



NEUROPATHOLOGY INFECTIONS

HAJNALKA RAJNAI



INFECTIOUS AGENTS

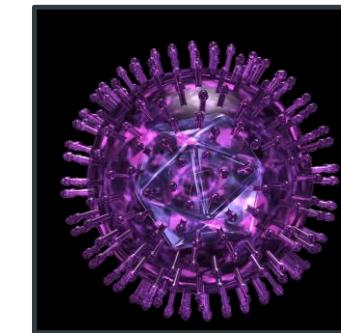
I. Bacterial infection

- Bakterial meningitis
- Brain abcessus
- Tuberculosis
- Neurosyphilis



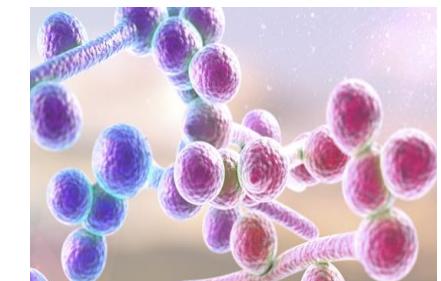
2. Viral infection

- Viral meningitis
- Herpesvirus
- Cytomegalovirus
- Poliovirus
- Rabies
- HIV
- Progressive multifocal leukoencephalopathy



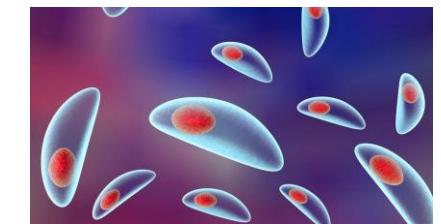
3. Fungal infection

- Candida
- Mucormycosis
- Aspergillus
- Cryptococcus



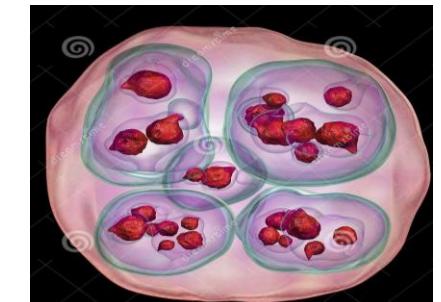
4. Protozoal infection

- Toxoplasma



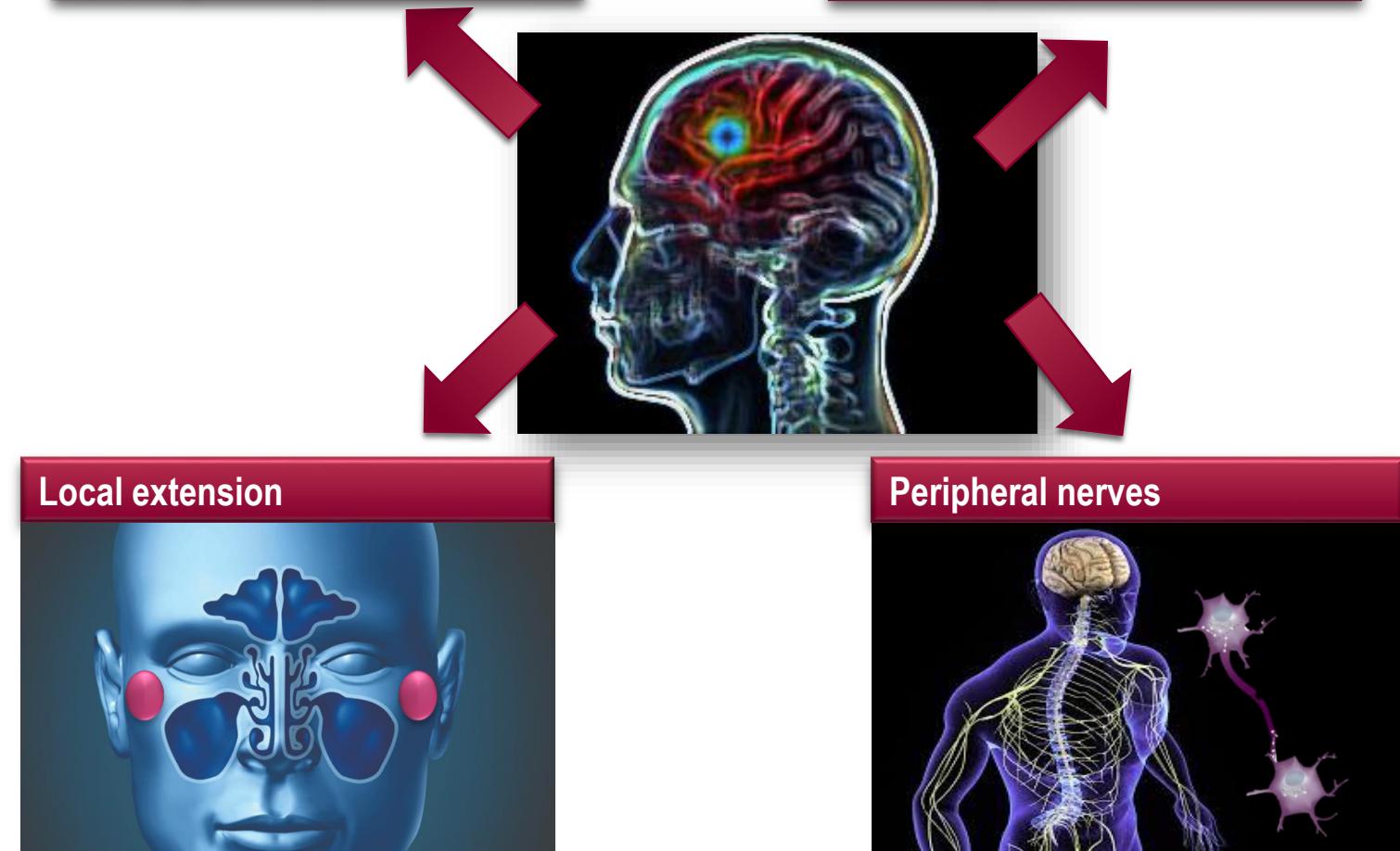
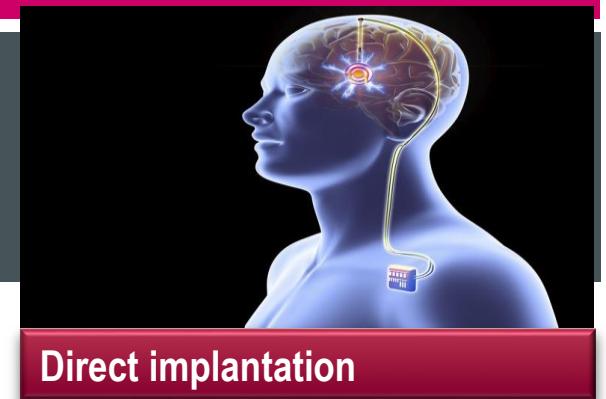
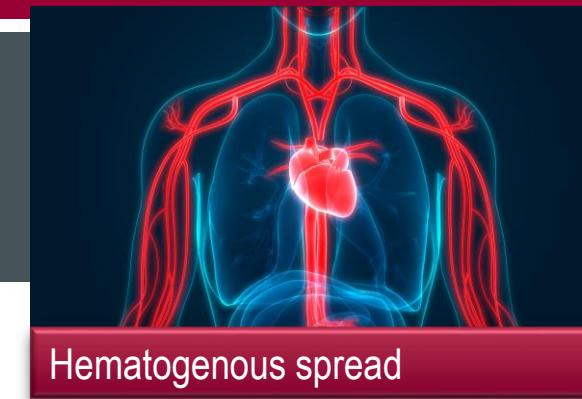
5. Parazite infection

- Cystercosis
- Echinococcus



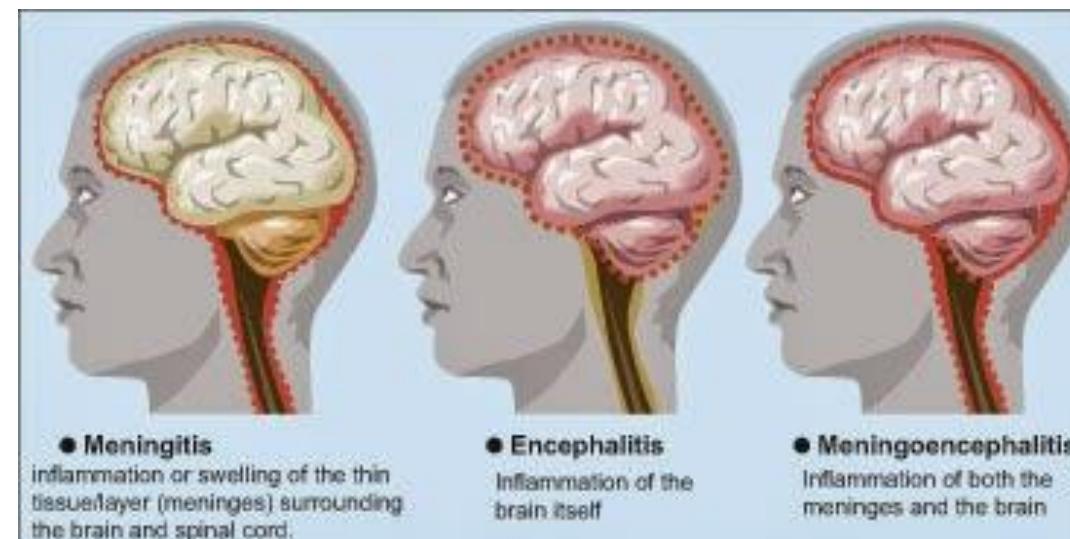
SPREAD

1. Hematogenous spread
2. Direct implantation
 - Trauma, iatrogenic (Epilepsy, surgery)
3. Local extension
 - Sinuses, Otitis media, Congenital malformations
4. Retrograde, peripheral nerves



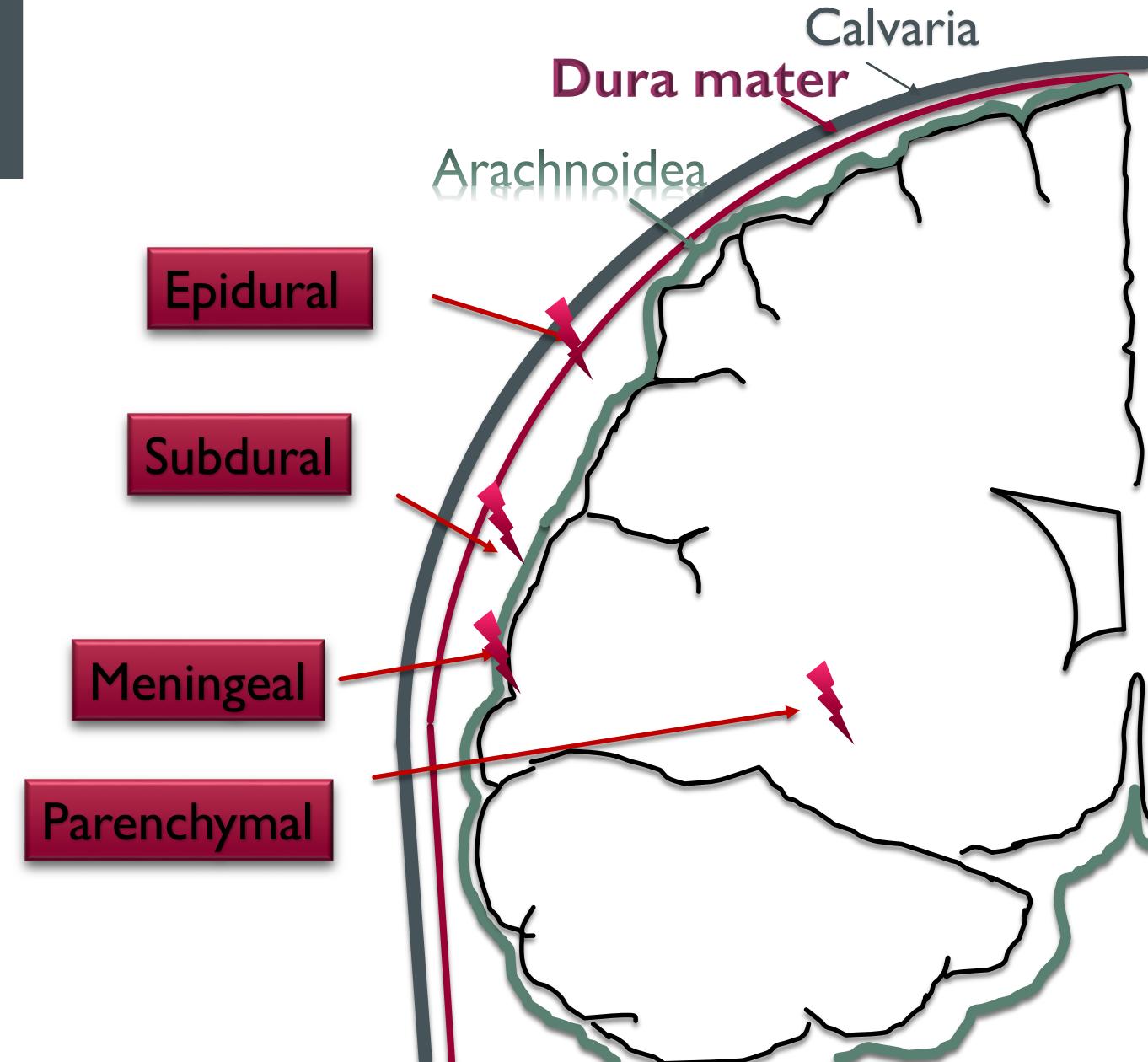
LOCATION

- 1. Parenchyma:** encephalitis , myelitis, encephalomyelitis.
- 2. Meninges:** meningitis, pachymeningitis.
- 3. Parenchyma and Meninges:** meningoencephalitis.



LOCATION

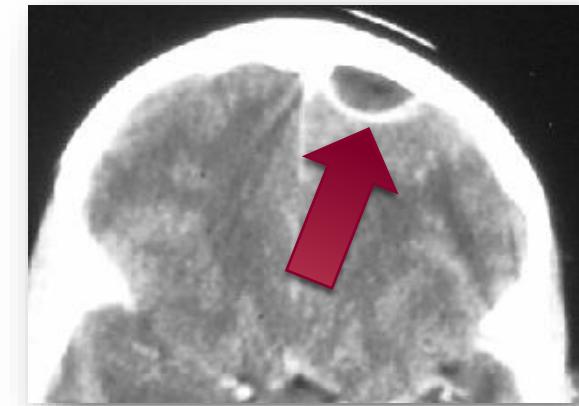
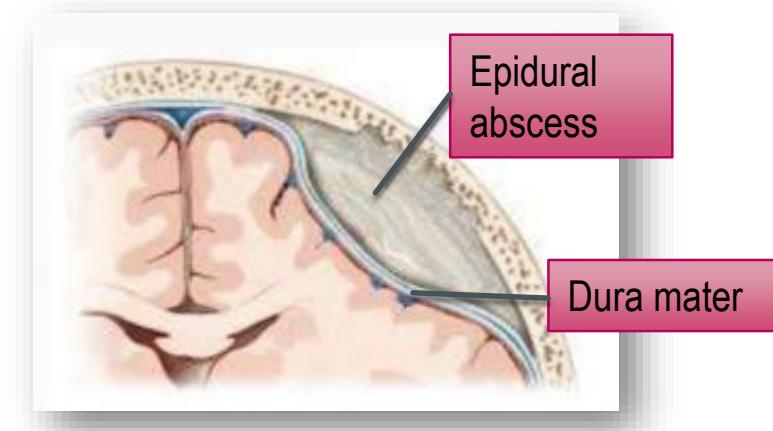
1. Epidural infection
2. Subdural infection
3. Meningeal infection – meningitis
4. Parenchymal infections –
Encephalitis



EPIDURAL AND SUBDURAL INFECTIONS

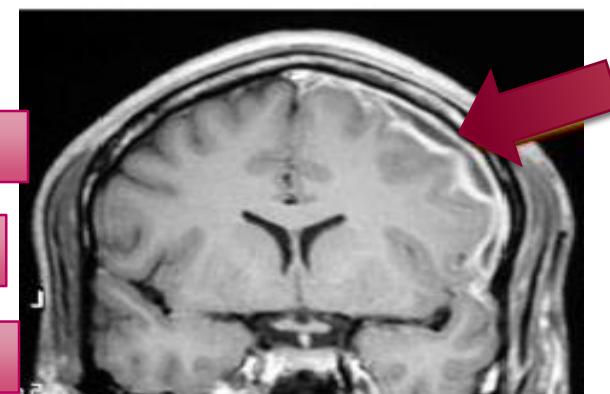
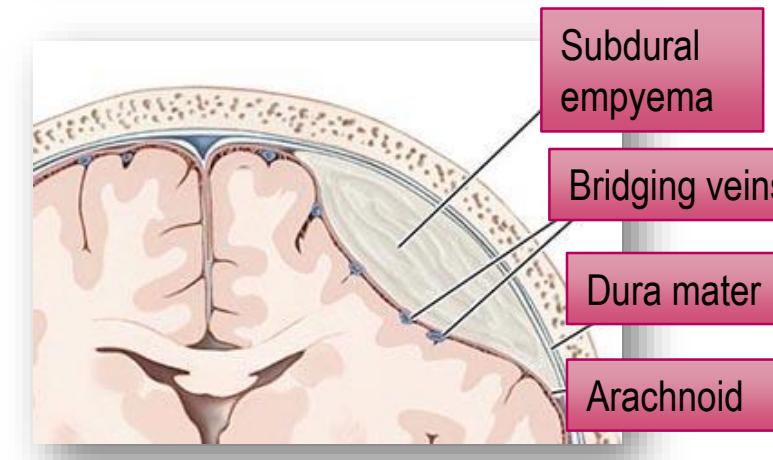
Epidural abscess

- Local spread – sinuitis, osteomyelitis
- Bacterial, fungal
- Spinal - spinal cord compression



Subdural empyema

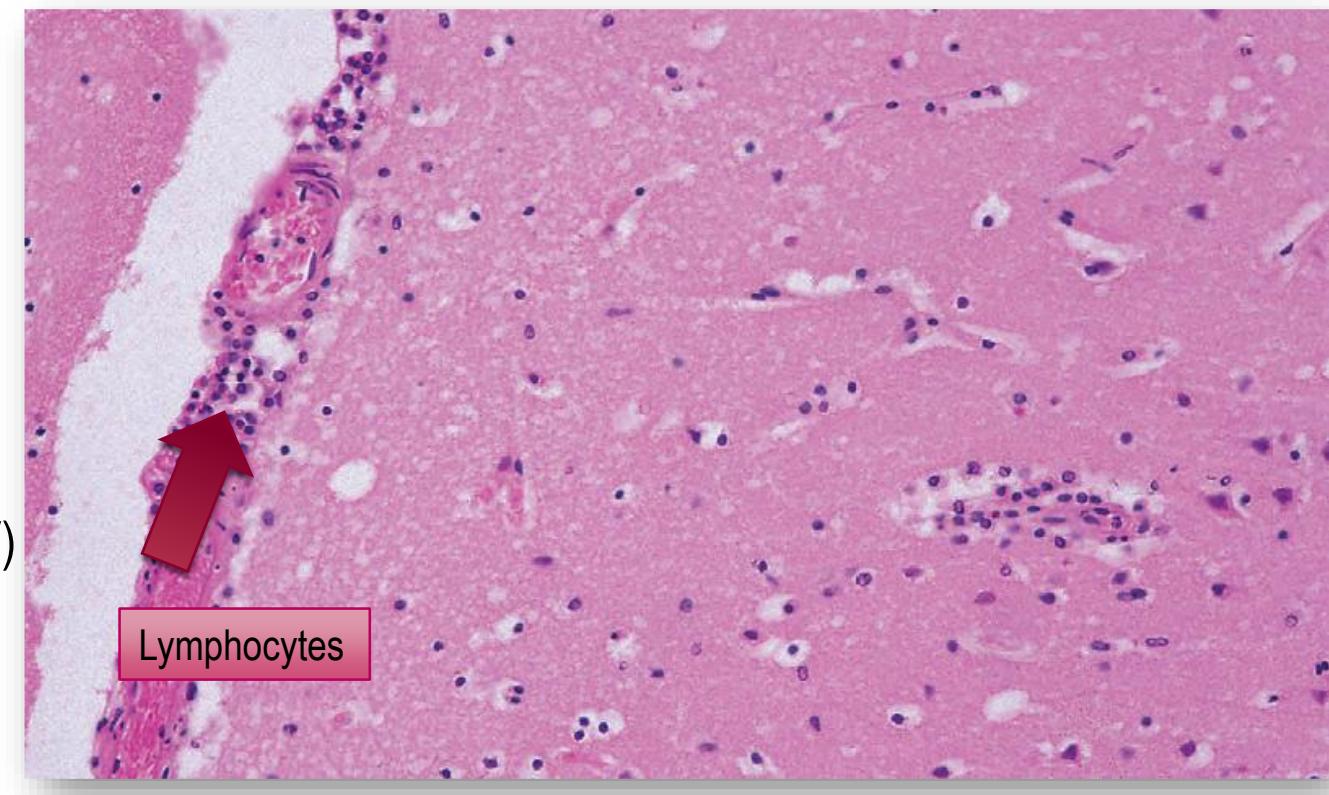
- Local spread – sinus, otitis
- Arachnoid, subarachnoid space is unaffected
- Thrombophlebitis in the bridging veins



MENINGITIS

Aseptic/Viral meningitis

- Mostly associated with encephalitis
- Mild meningeal symptoms
- Viral agents: Echovirus
 - Coxsackie B
 - Coxsackie A
 - Herpes simplex virus (HSV)-2
 - Mumps
 - Human immunodeficiency virus (HIV)
 - Lymphocytic choriomeningitis virus
 - Arbovirus
 - Rubeola
 - Parainfluenza virus
 - Adenovirus



Bacterial meningitis

1. Neonates

- Escherichia coli
- B Streptococcus

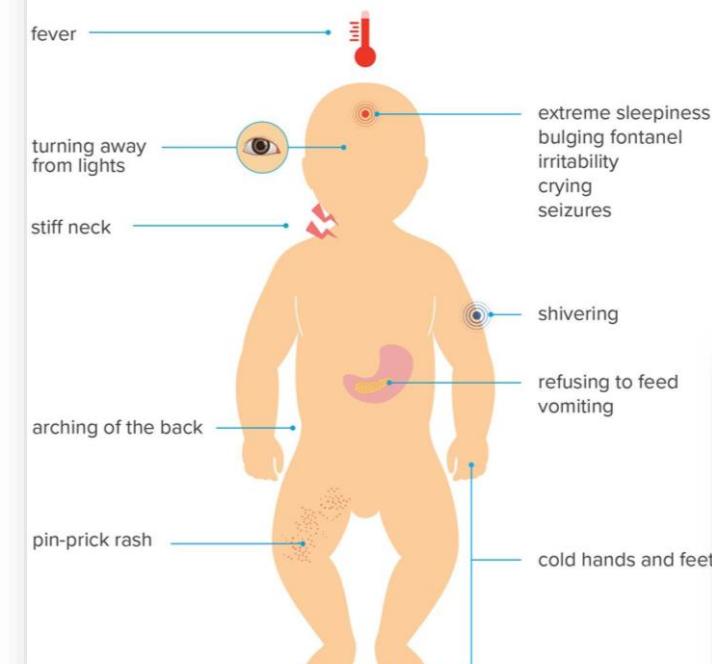
2. Children young, adults

- Neisseria meningitidis
- Streptococcus pneumoniae

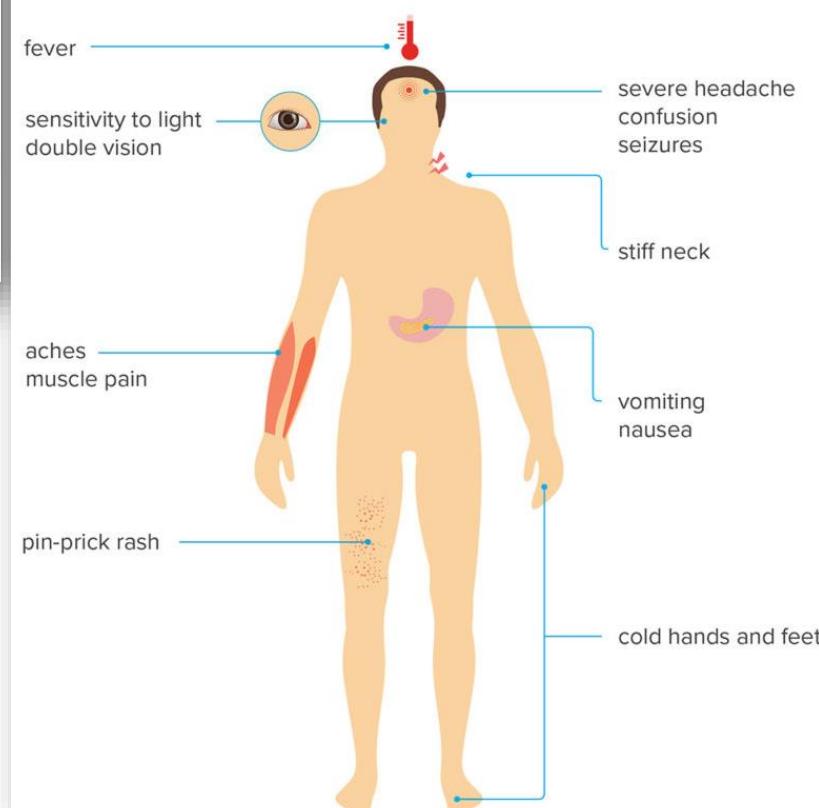
3. Older individuals

- Streptococcus pneumoniae
- Listeria monocytogenes

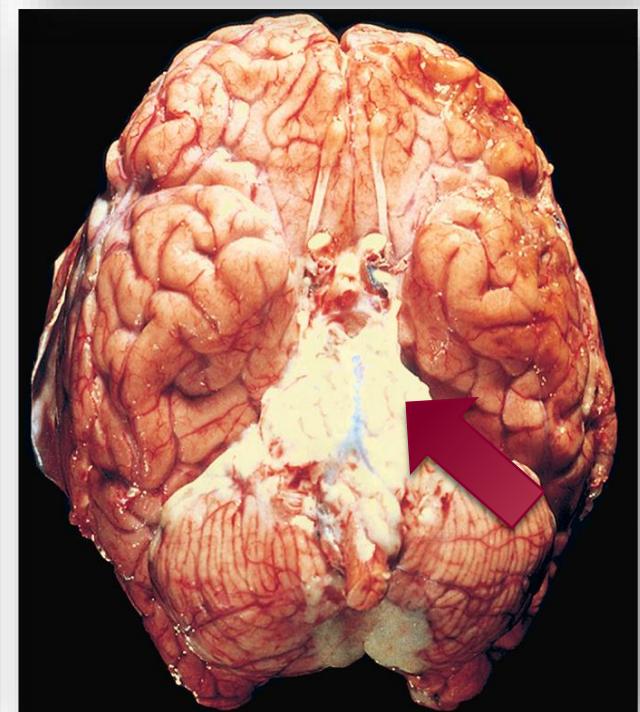
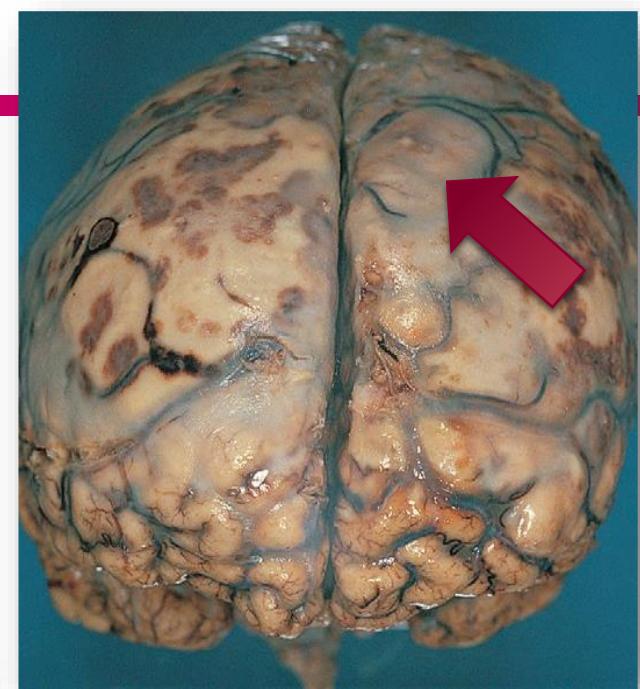
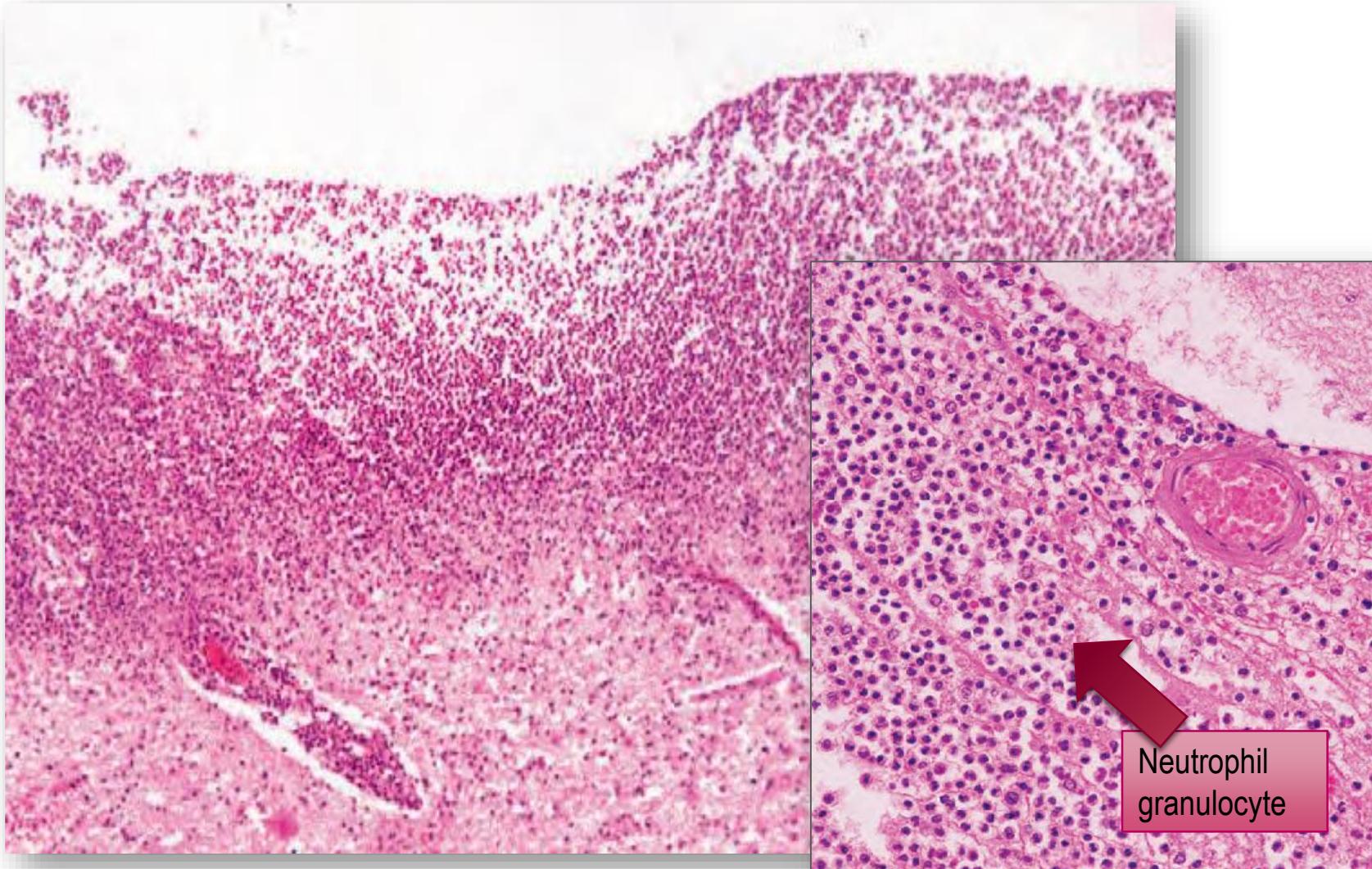
Meningitis in Infants



Meningitis in Adults



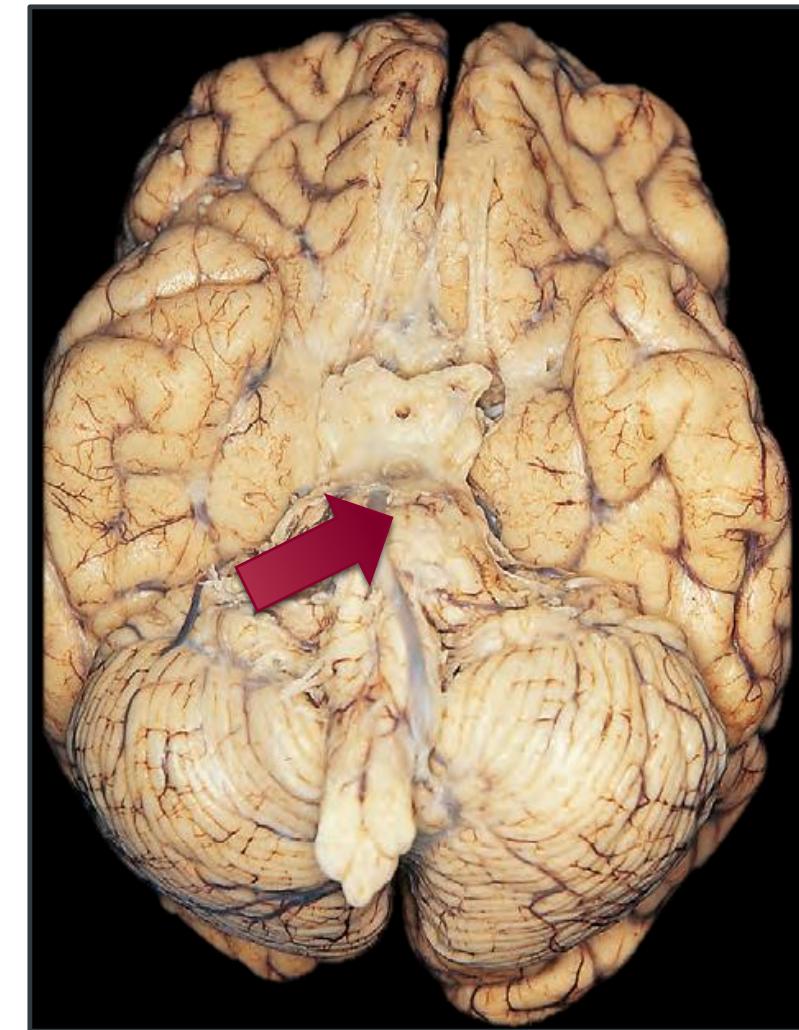
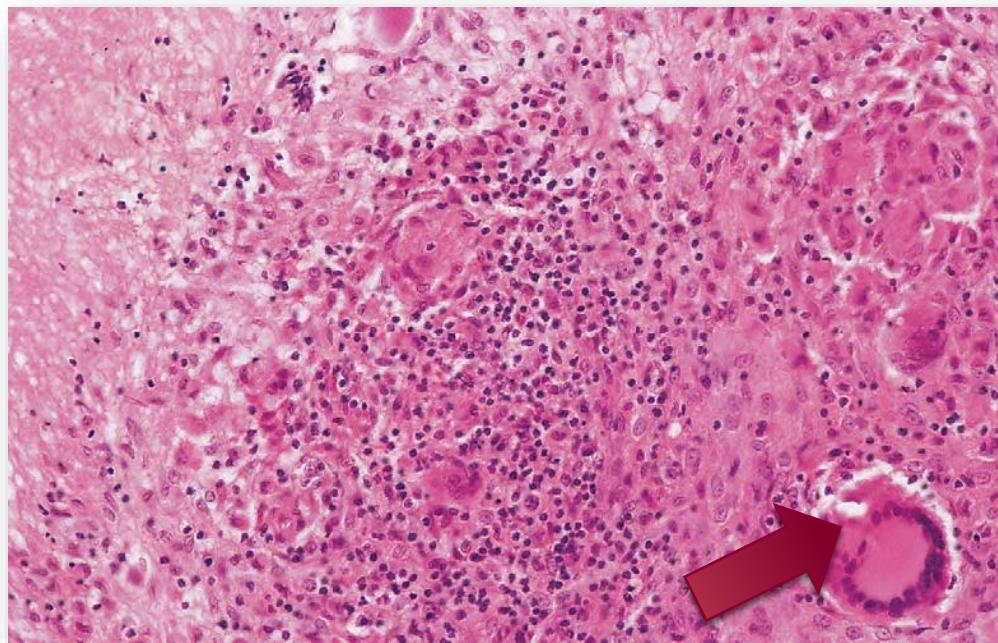
Bacterial meningitis



Chronic meningitis

Mycobacterium tuberculosis

- Meningitis – Fibrinous exudate
- Intraparenchymal mass (tuberculoma)
- Chronic tuberculous infection - arachnoidal fibrosis - hydrocephalus



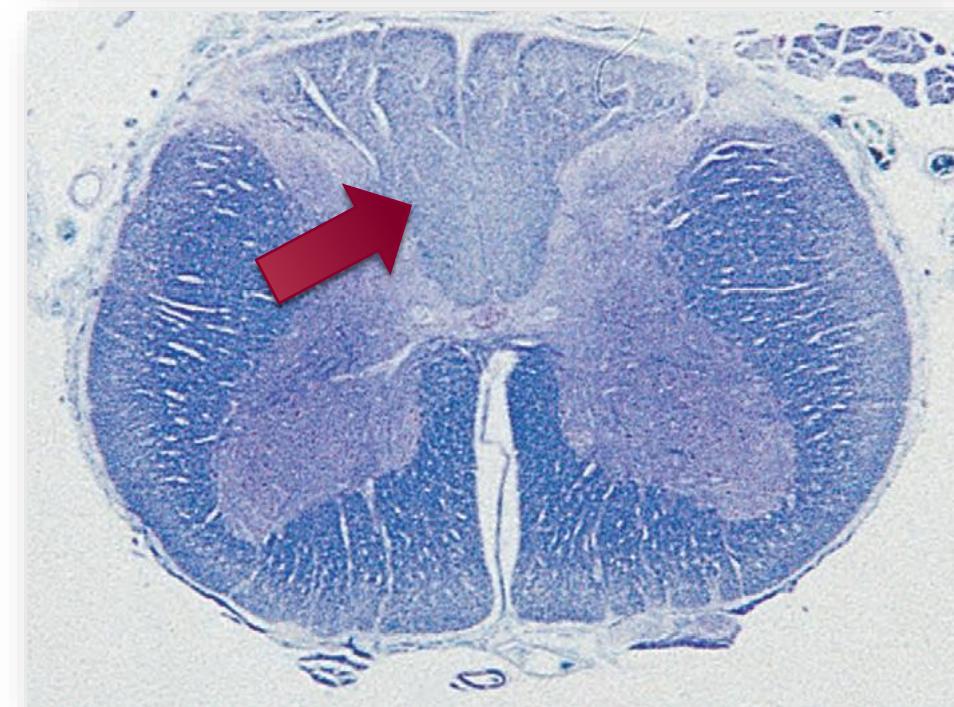
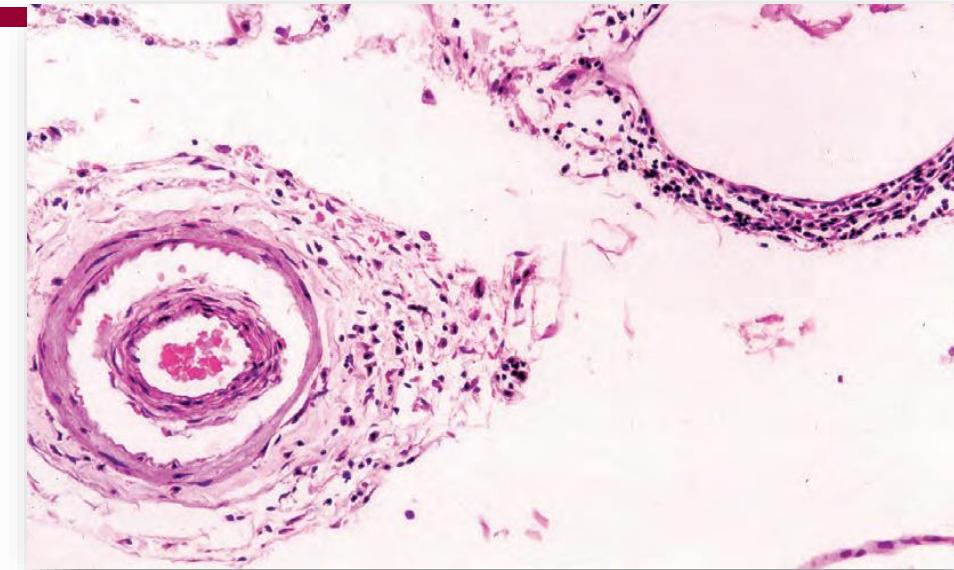
Spirochaetal infections

A. Neurosyphilis (3rd stage) – *Treponema pallidum*

- 10% of persons with untreated infection
- 1. Chronic meningitis/meningovascular neurosyphilis
 - Involves the base of the brain
- 2. Paretic neurosyphilis
 - Neuron loss – loss of mental, physical functions
- 3. Tabes dorsalis
 - Sensory nerves in the dorsal roots
 - Sensory ataxia

B. Neuroborreliosis – *Borrelia burgdorferi*

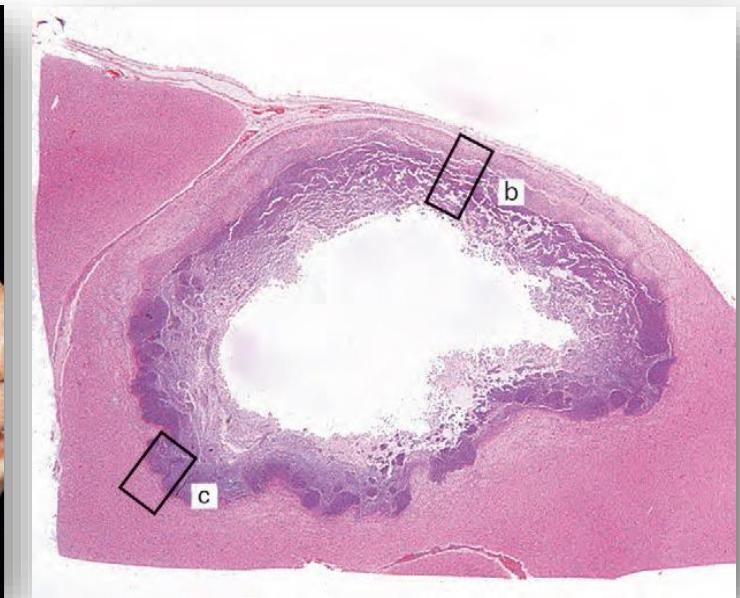
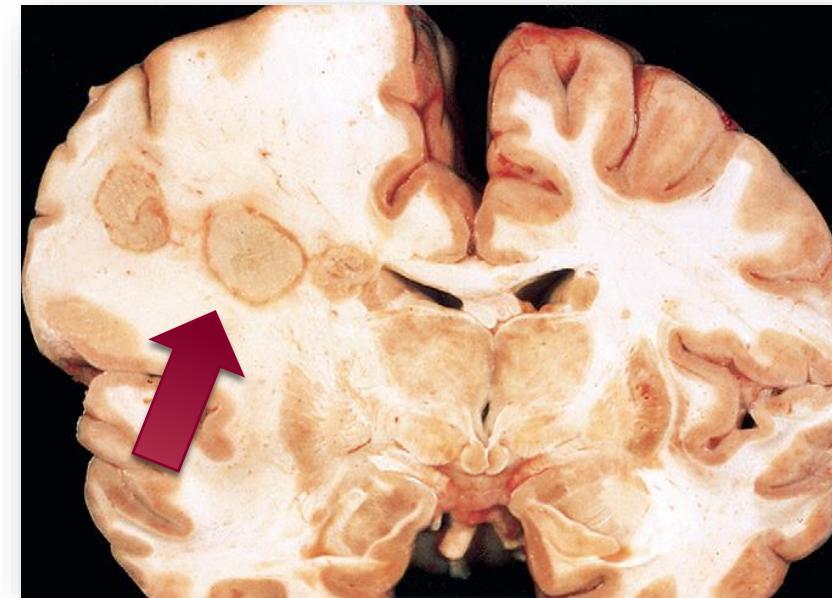
- Aseptic meningitis
- Facial nerve palsies
- Mild encephalopathy
- Polyneuropathies



PARENCHYMAL INFECTIONS

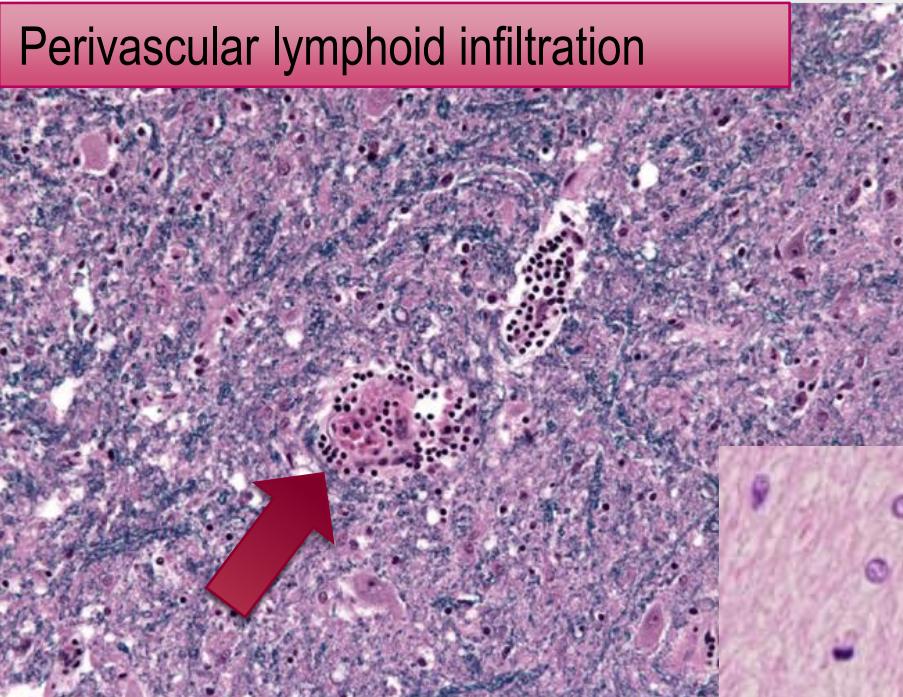
Brain abscesses

- Bacterial infections
- Spread:
 - Direct implantation
 - Local extension
 - Hematogenous spread
- Symptoms - Focal

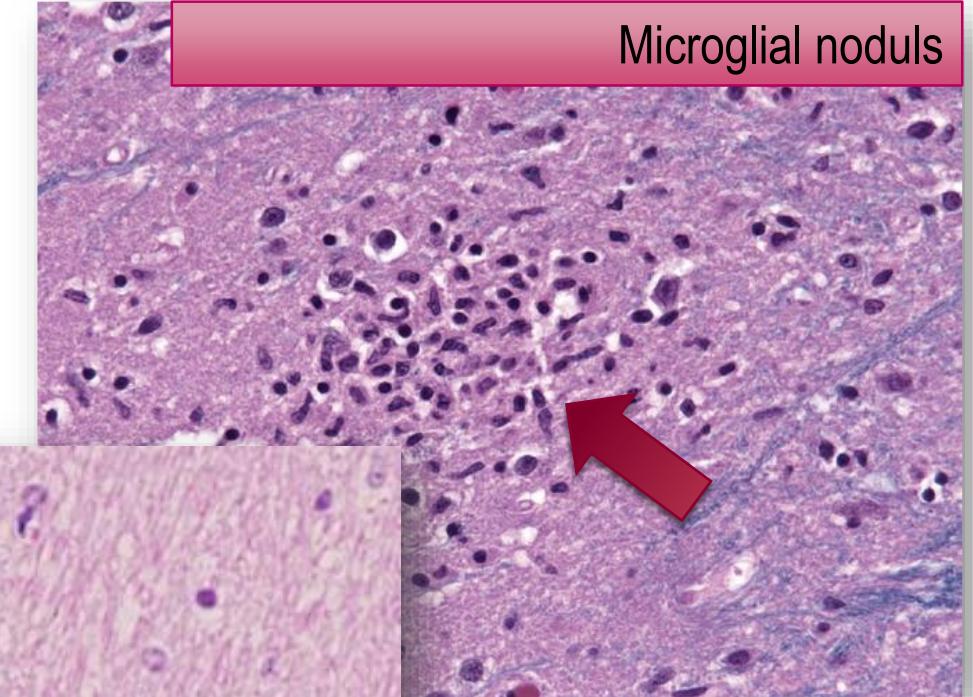


Viral encephalitis

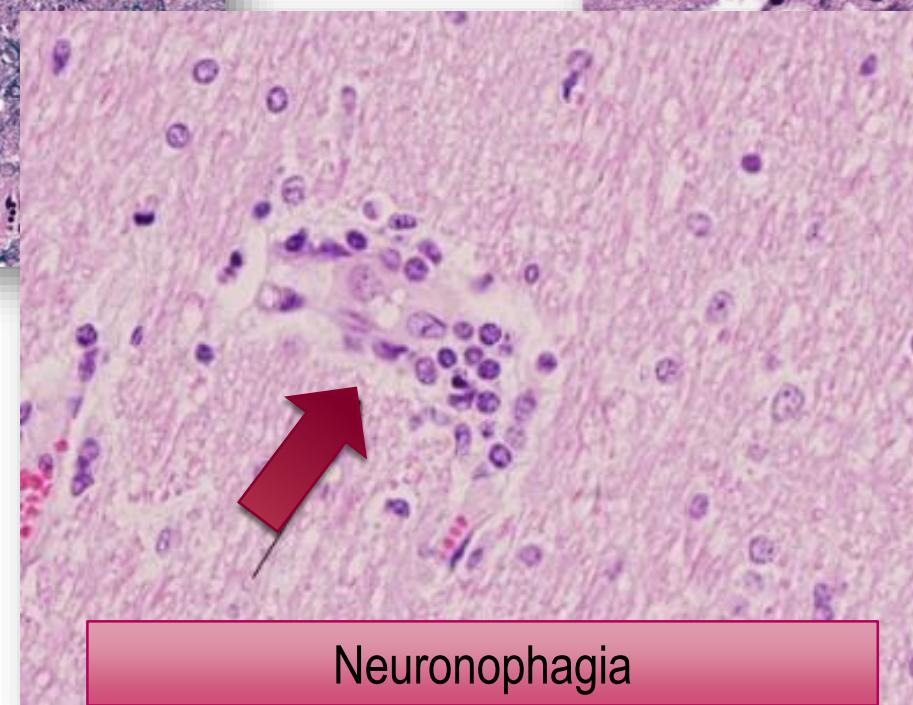
Perivascular lymphoid infiltration



Microglial nodules



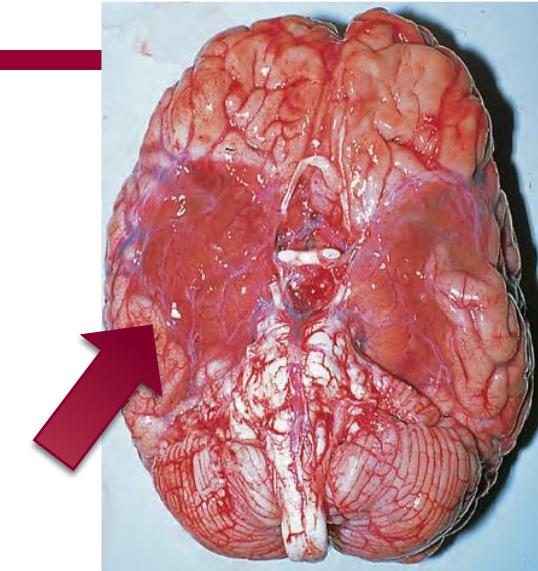
Neuronophagia



Herpes virus

A. Herpes simplex-1

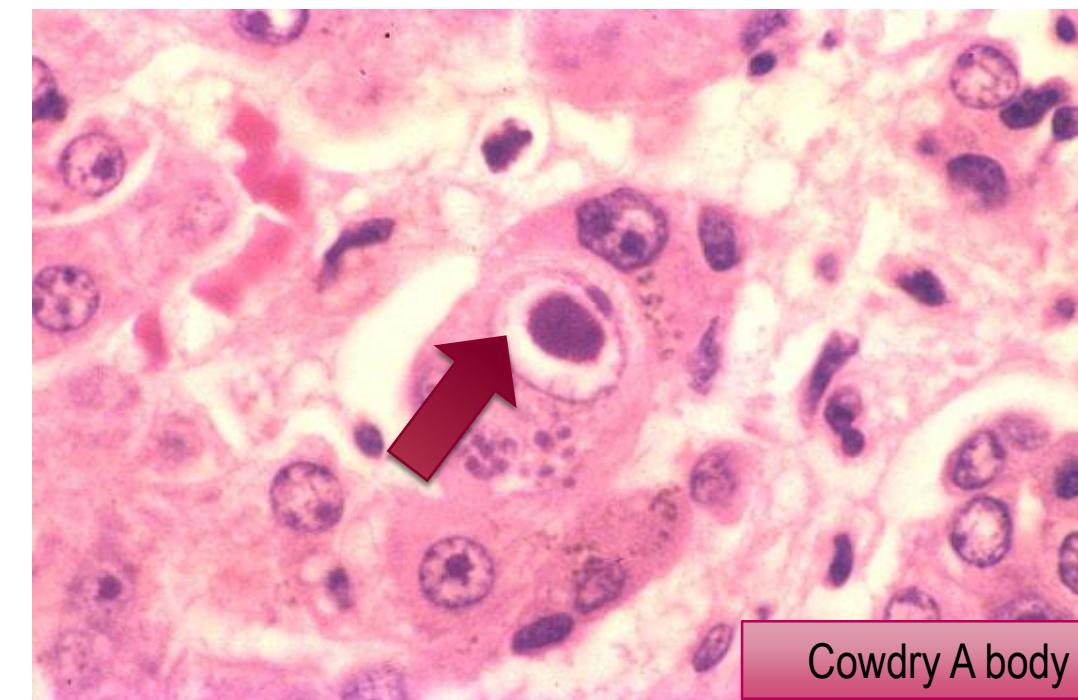
- Children and young adults
- Frontal, temporal lobe involvement
- Necrotizing encephalitis



Necrotizing encephalitis

B. Herpes simplex-2

- Adults
- Viral meningitis
- Primary HSV genital inf - neonates



Cowdry A body

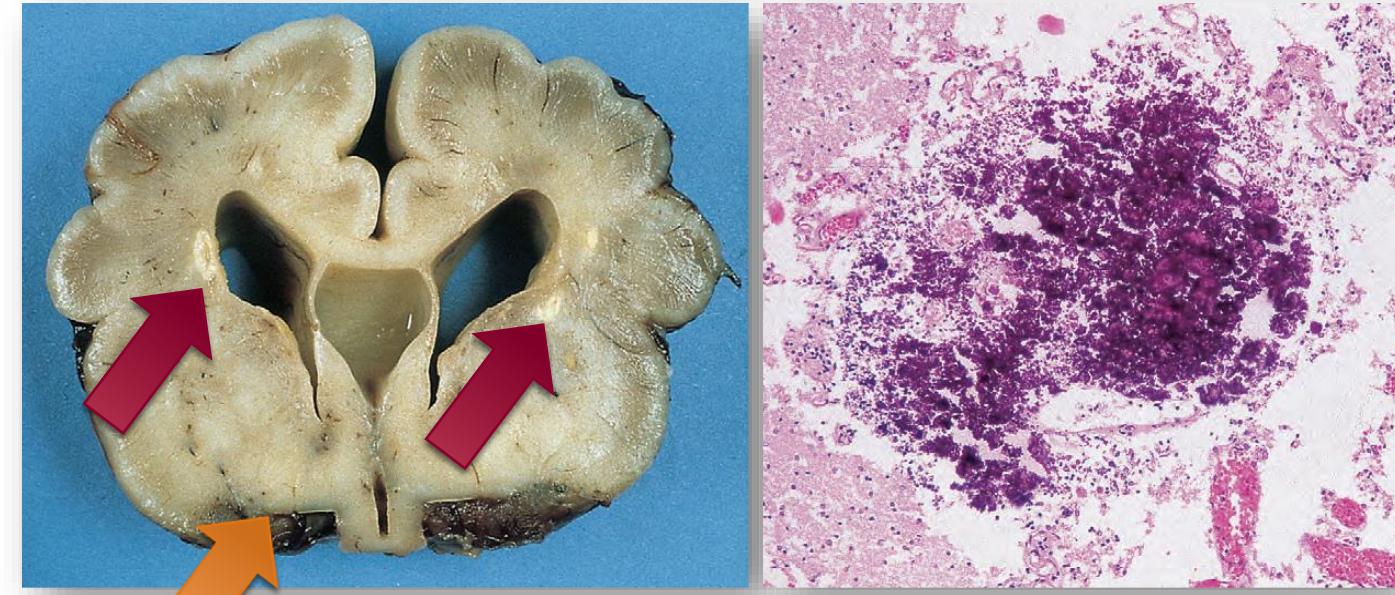
C. Varicella zoster

- Immunosuppressed patients
- HZV encephalitis

Cytomegalovirus

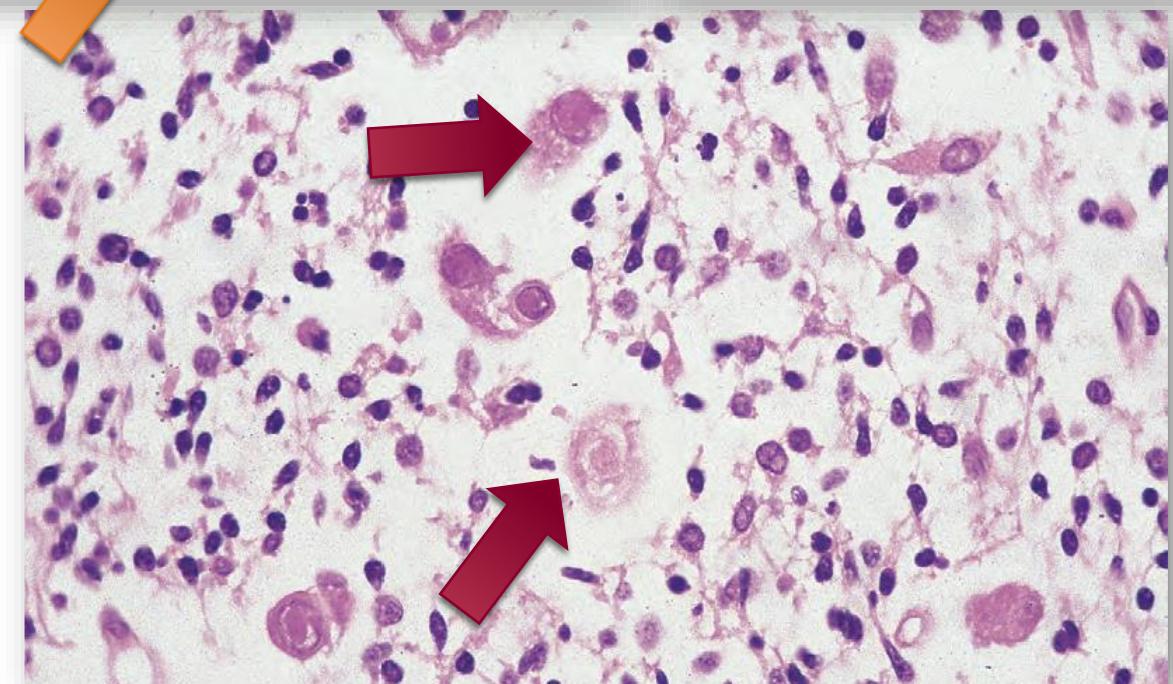
A. Fetal infection

- **TORCH**
- Periventricular necrosis
- Microcephalia
- Periventricular calcification



B. Adult infection

- Immunosuppressed patients
- Periventricular
- Subacute encephalitis

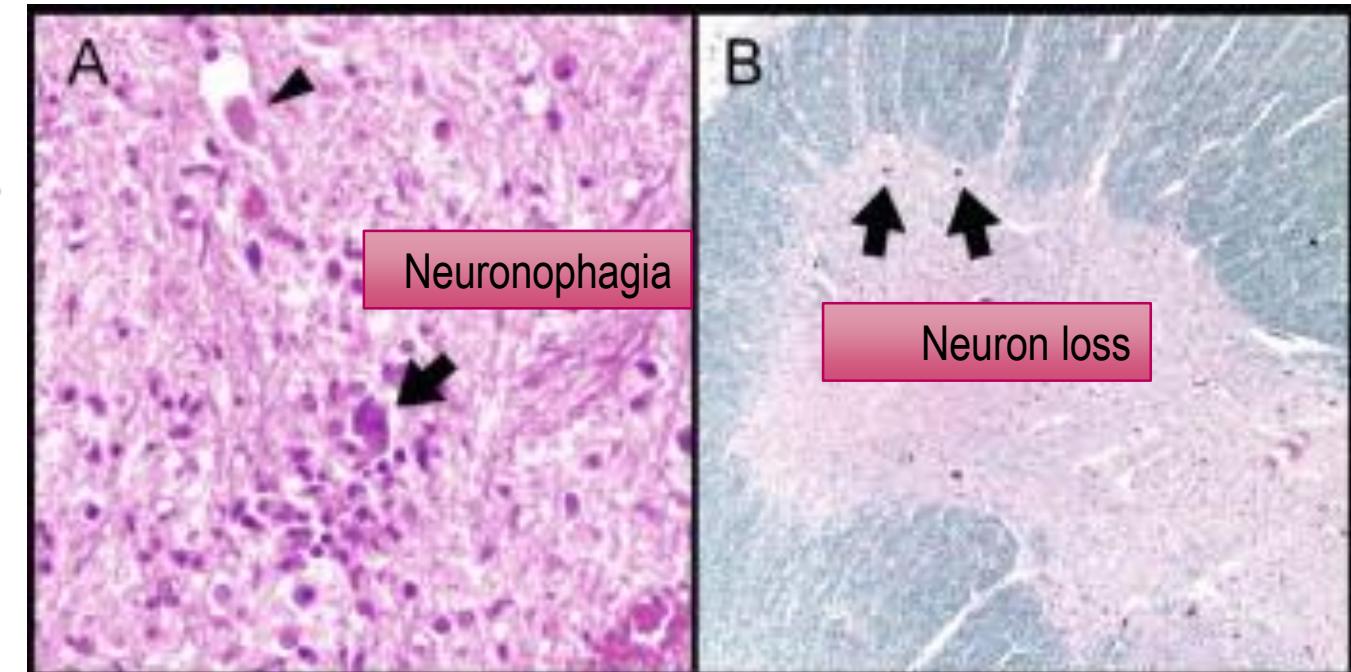


Poliovirus

- Gastroenteritis – Secunder CNS spread
 - **Poliomyelitis anterior acuta /Paralytic poliomyelitis**
 - Damages motor neurons in the spinal cord and brain stem
 - Flaccid paralysis with muscle wasting and hyporeflexia
- 25 to 35 years – **Postpolio syndrome**
 - Progressive weakness, pain



The nation

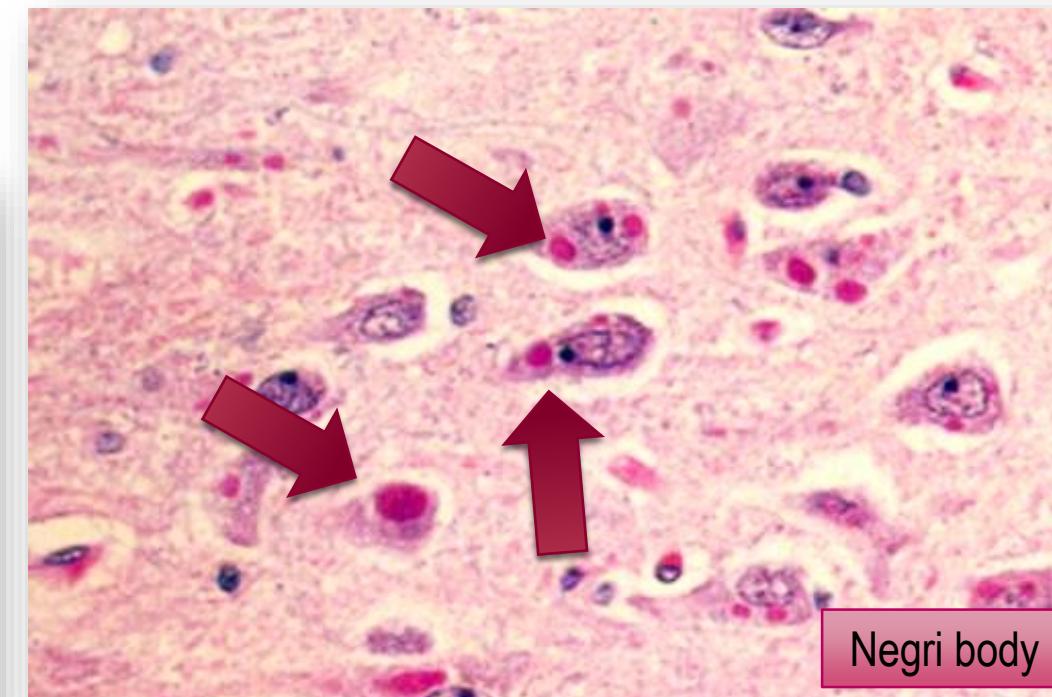
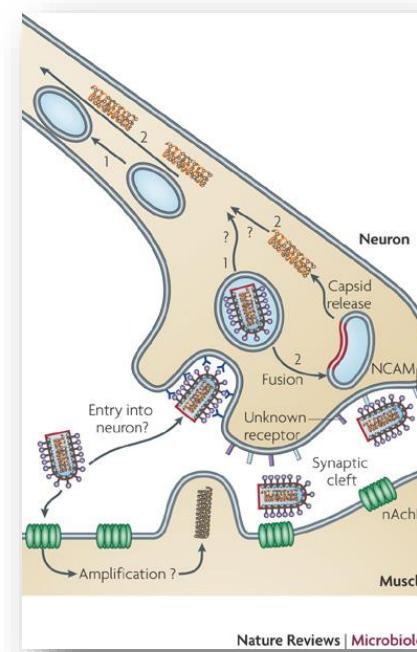


Retrograde trans-synaptic spread

Rabies Virus

Rabies

- Rabid animals, usually by a bite
- Ascending along the peripheral nerves
 - The incubation period depends on the distance between the wound and the brain
- Symptoms:
 - Non specific
 - Signs of CNS excitability
 - Pain, hydrophobia
 - Mania-coma



Human Immunodeficiency virus

A. Asepticus meningitis

- Within 1 to 2 weeks in about 10% of patients

B. HIV Encephalitis (HIVE)

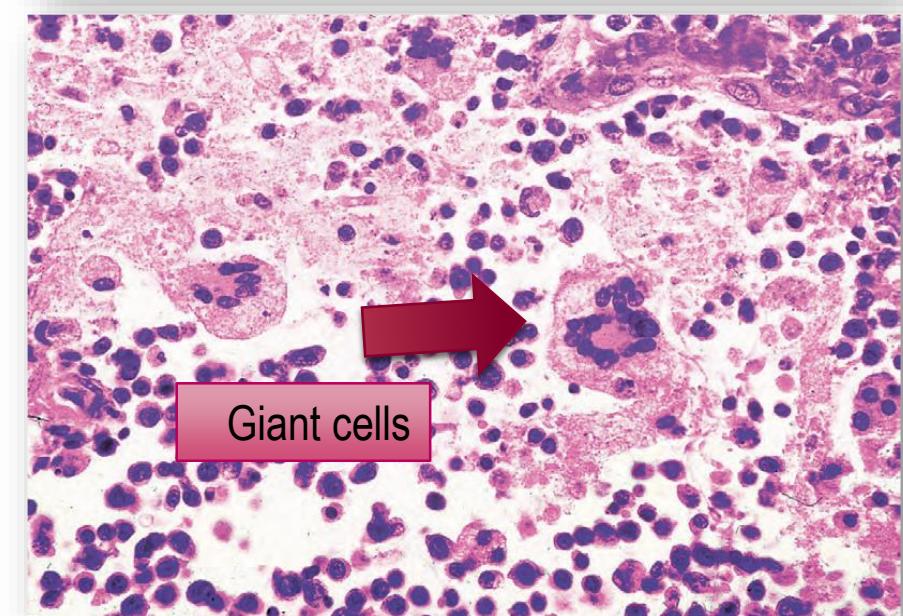
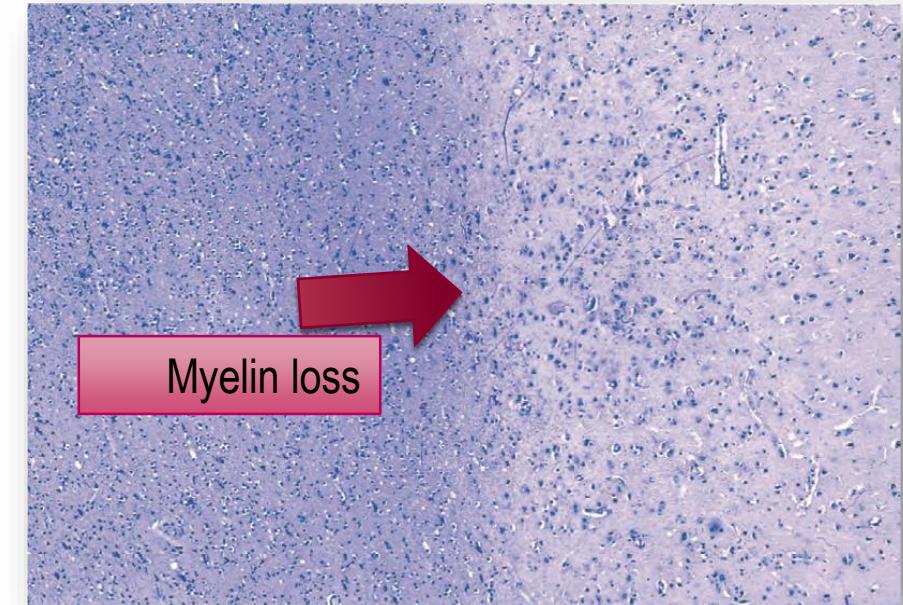
- Perivascular lymphoid infiltration
- Myelin loss in the hemispheres (Leukoencephalopathia)
- Microglial noduls
- Giant cells

C. Opportunistic infections

- Toxoplasma
- Cryptococcal
- Progressive multifocal leukoencephalopathy (PML)
- Cytomegalovirus (CMV)

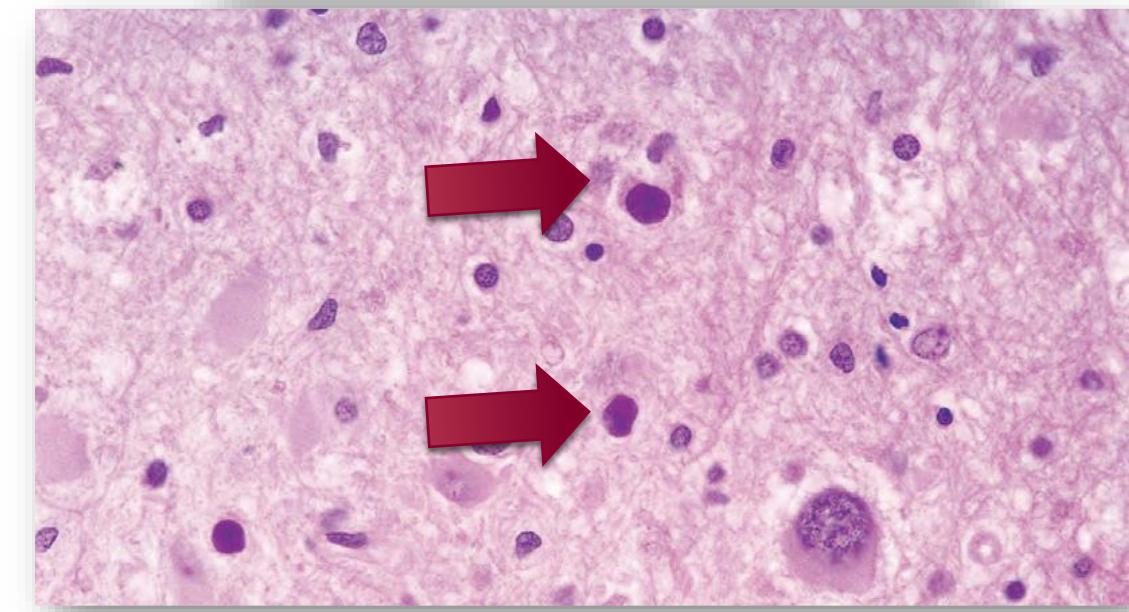
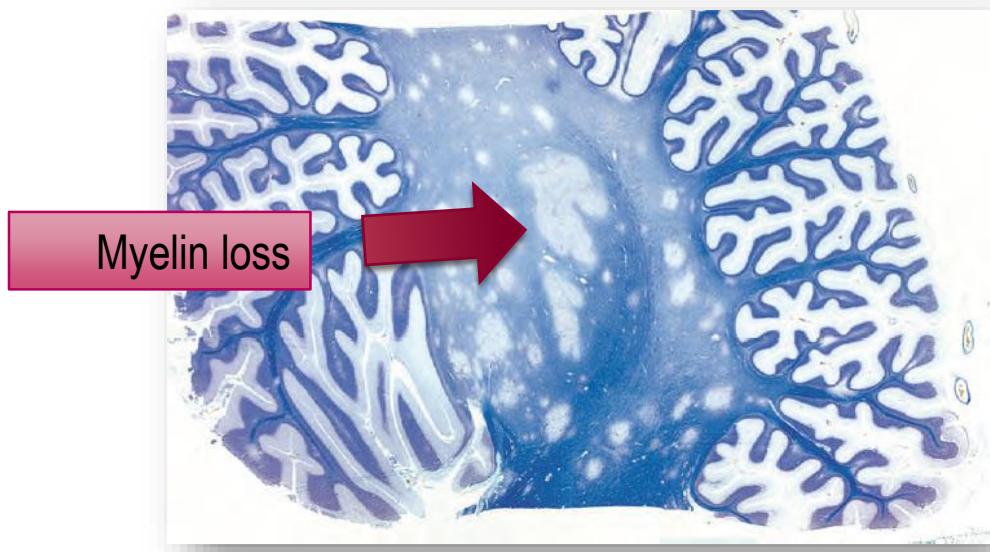
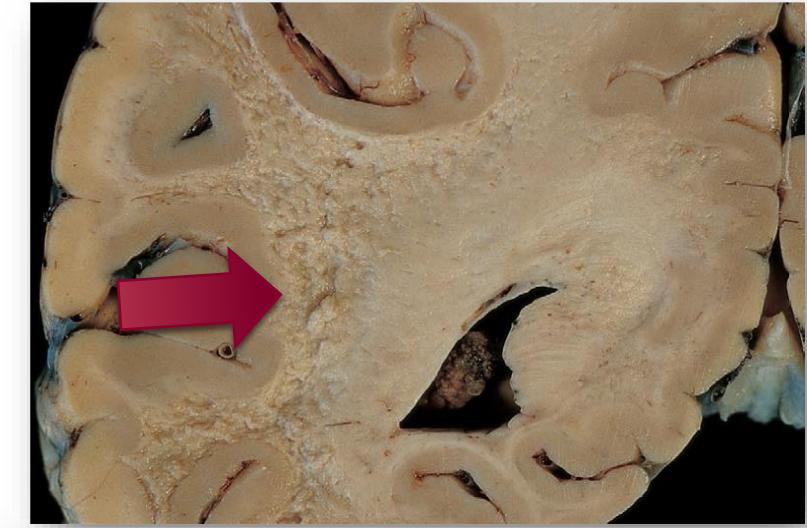
D. Primary CNS lymphoma

- EBV +



JC virus / Progressive multifocal leukoencephalopathy (PML)

- Polyoma virus
- Infects oligodendroglial cells
 - Demyelinisation
 - White matter – Hemispheres, Cerebellum
- Progressive neurologic symptoms



Fungal infections

A. *Candida Albicans*

- Multiplex microabscesses

B. *Mucormycosis*

- Nasal cavity, sinus infection
- Direct extension, Vascular invasion

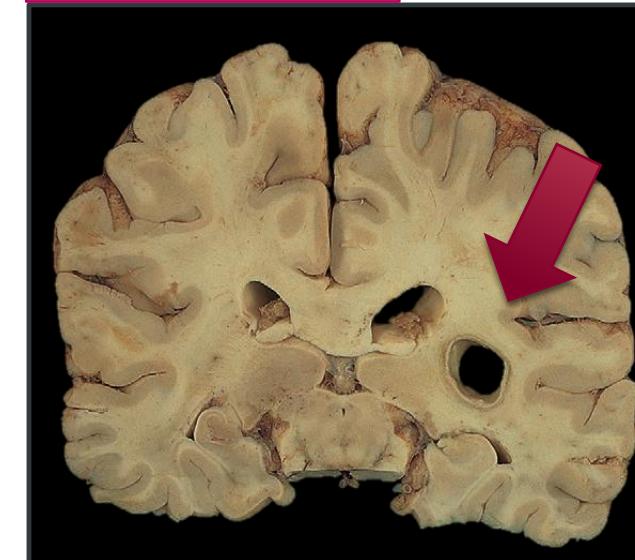
C. *Aspergillus fumigatus*

- Hemorrhagic infarctions
- Vascular invasion

D. *Cryptococcus neoformans*

- Meningitis, Meningoencephalitis
- Fulminant

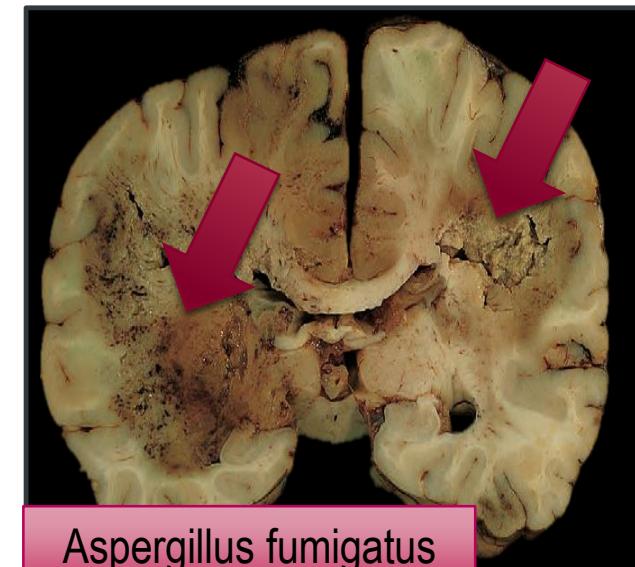
Candida albicans



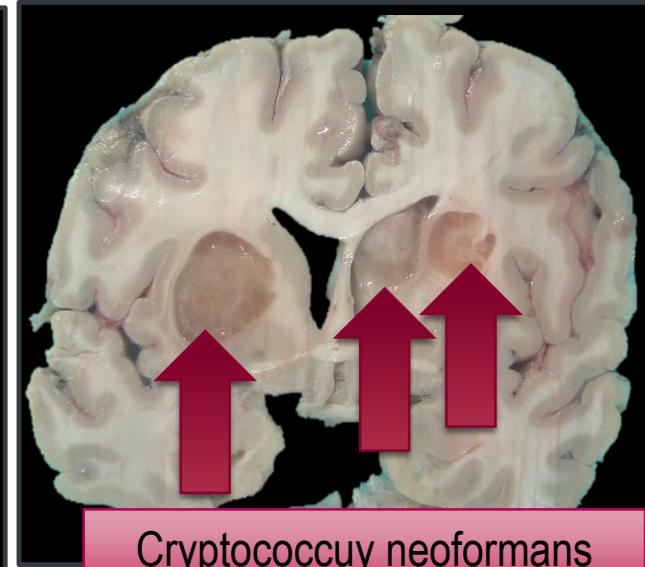
Mucormycosis

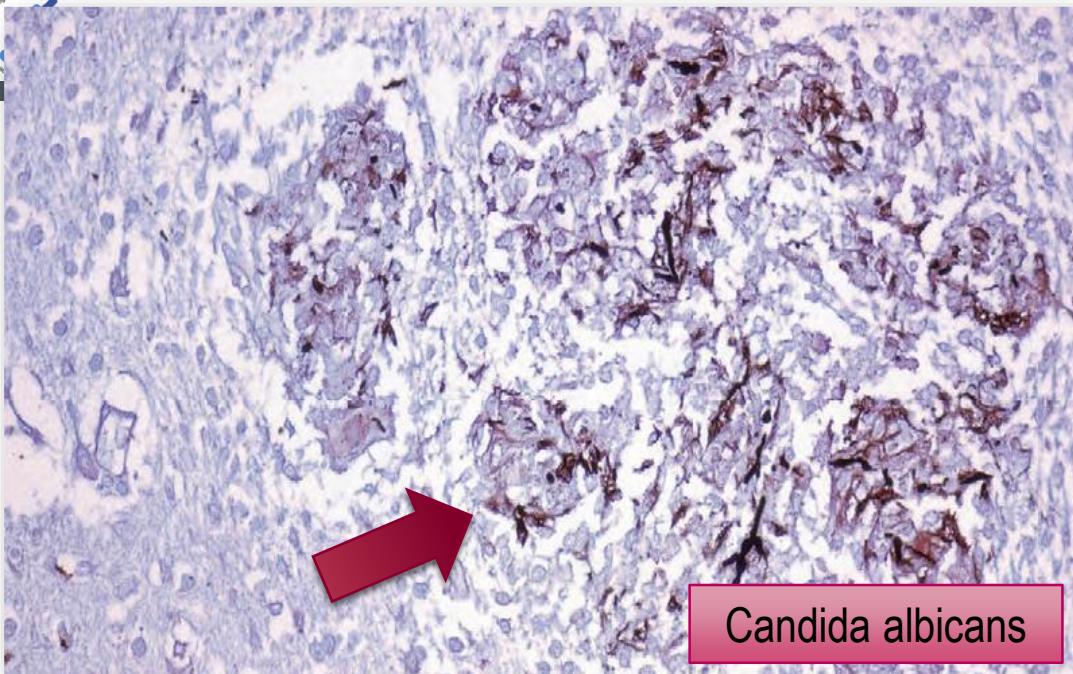


Aspergillus fumigatus

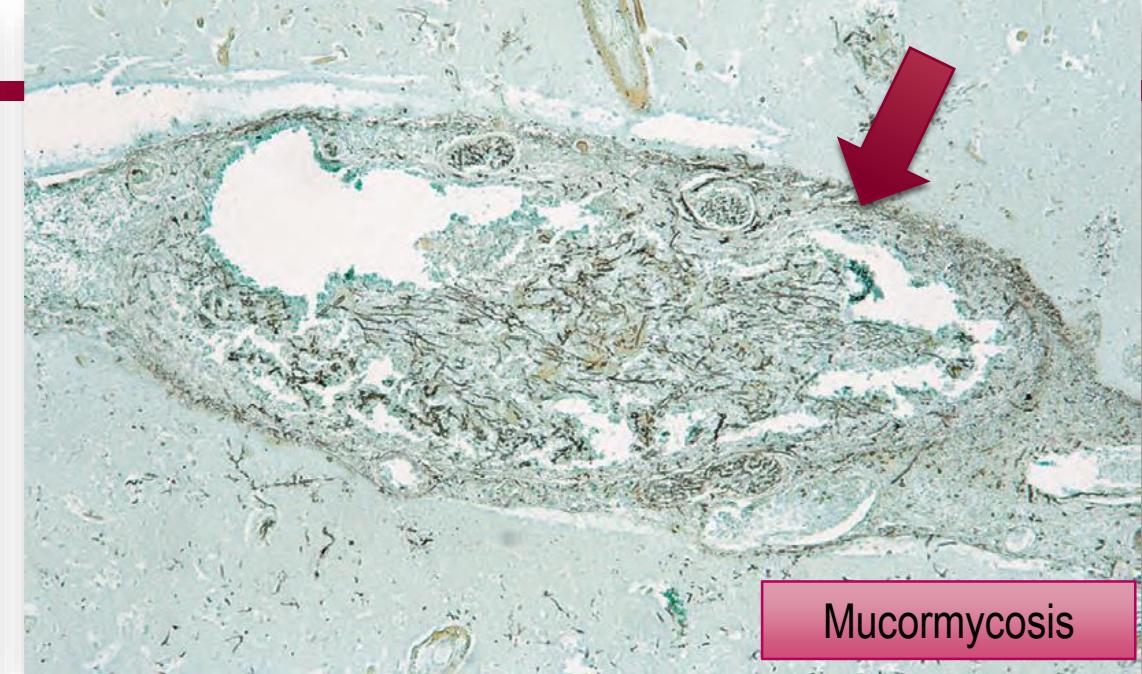


Cryptococcuy neoformans

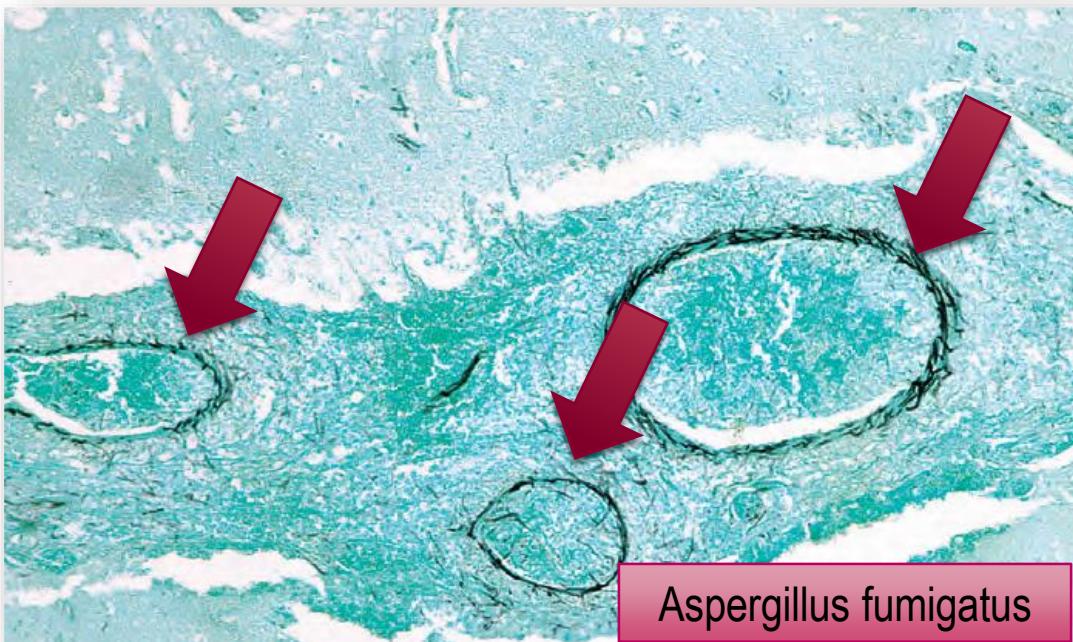




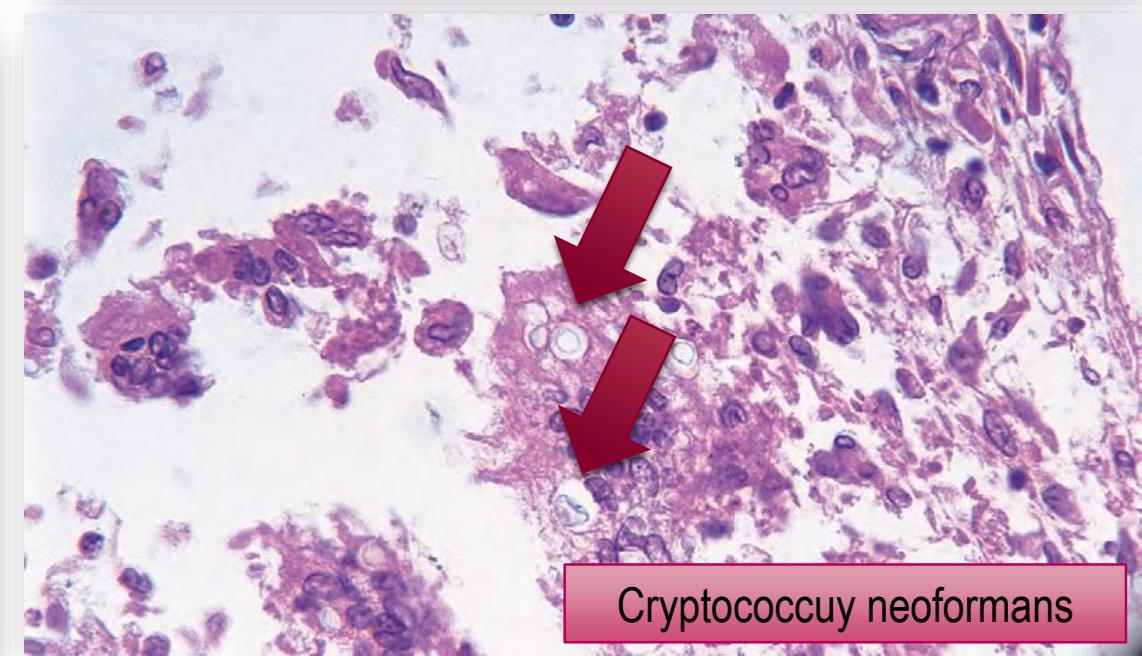
Candida albicans



Mucormycosis



Aspergillus fumigatus



Cryptococcus neoformans

Protozoal infections - Toxoplasmosis

Toxoplasma gondii

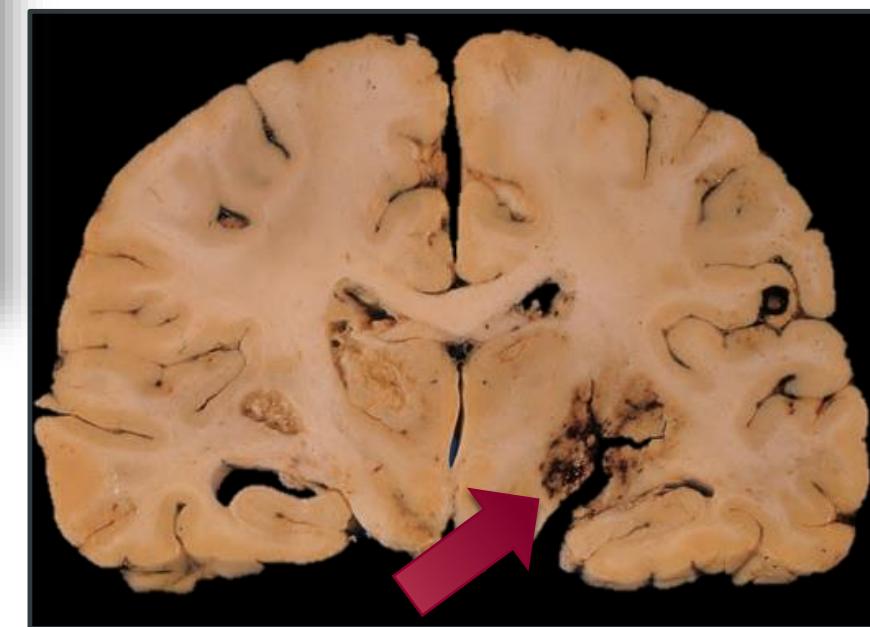
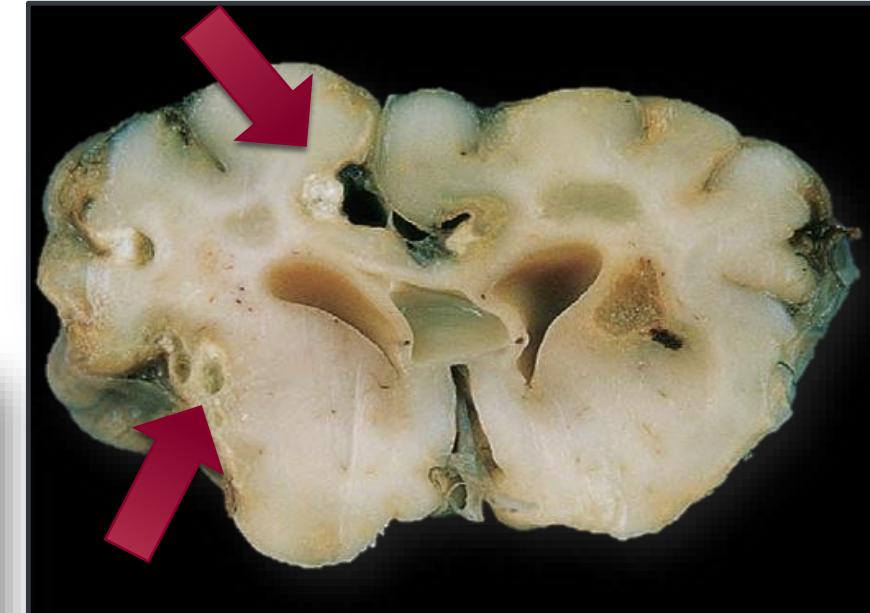
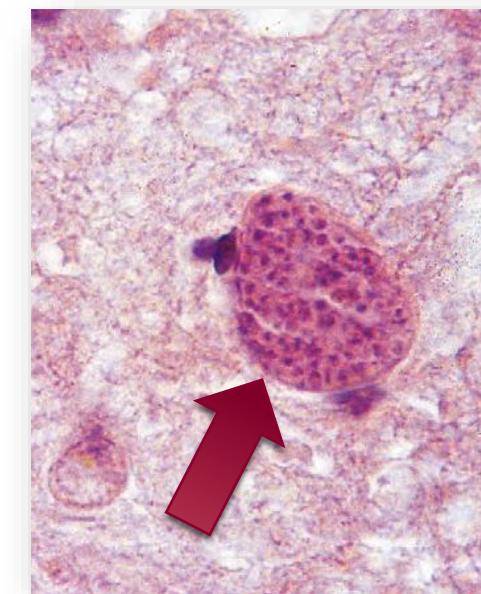
- Humans intermedier hosts
- Definitive host - Cat

A. Fetal infection

- TORCH
- Chorioretinitis
- Hydrocephalus
- Intracranial calcification

B. Adult infection

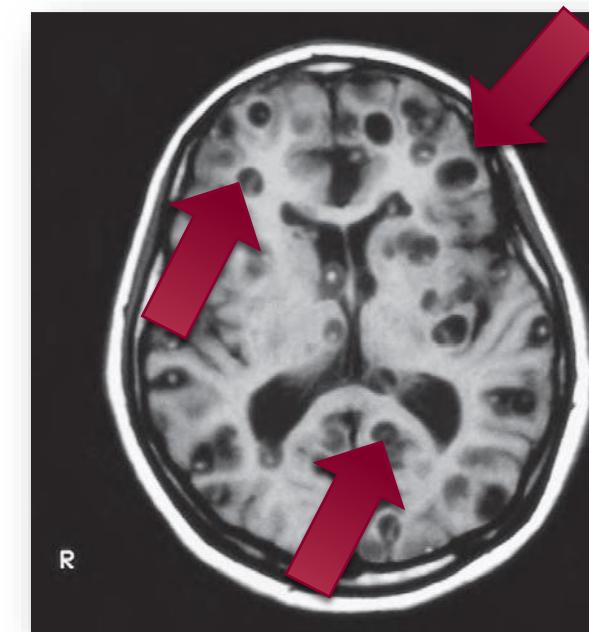
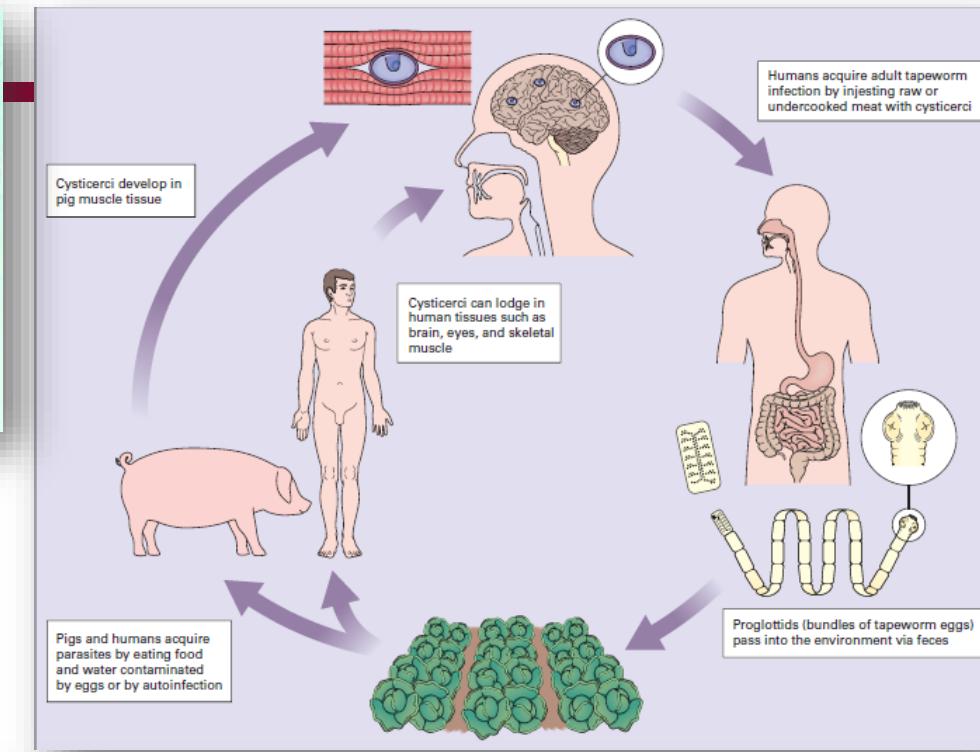
- Immunosuppressed adults
- Subacute symptoms
- Evolving in 1 or 2 week period
- Focal-diffuse



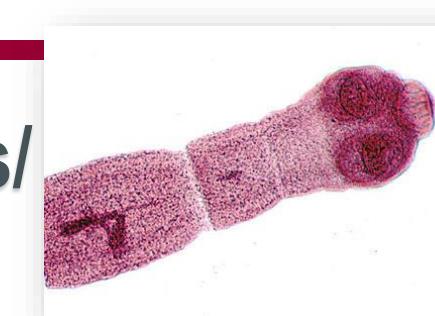
Parasitic Infections

Tenia solium - Cysticercosis

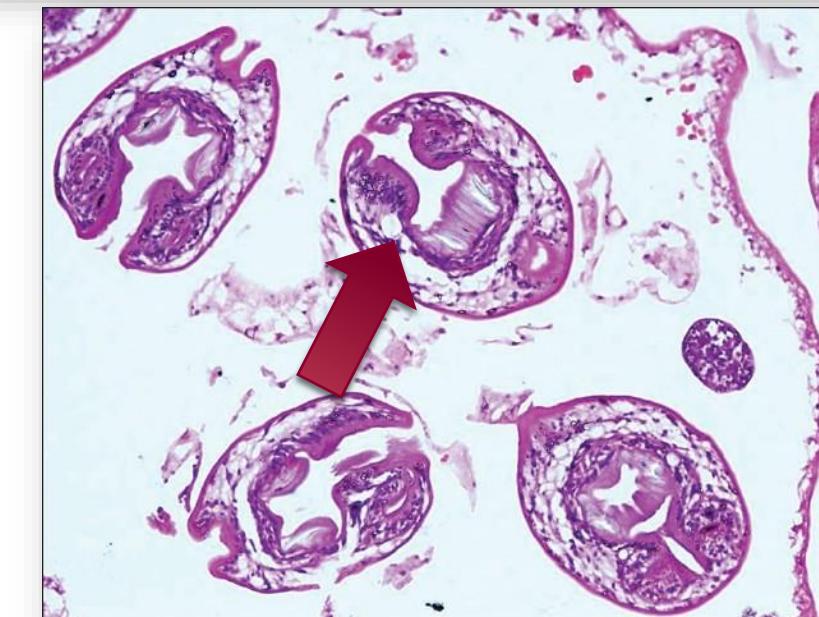
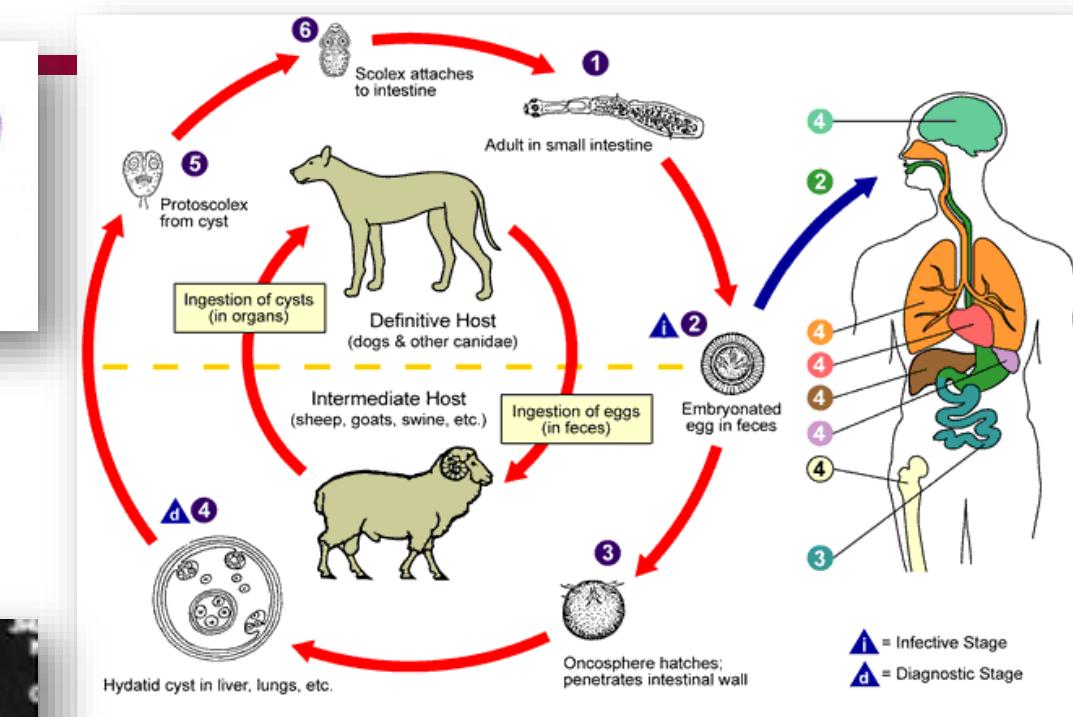
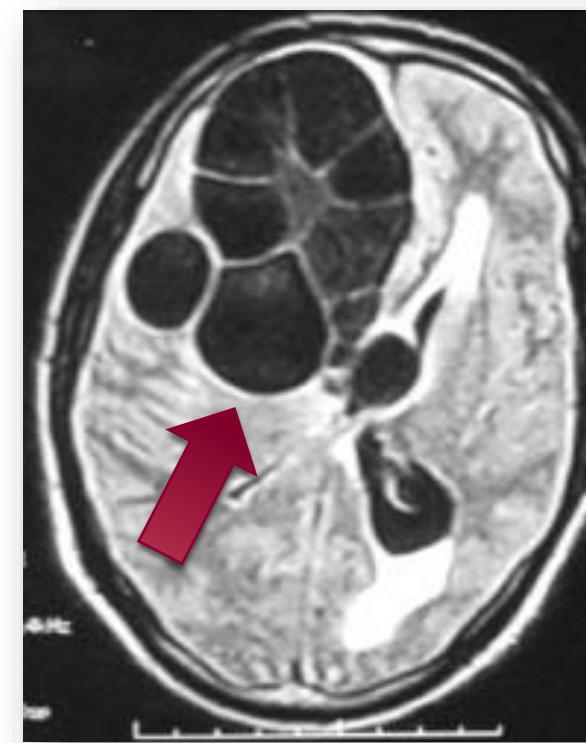
- End-stage infection
 - Larval organisms leave the lumen of the gastrointestinal tract
 - Encyst – Brain – subarachnoid space
- Symptoms
 - Focal symptoms
 - Epilepsy



Echinococcus /Hydatidosis/



- Childhood
- Contact with dogs
 - Encysts – Usually liver, lung rarely brain





- Robbins Basic Pathology, 10th Edition
- Neuropathology: A Reference Text of CNS Pathology, 3rd Edition

