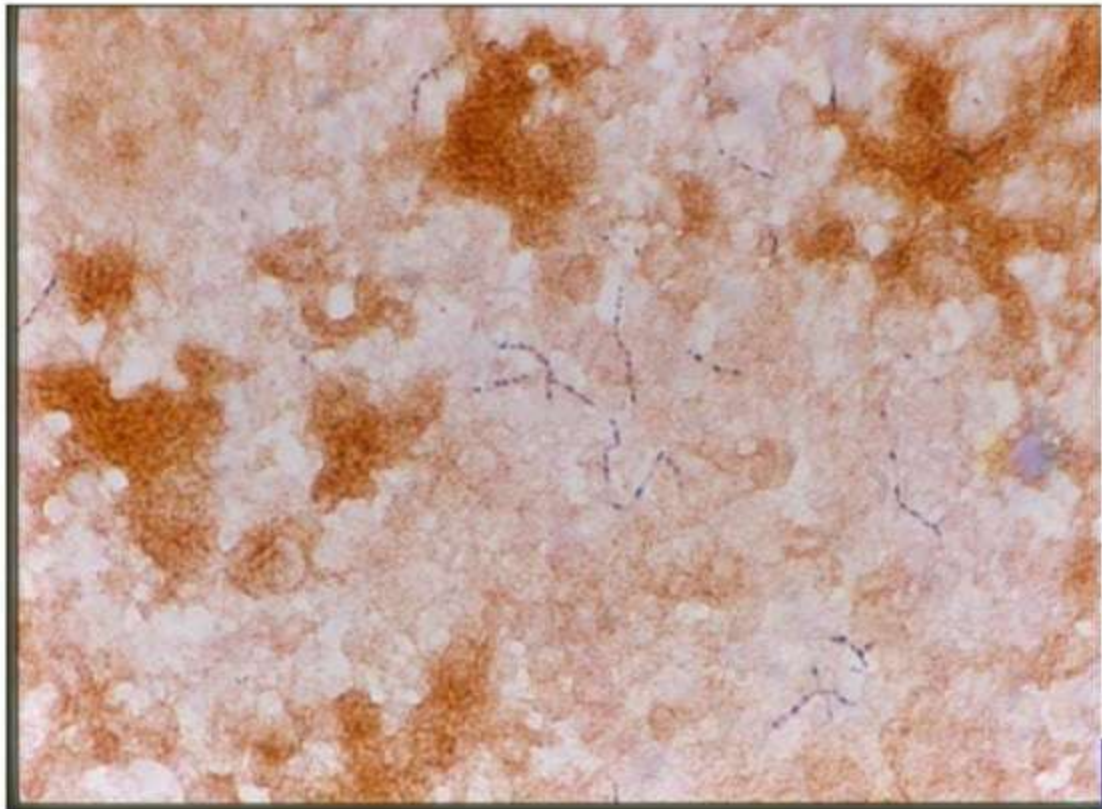
CLINICAL MANIFESTATIONS



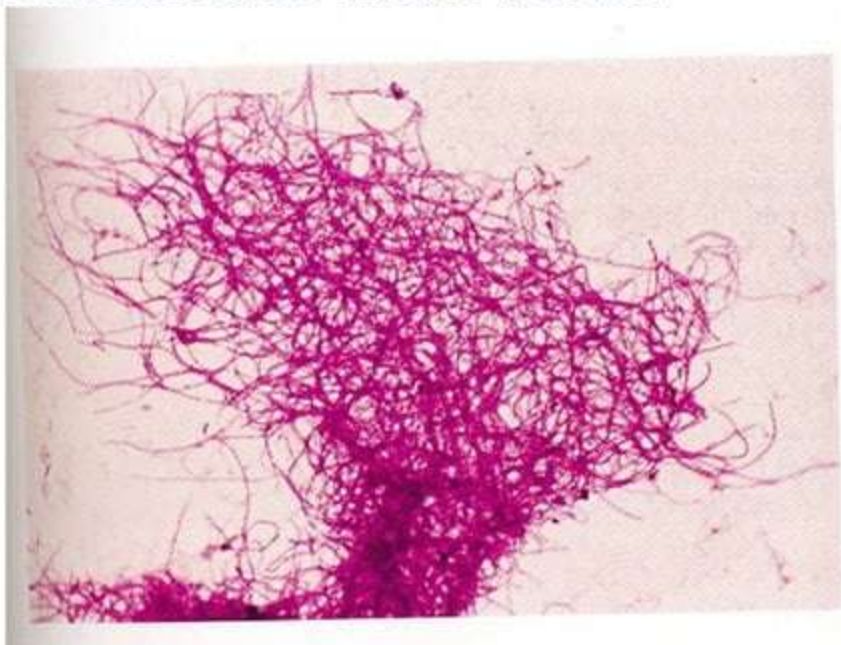
Lab diagnosis:

- White granules in pus, sputum
- Microscopy: branching Gm+ve, AF filaments
- Culture: ordinary media, dry, granular, wrinkled pigmented colonies (yellow to red)



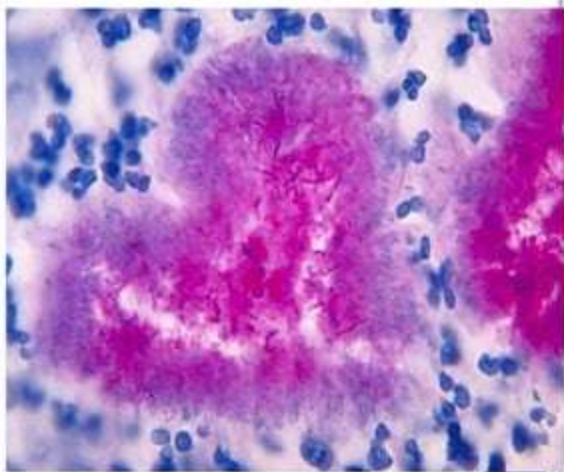
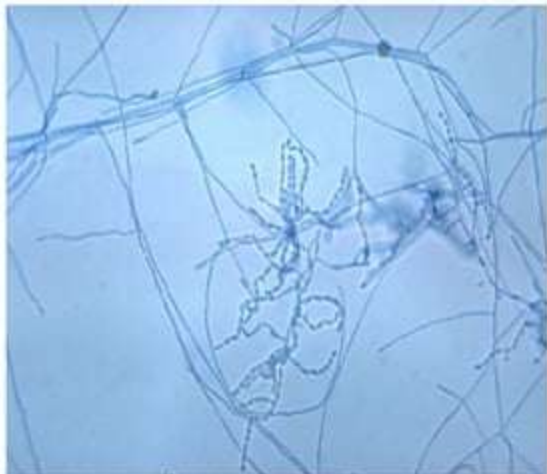


NOCARDIA ACID FAST STAIN



NOCARDIA ASTEROIDES AND NOCARDIA BRASILIENSIS

- Gram-positive aerobic *Nocardia asteroides* slide
- Gram-positive acid-fast *Nocardia brasiliensis* bacteria using a modified Fite-Faraco stain



CULTURAL CHARACTERISTICS




TREATMENT

- Cotrimoxazole
- Minocycline
- Amikacin
- Cefotaxime

for several months
along with surgical drainage



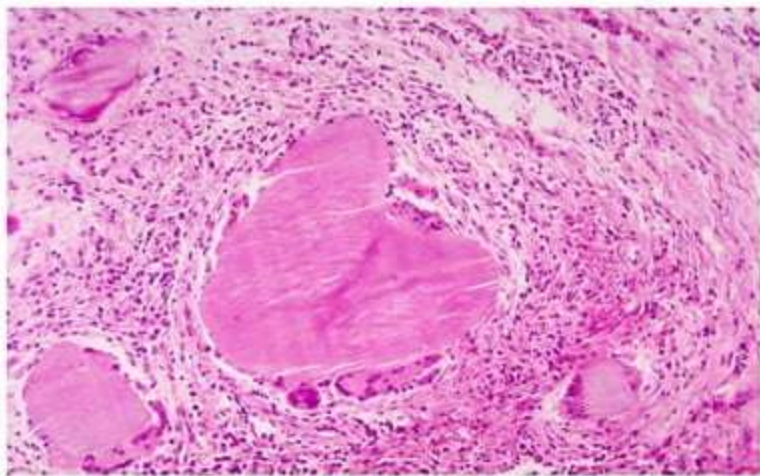
STREPTOMYCOSIS

- The *streptomyces* species usually cause the disease entity known as mycetoma (fungus tumor).
 - These infections are usually subcutaneous, but they can penetrate deeper and invade the bone.
 - Some species produce a protease which inhibits macrophages.
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- Material sent to the lab is pus or skin biopsy.
- The streptomycetes are aerobic like *Nocardia*, and can grow on both bacterial and fungal (Sabouraud) media. They produce a chalky aerial mycelium with much branching .




STREPTOMYCES GRANULES



Actinomycotic mycetomatous granule due to the bacteria *Streptomyces somaliensis*

STREPTOMYCOSIS

- The organisms are found world-wide.
 - There are no serological tests
 - The drugs of choice are the combination of sulfamethoxazole/trimethoprim or amphotericinB.
 - In the tropics, this disease may go undiagnosed or untreated for so long that surgical amputation may be the only effective treatment.
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ACTINOMYCOTIC MYCETOMA

Mycetoma:

- Localised chronic granulomatous lesions of subcut. & Deeper tissues
- Commonly of foot, less often hand & other parts
- Present as tumour with multiple sinuses
- Maduramycosis (gill in 1842 from madura)



MYCETOMA



- Mycetomas are usually caused by fungi
- Less commonly by bacteria

Bacterial agents:

- Actinomyces (*A. bovis*, *A. israelii*, *A. bovis*)
- *N. brasiliensis*, *N. caviae*, *N. asteroides*
- *Streptomyces somaliensis*
- Actinomadura (*A. madurae*, *A. pelletieri*)
- Even *Staph. aureus* (botryomycosis)



Aetiological diagnosis important in treatment

Colour of granule:

- Actinomycotic – white or yellow
- Eumycotic – black

Microscopy:

- Actinomycotic – thin filaments (1 μ m)
- Eumycotic – thick (4-5 μ m)

Culture: isolation & identification

