Infectious Diseases of the Central Nervous System

Bacterial Meningitis

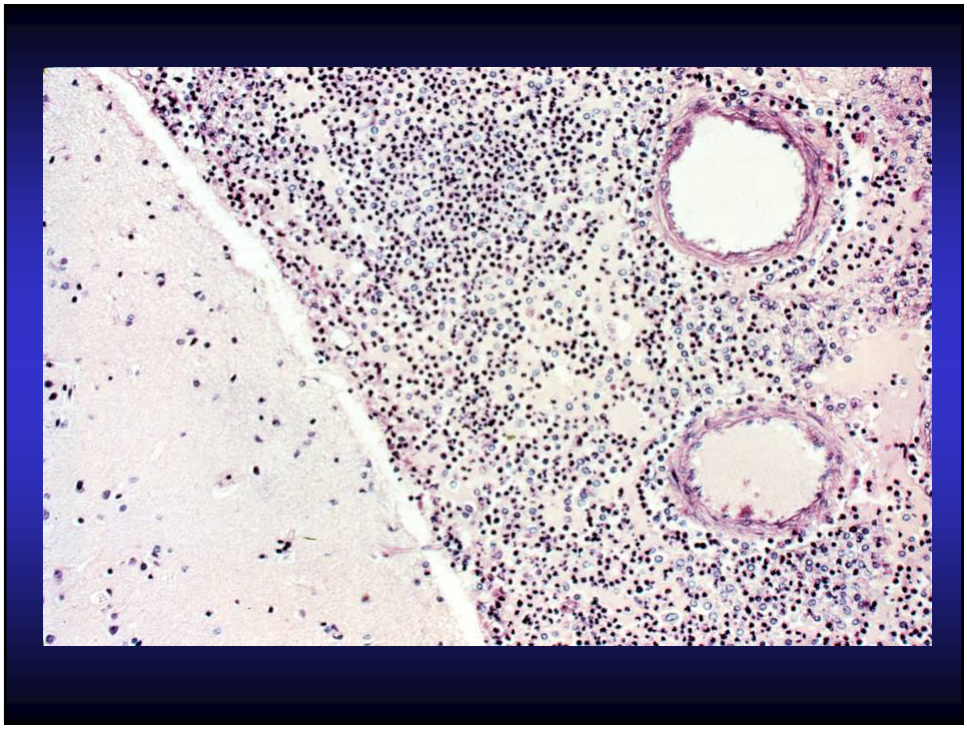
Most common form of CNS infection

Organisms reach the leptomeninges via hematogenous spread or direct extension

Spinal tap yeilds cloudy CSF with many neutrophils and bacteria may be seen

Age group	Organism
Neonates	Group B streptococci; *E. coli*
Infants and children	*Haemophilus influenzae (now <2 / 100,000)*
Adolescents and young adults	*Neisseria meningitidis*
Elderly	*Streptococcus pneumoniae*


Pneuomococcal meningitis



Brain abscess

Second most common infection of CNS following bacterial meningitis

Source of infection

Local contiguous spread (sinusitis, otitis, mastoiditis)

Hematogenous (Septic emboli from bacterial endocarditis, pulmonary infection, ect.)

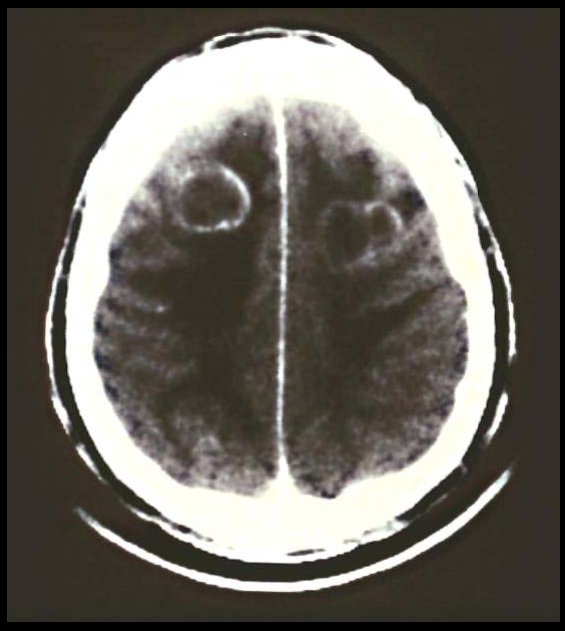
Stages of cerebral abscess formation

Early cerebritis (1-3 days)

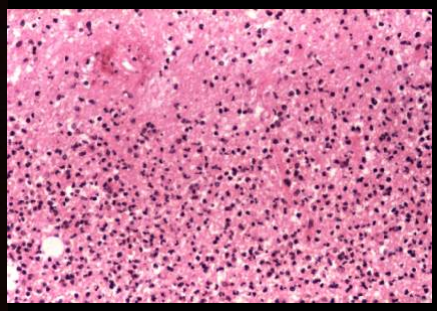
Late Cerebritis (4-9 days)

Early Capsule Formation (10-13 days)

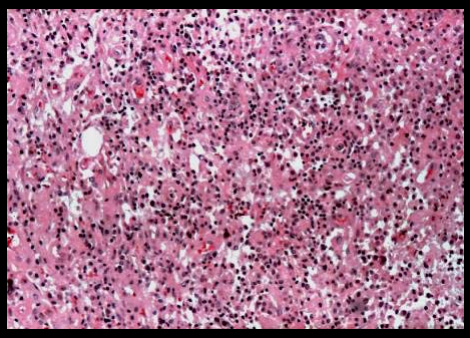
Late Capsule Formation (14 days and later)



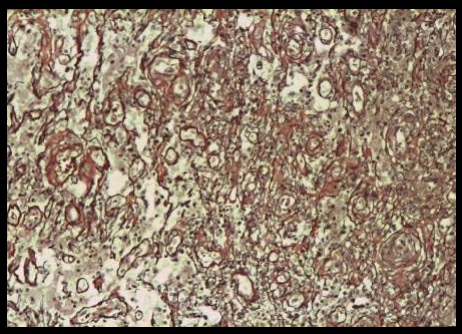
Early Cerebritis



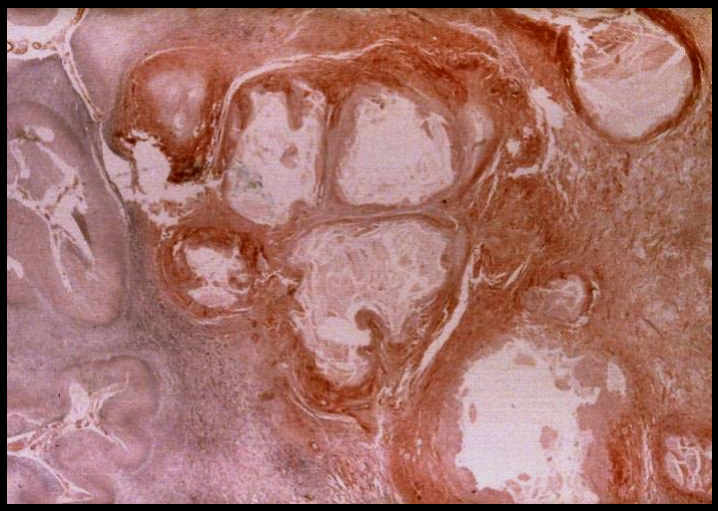
Late Cerebritis

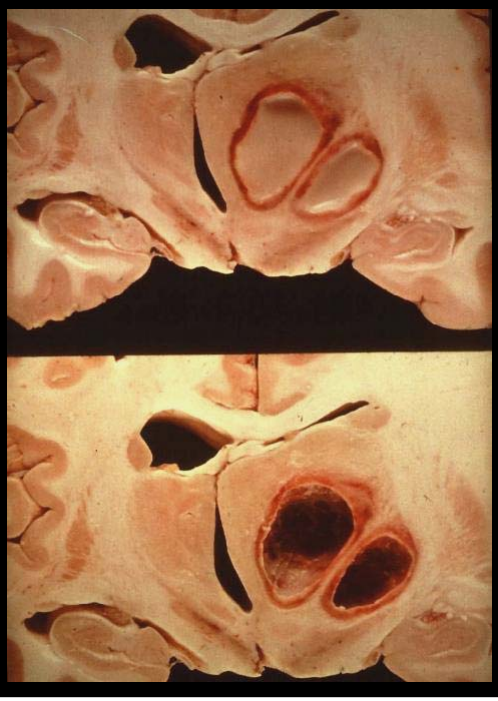


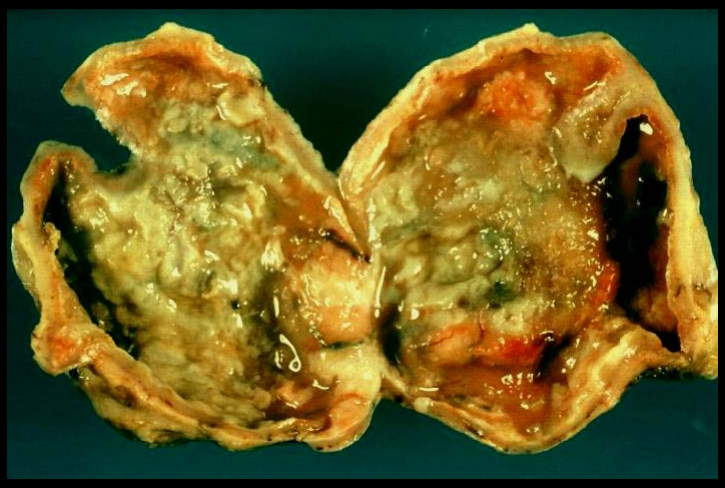
Early Capsule Formation



Late Capsule Formation







Cerebral Fungal Infections

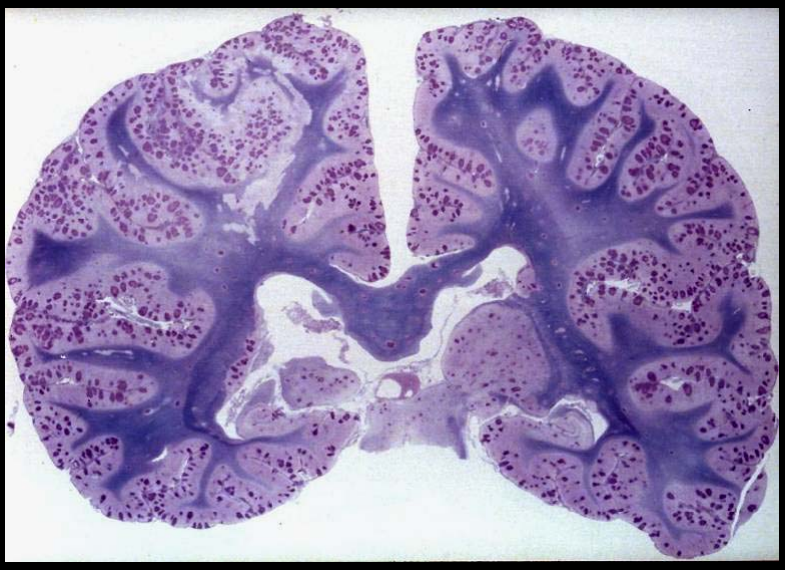
Often seen as an opportunistic infection in immunocompromised patients

Typically reach CNS via hematogenous spread from other organs

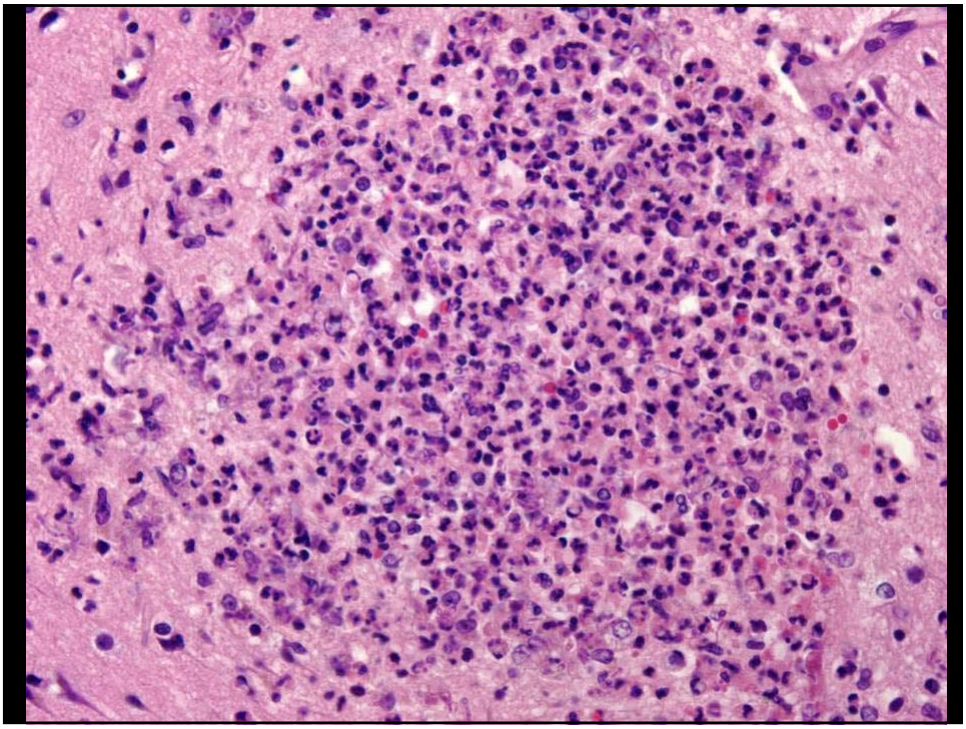
May produce leptomeningitis, vasculitis, granulomas or cerebral abscess

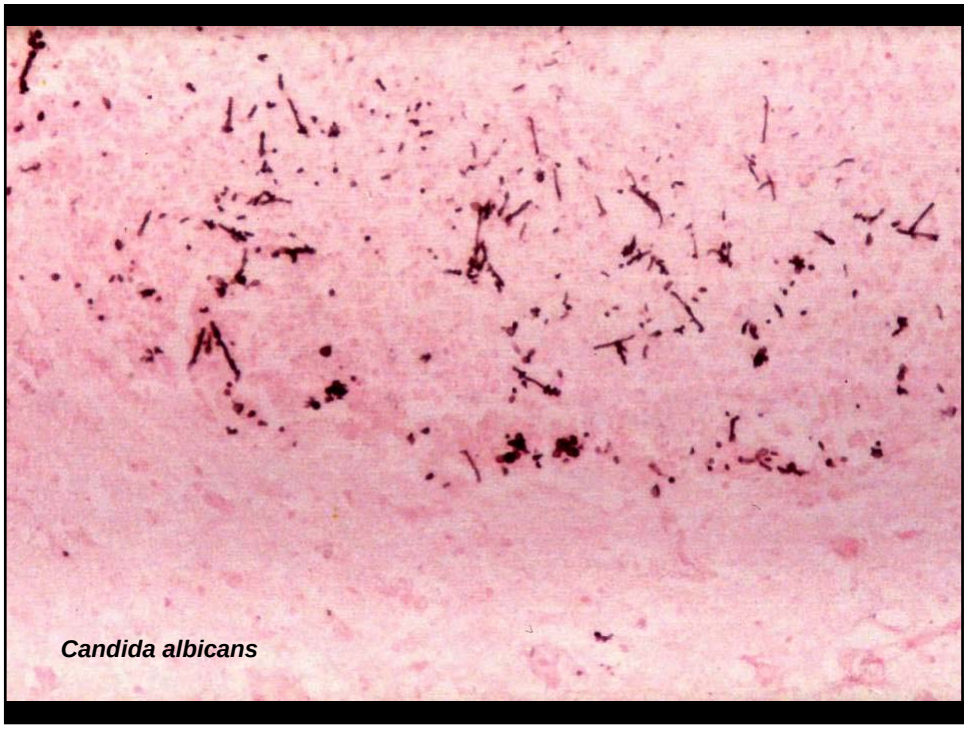
Common Organisms

Genus	Morphology	Patient status
Aspergillus	Septate hyphae	Opportunistic
Mucormycosis	Nonseptate hyphae	Opportunistic
Candida	Budding yeast, pseudohyphae	Opportunistic
Cryptococcus	Budding yeast, encapsulated	Opportunistic or previously healthy

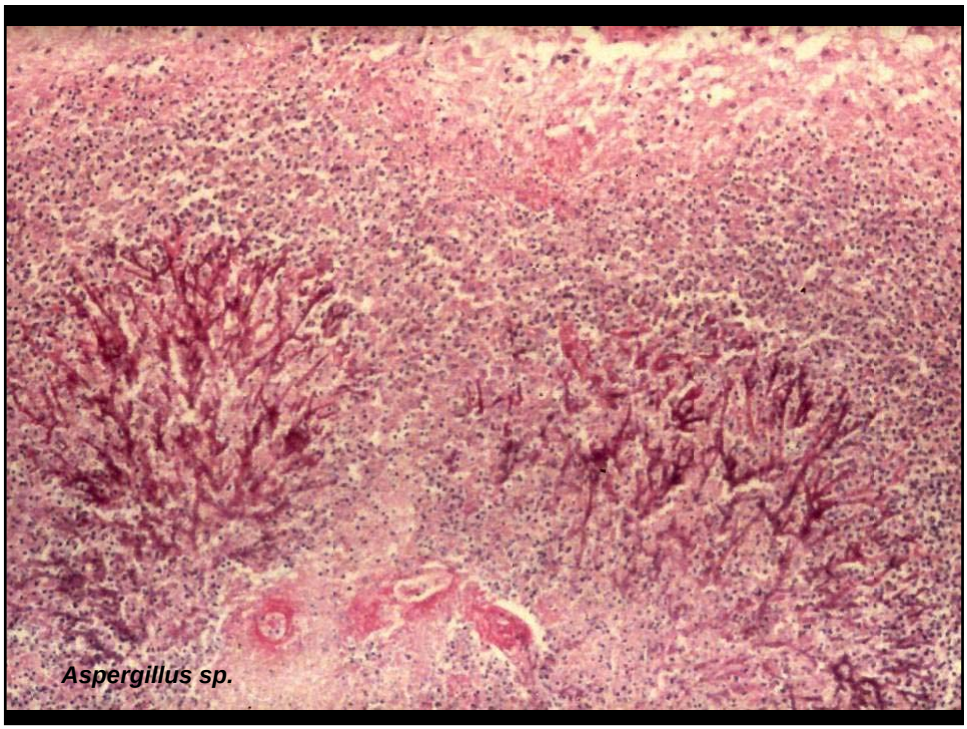


Candida albicans

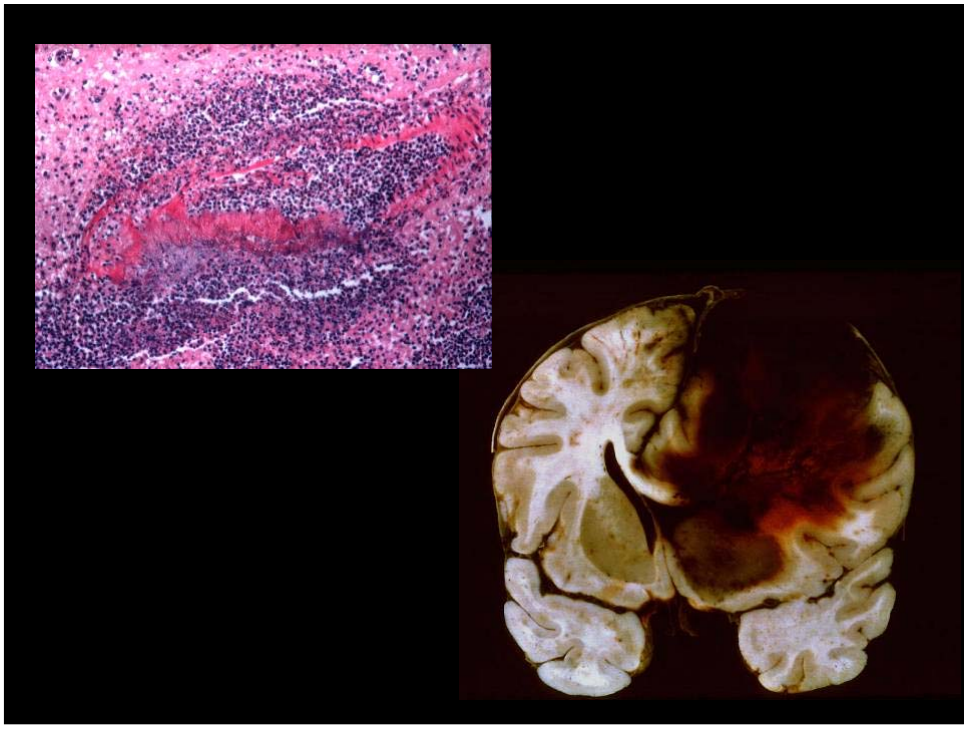


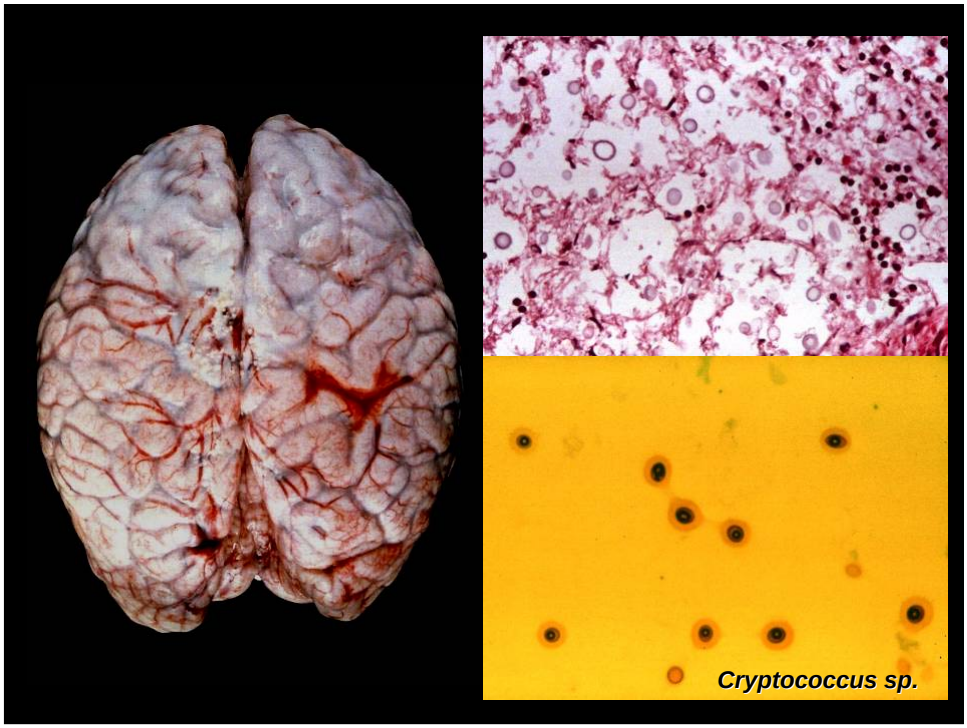


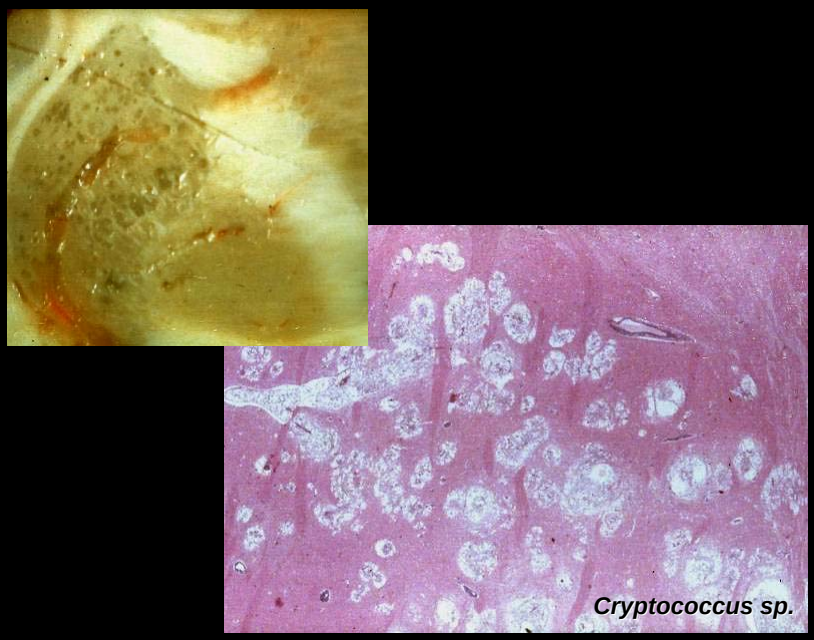
Candida albicans



Aspergillus sp.



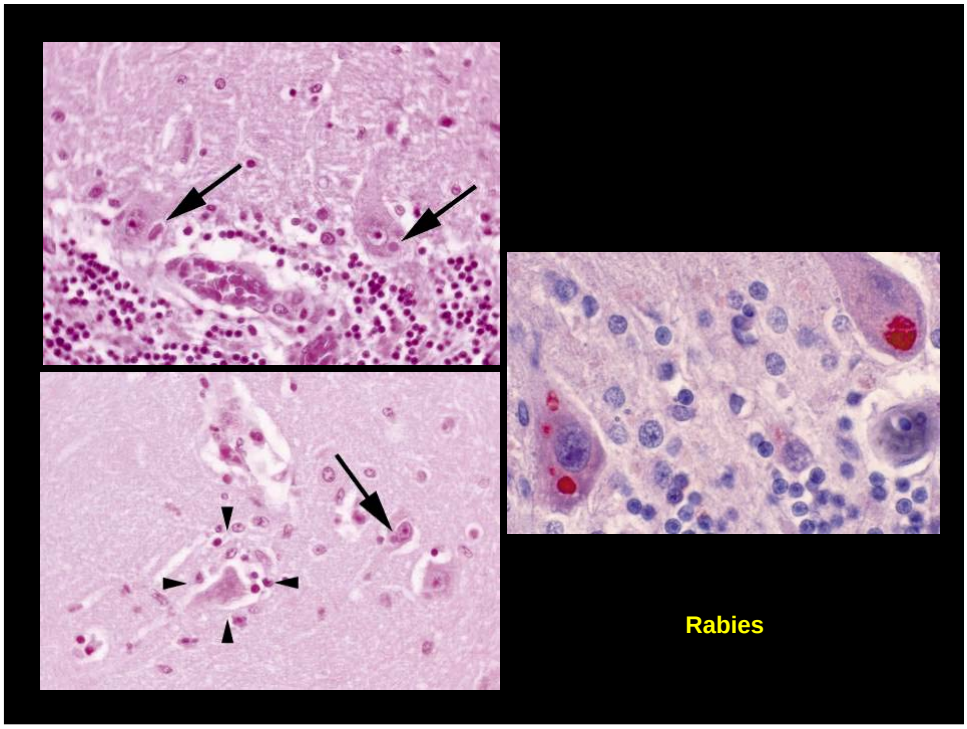

Cryptococcus sp.



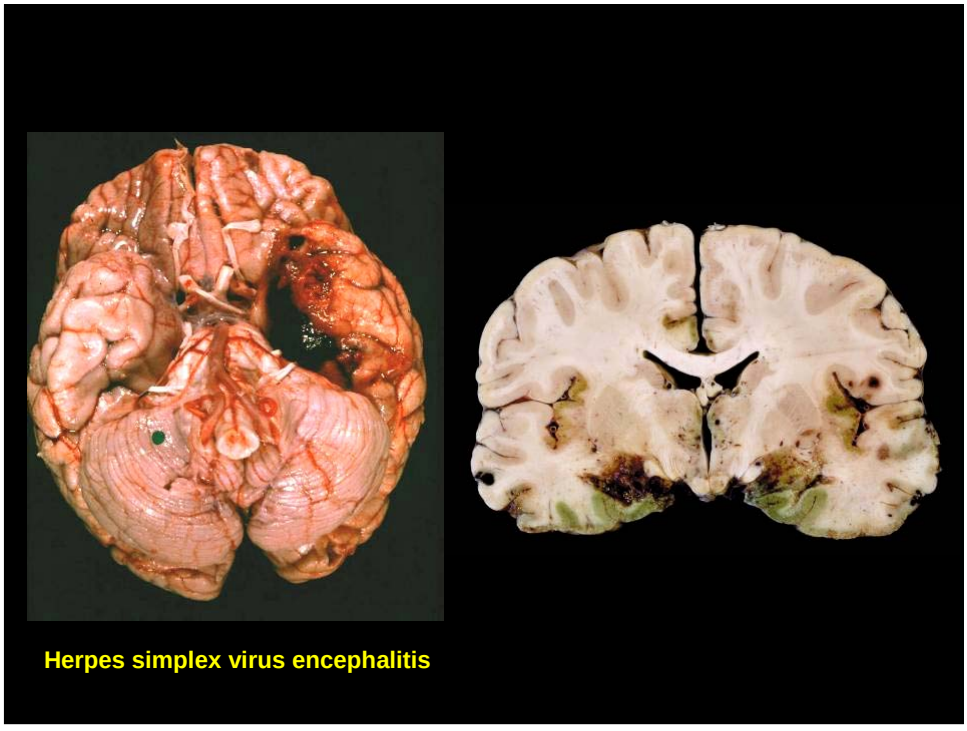
CNS viral infections

Manifestations
- 'Aseptic' meningitis
- Encephalitis
- Meningoencephalitis
- Myelitis

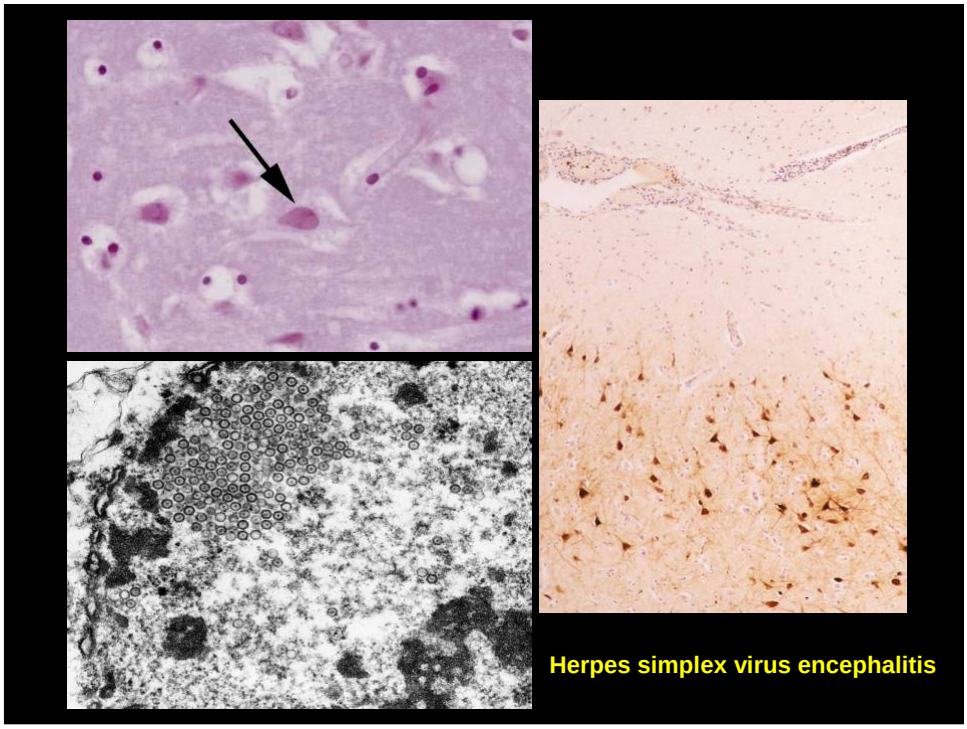
Stereotypical tissue reactions
- Inflammatory cell infiltrates
- Microgliosis
- Neuronophagia
- Microglial nodules
- Astrocytosis
- Intracellular inclusion bodies
- Neuronal cell degeneration
- Cellular and tissue necrosis



Rabies



Herpes simplex virus encephalitis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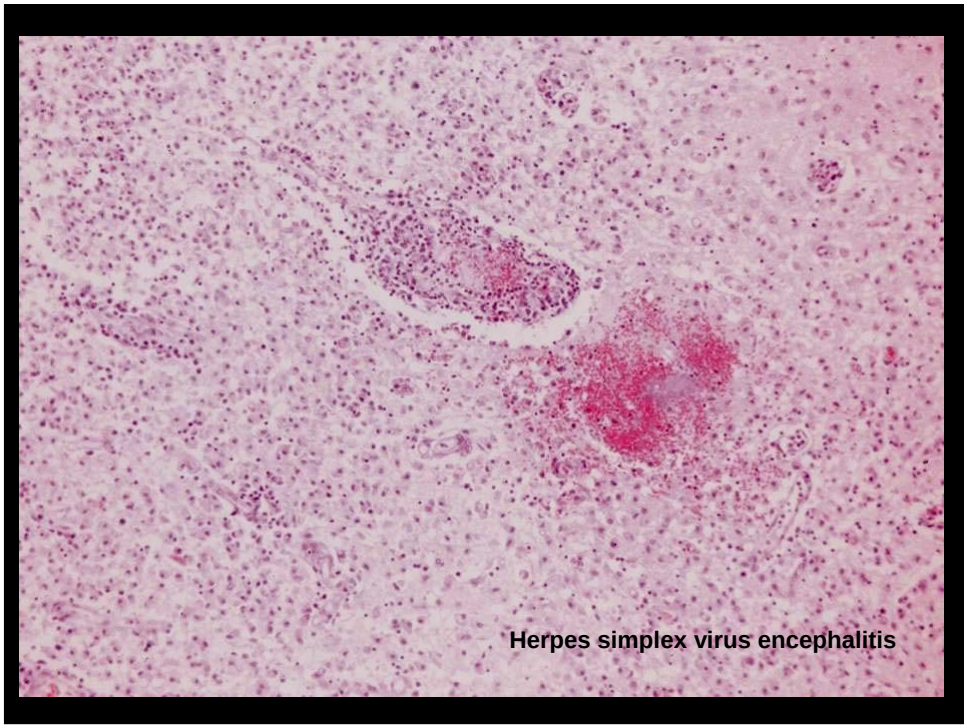

Herpes simplex virus encephalitis

Neuropathology of AIDS

Human immunodeficiency virus type 1 (HIV-1)

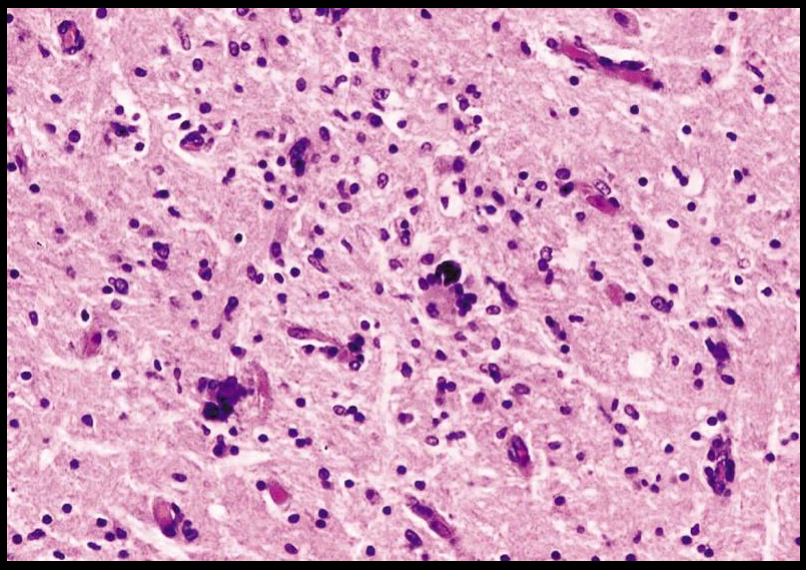
Primary complications

- HIV encephalitis or AIDS dementia complex
- HIV-associated myelopathy (vacuolar myelopathy)
- HIV-associated neuropathy (distal sensory neuropathy)
- HIV-associated myopathy

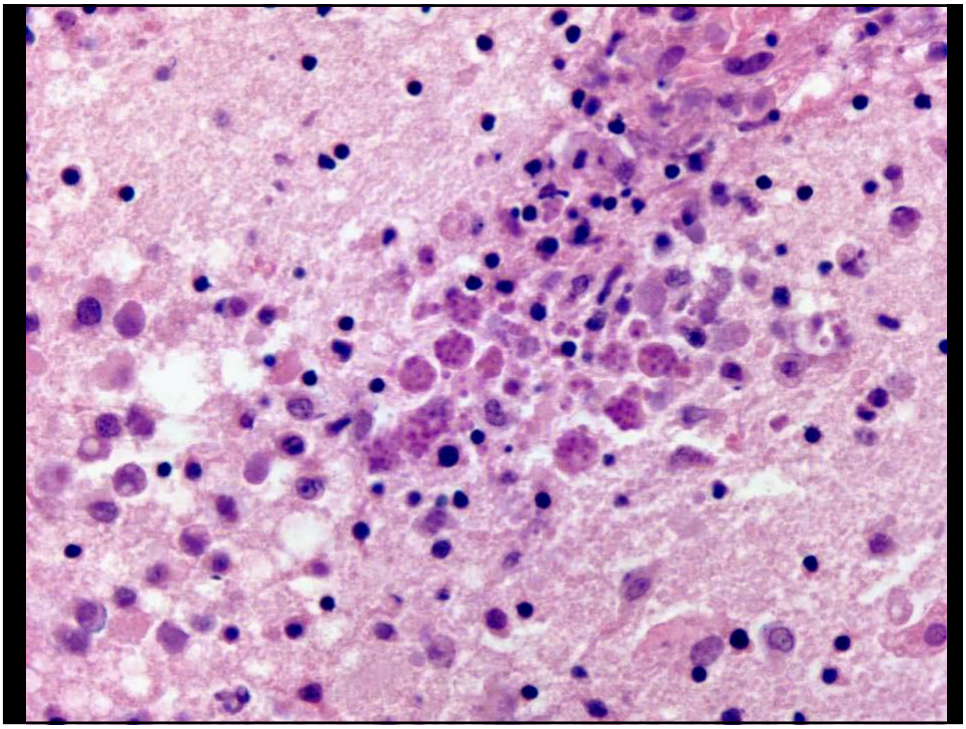
Secondary complications

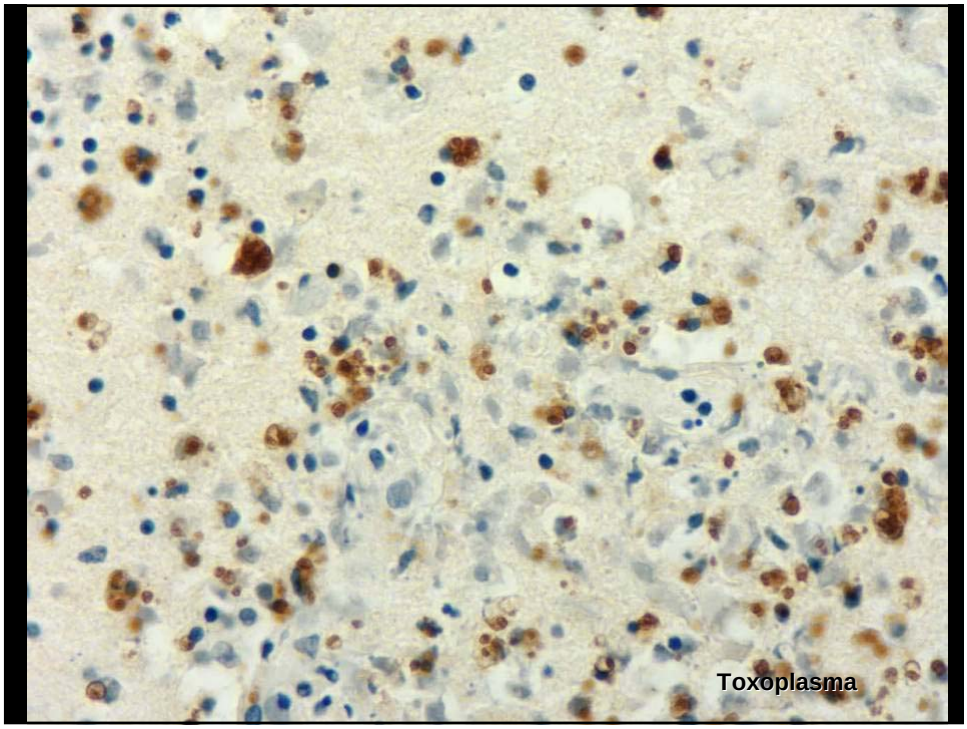
- Opportunistic infections
  - Cryptococcosis
  - Toxoplasmosis
  - Progressive multifocal leukoencephalopathy
  - Cytomegalovirus infections
- Primary CNS lymphoma

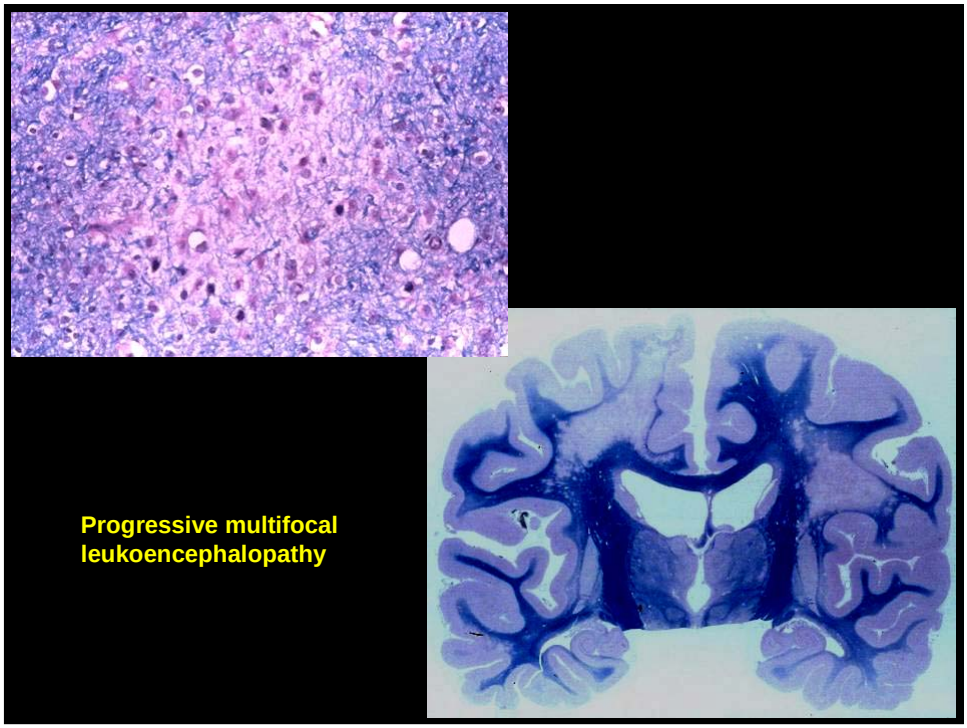
Microglial nodule with multinucleated giant cell

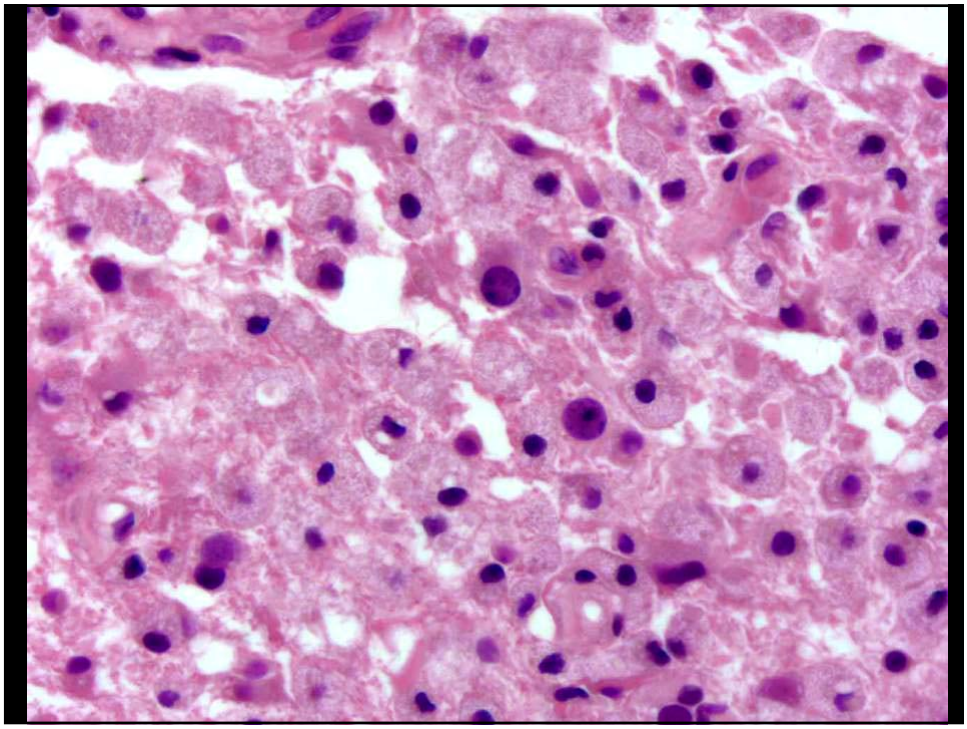


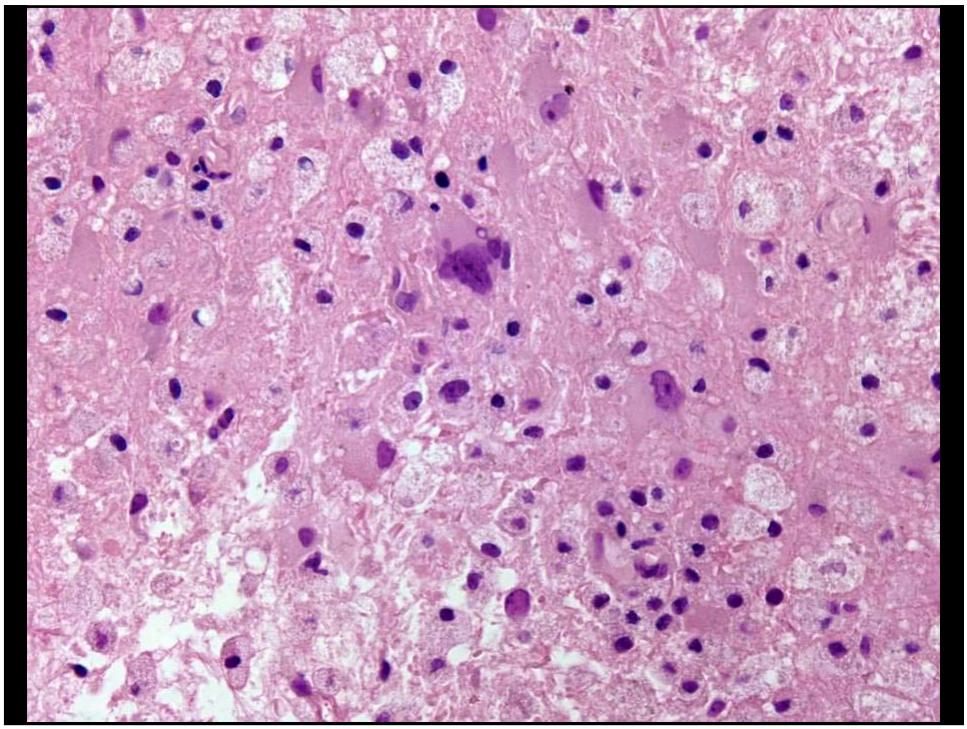
Large necrotic Toxoplasma lesion

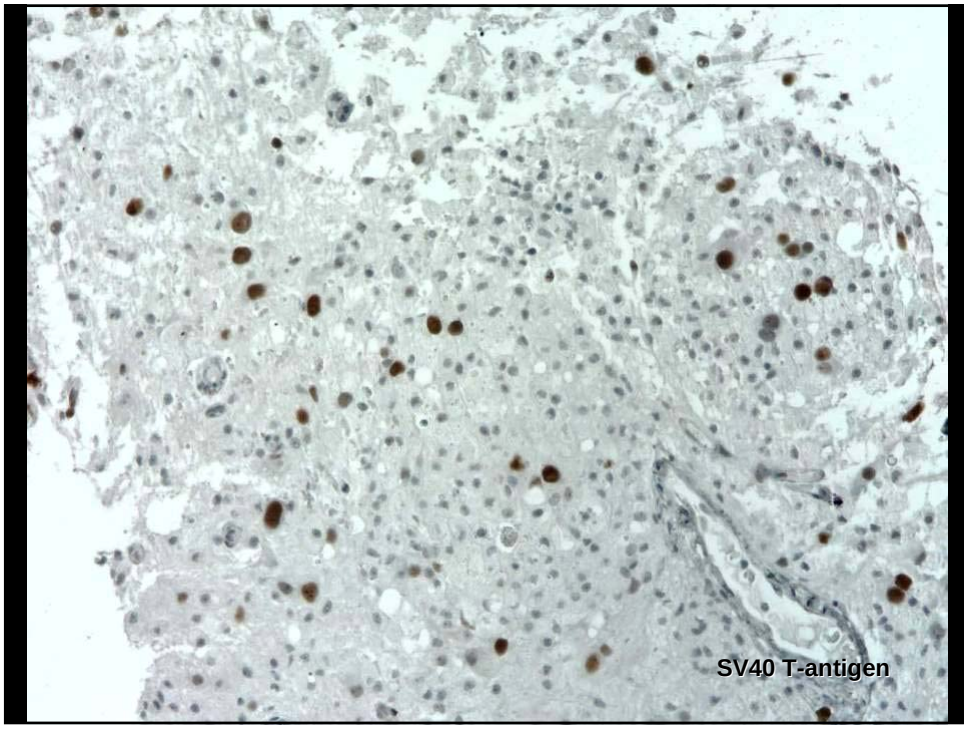


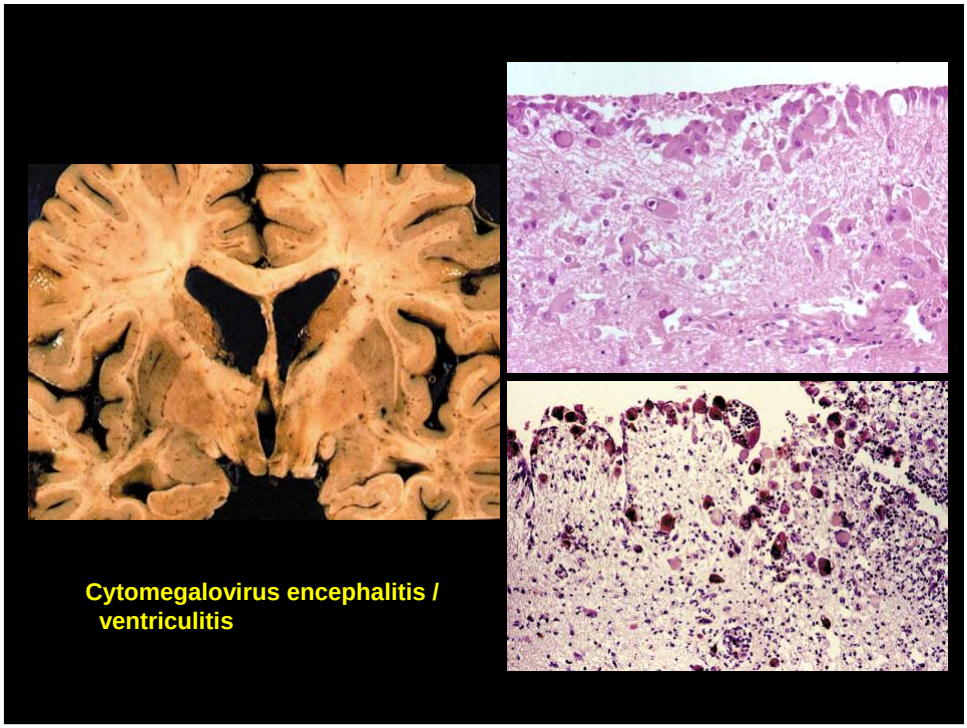

Toxoplasma

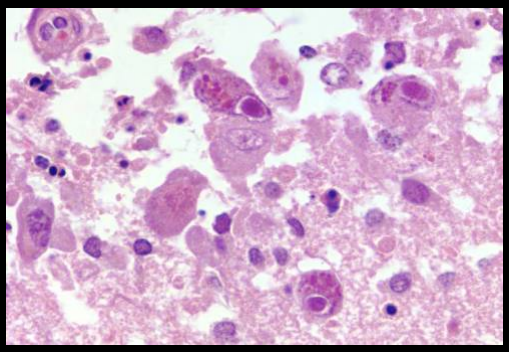

Progressive multifocal
leukoencephalopathy

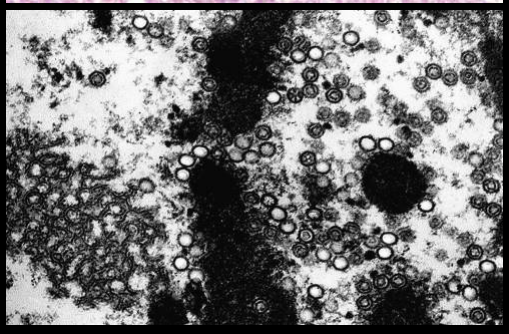





SV40 T-antigen


Cytomegalovirus encephalitis / ventriculitis





Cytomegalovirus encephalitis

Transmissible spongiform encephalopathies - Prion diseases

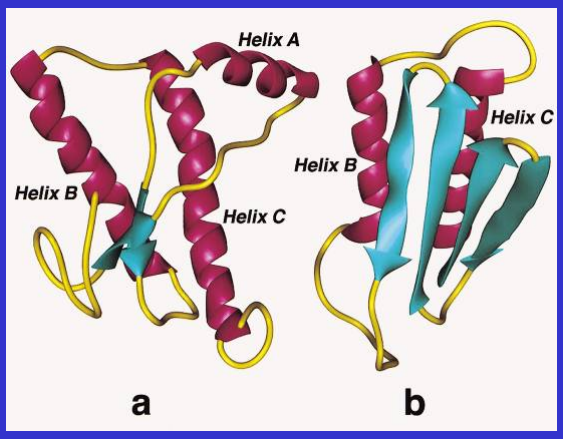
Creutzfeldt-Jakob Disease
Worldwide incidence of approximately 1 per million
Peak incidence in seventh decade of life
Sporadic (85%), familial (15%) or iatrogenic transmission (very rare)
Rapid progressive dementia, myoclonus, ataxia, usually fatal < 1 year

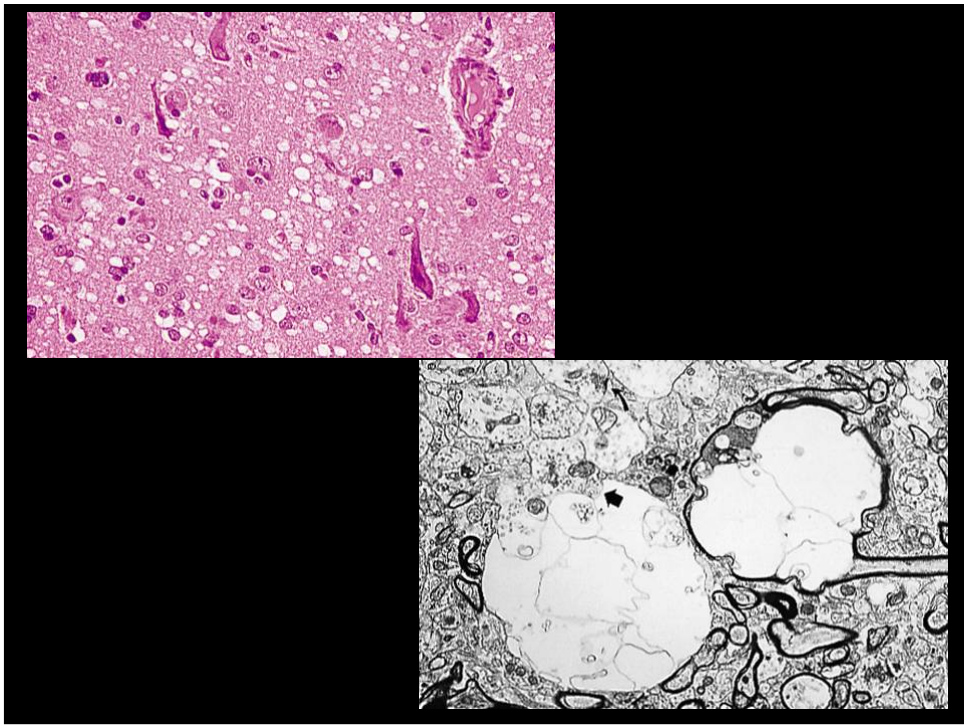
Other Human Prion Diseases
Gerstmann-Straussler-Scheinker disease
Fatal familial insomnia
Kuru
New Varient CJD (Mad Cows Disease)

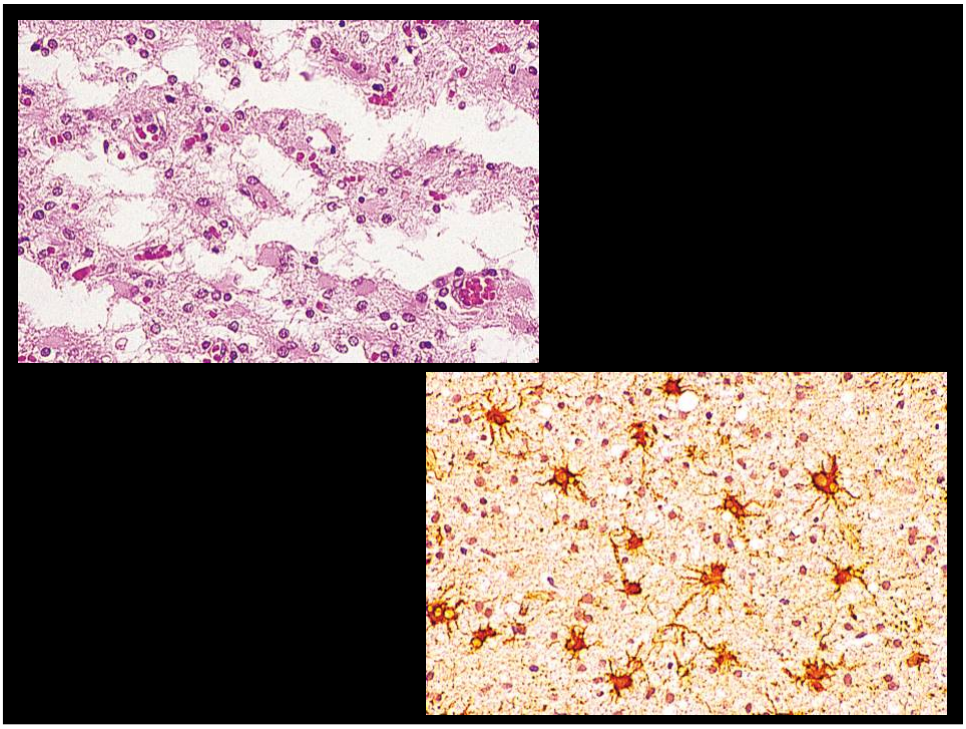
Animal Prion Diseases
Scrapie
Bovine spongiform encephalopathy
Others

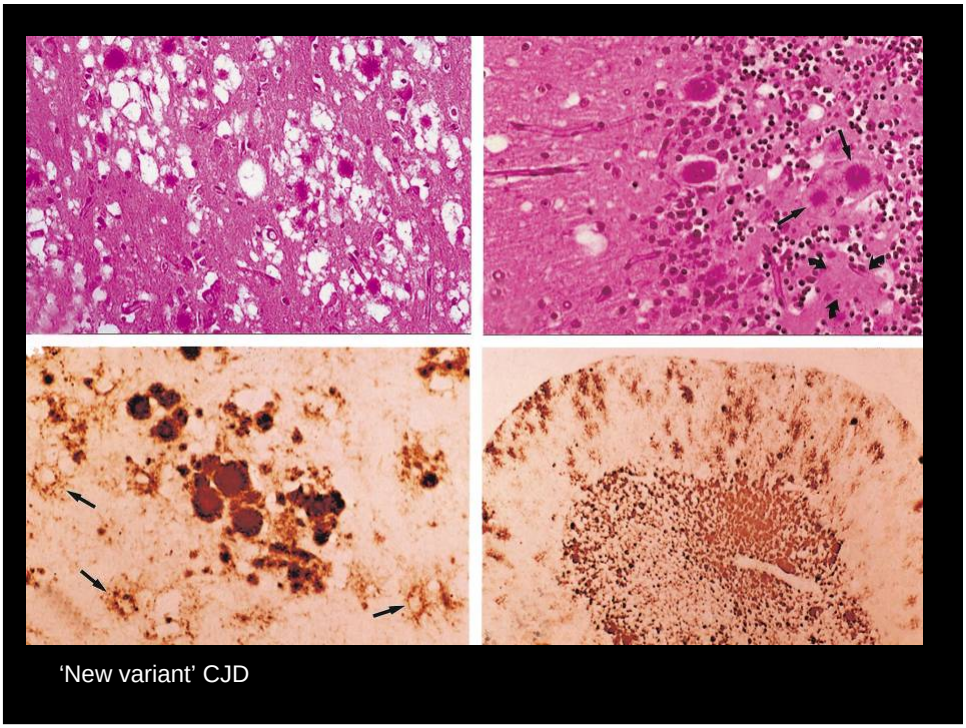
Prion Hypothesis

PrP is a 30-KD normal cellular protein present in neurons
Disease occurs when PrP undergoes confromational to a protease resistant form
This change occurs spontaneously at a very low rat- resulting in the sporadic cases
Various mutations in PrP facilitate the confromational change-famililal cases
The infectious nature comes from ability of PrP^{sc} to conformation of normal PrP
How accumulation of PrP^{sc} causes neuronal cell death is still not understood









‘New variant’ CJD

Other infections of the CNS

Arbovirus infections (arthropod-borne)
Poliomyelitis
Neurosyphilis
Neuroborreliosis (Lyme Disease)
Tuberculosis
Cysticercosis