Nervous System Pathology

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CNS Outline

- Cerebral ischemia
- Trauma
- Infections
- Tumors
- Demyelinating diseases
- Degenerative diseases

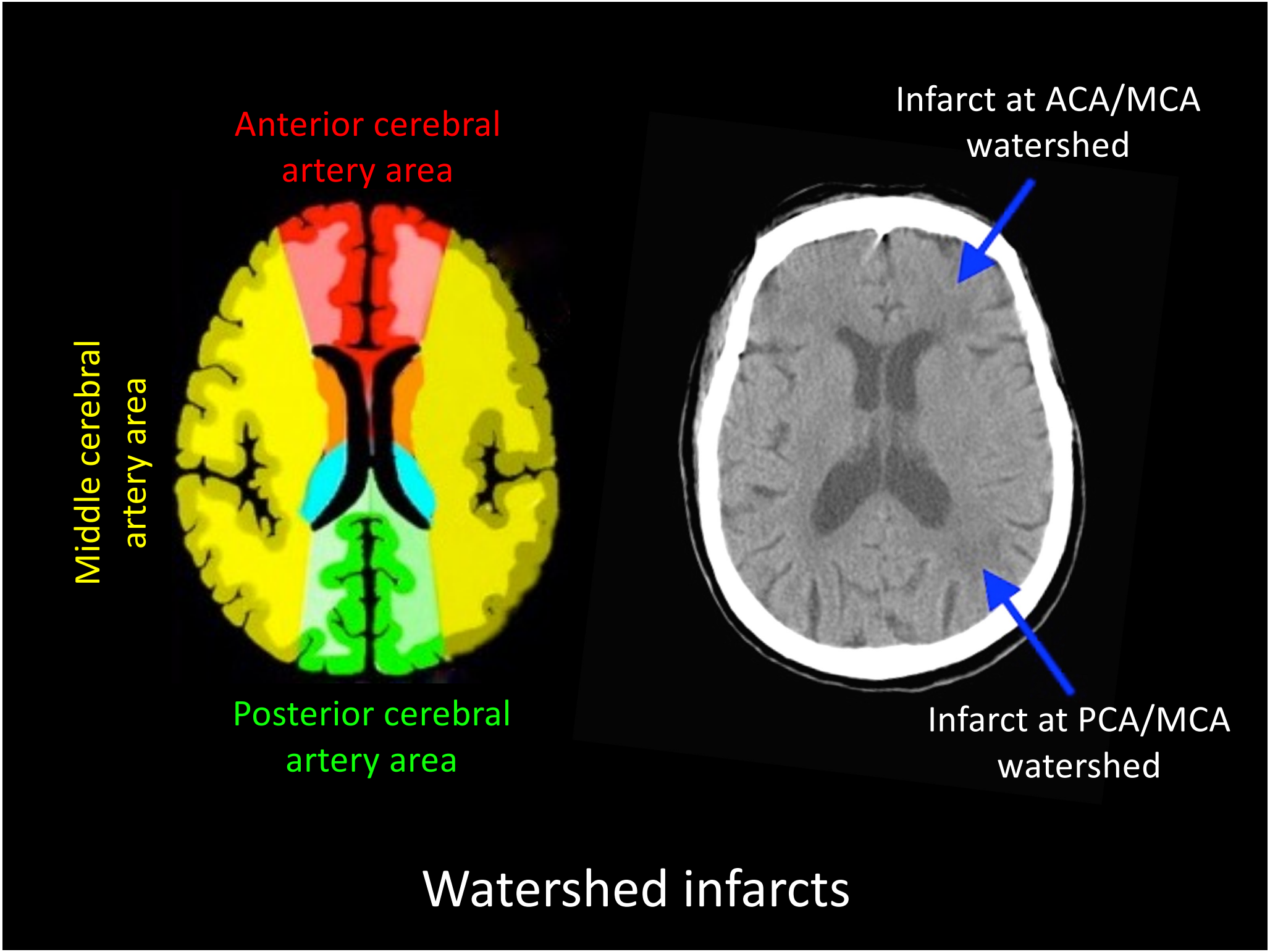
CNS Outline

- Cerebral ischemia

Global Cerebral Ischemia

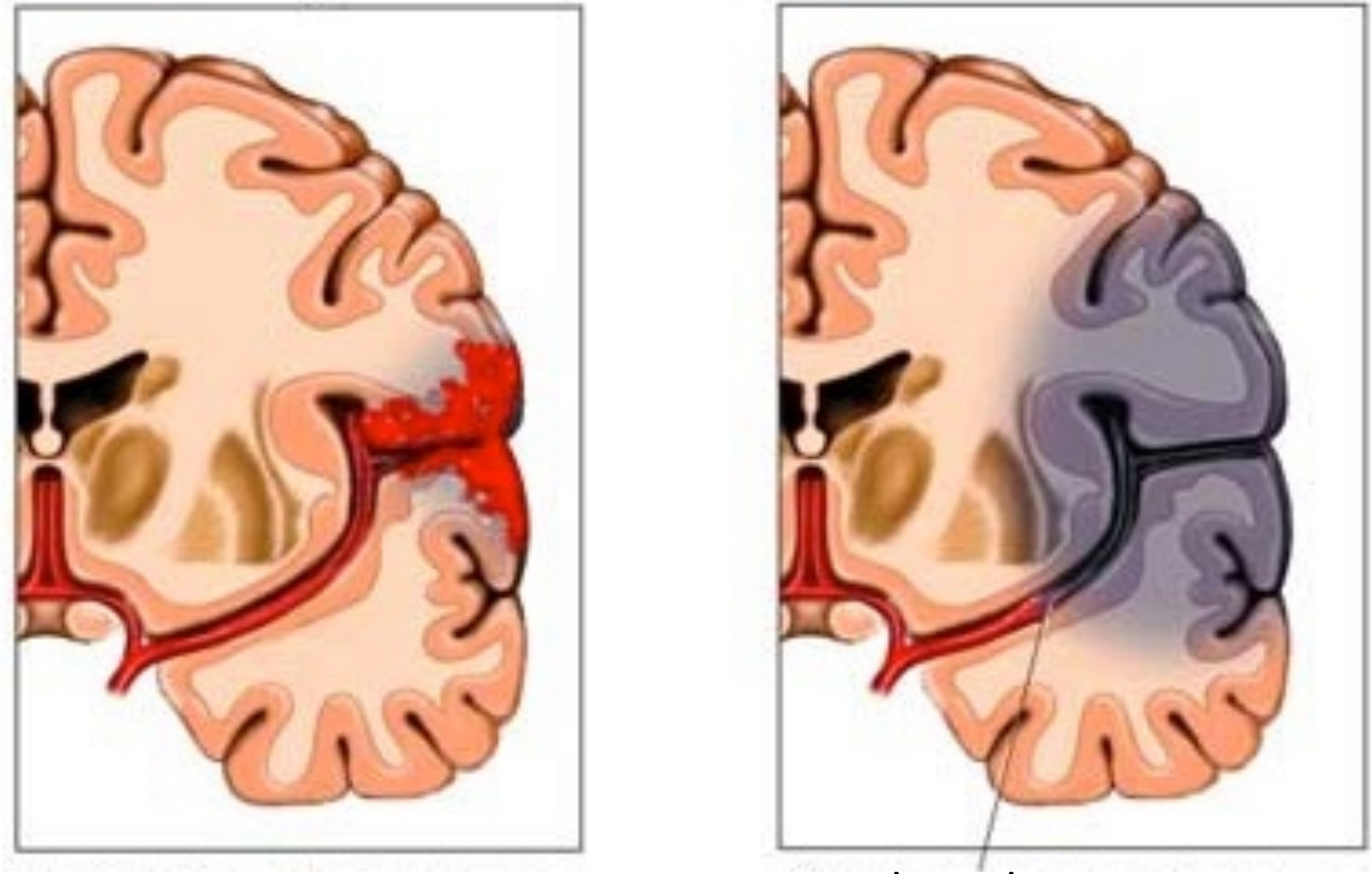
- Cause: hypotension
- Outcome depends on severity of hypotension
  - Mild: transient confusion
  - Severe: persistent vegetative state or brain death
- Severe hypotension can also cause "watershed" infarcts

Global ischemia


Anterior cerebral artery area
Middle cerebral artery area
Posterior cerebral artery area
Infarct at ACA/MCA watershed
Infarct at PCA/MCA watershed
Watershed infarcts

Focal Cerebral Ischemia ("Stroke")

- Due to obstruction of blood flow
- Hemorrhagic (red) infarcts
  - due to emboli + reperfusion
  - Common cause: atrial fibrillation
- Ischemic (pale) infarcts
  - due to thrombi
  - Common cause: atherosclerosis
- Infarcts may be preceded by transient ischemic attacks (TIAs)



Hemorrhagic (L) vs. ischemic (R) infarction

CNS Outline

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- Trauma

Concussion

- Definition: Altered consciousness from head injury due to change in momentum of head (head hits rigid surface)
- Mechanism unknown
- Symptoms: amnesia, confusion), headache, visual disturbances, nausea, vomiting, dizziness
- Post-concussive neuropsychiatric syndromes exist (especially after repetitive injuries)

Traumatic Vascular Injury

Epidural hemorrhage

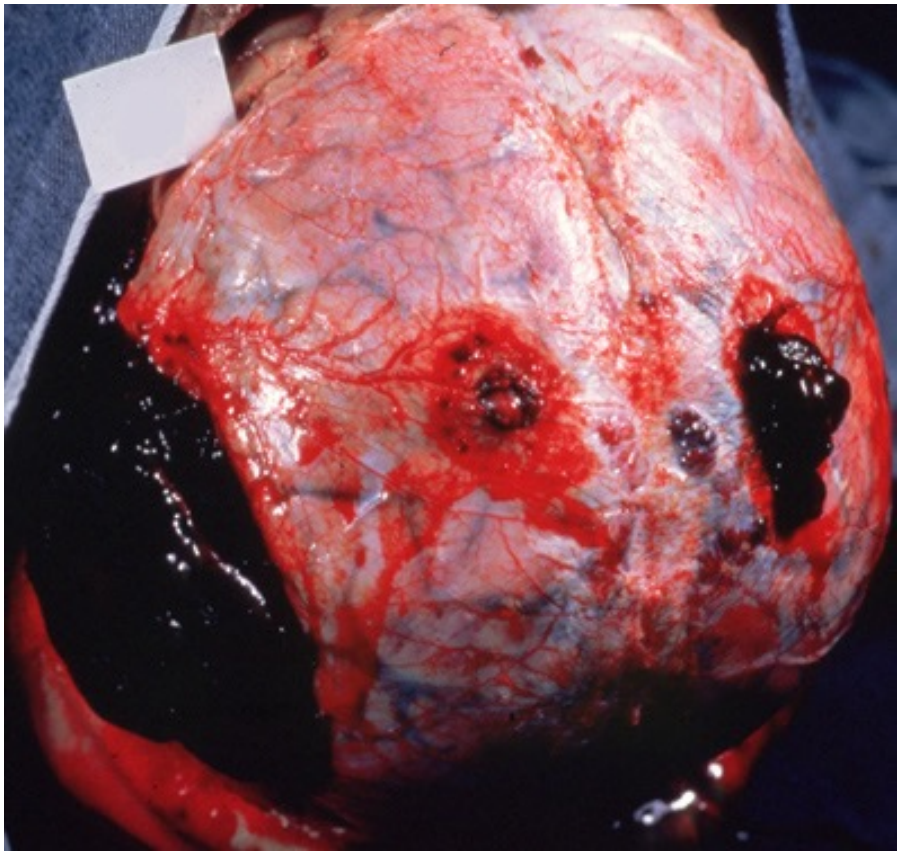
- Blood above dura
- Tear in middle meningeal artery
- Neurosurgical emergency

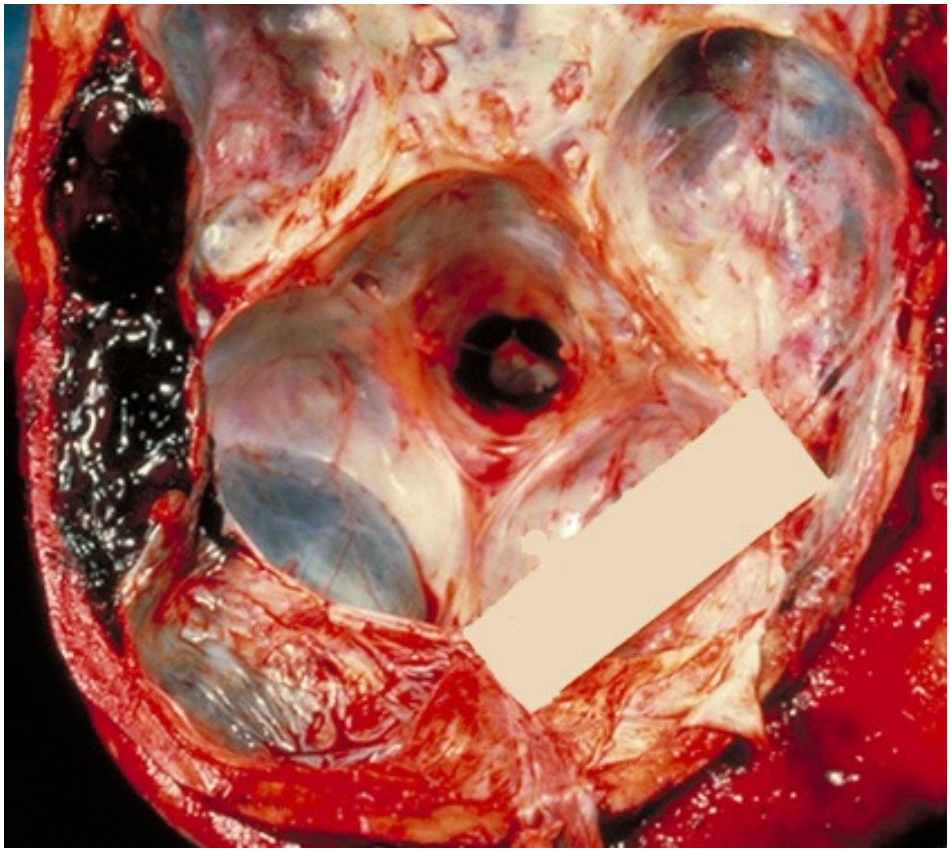
Subdural hemorrhage

- Blood between dura and arachnoid
- Shearing of bridging veins
- Acute (hours) or chronic (months)

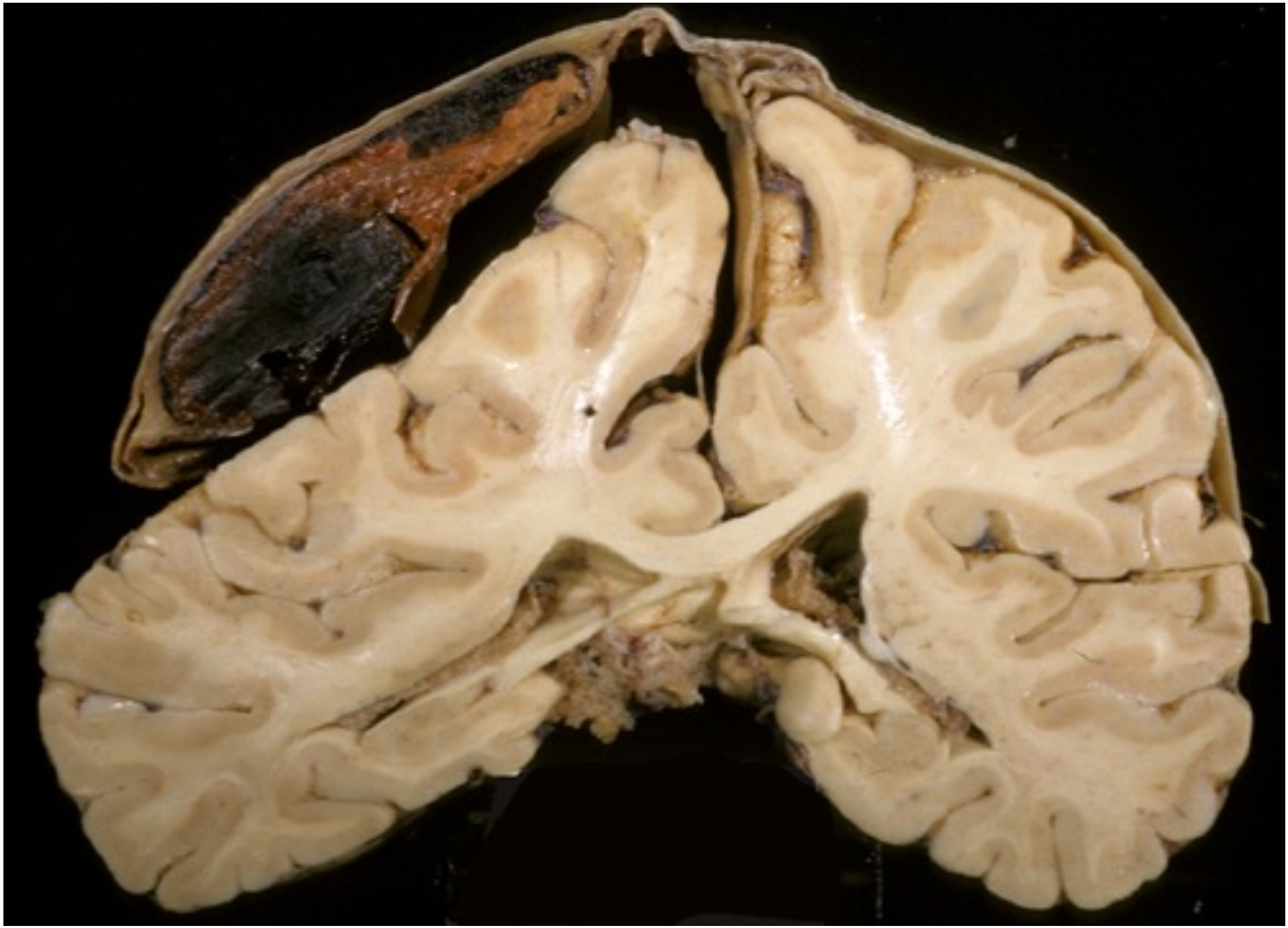
Subarachnoid hemorrhage

- Blood in subarachnoid space
- Contusions, ruptured berry aneurysms
- Neurosurgical emergency





Epidural hematoma



Subdural hematoma

Subarachnoid hemorrhage from ruptured berry aneurysm

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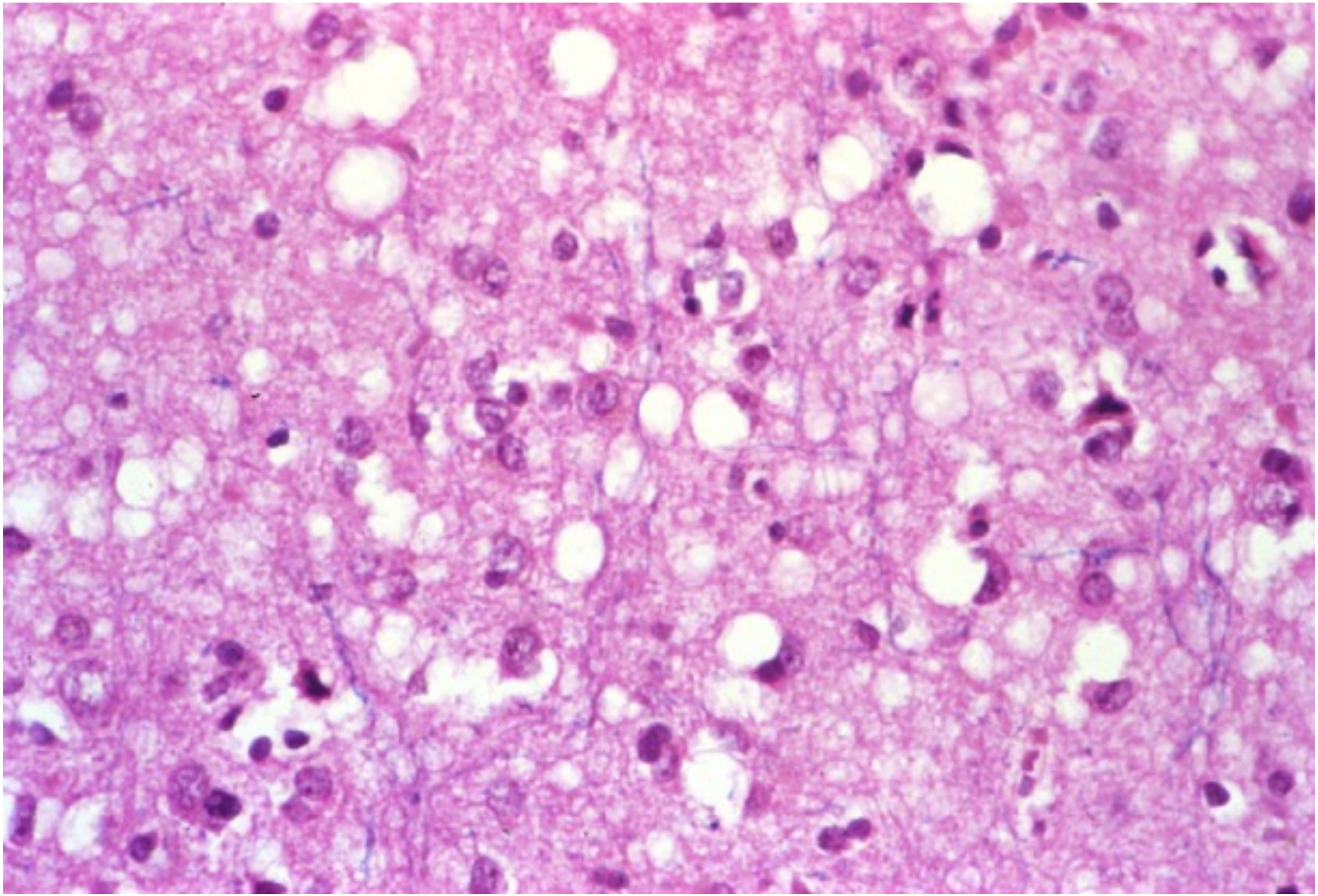
Meningitis

- Inflammation of the meninges
- Symptoms: Fever, headache, stiff neck.
- Bacterial meningitis is dangerous!
  - Newborns: *E. coli*, *Strep agalactiae*
  - Young adults: *Neisseria meningitidis*
  - Elderly: *Strep pneumoniae*
- Viral meningitis is much less serious

Bacterial meningitis

Prion diseases

- Prion = abnormal form of a cellular protein called prion protein (PrP)
- Weird: prions are infectious and transmissible
- Diseases: Creutzfeldt-Jakob disease, kuru, scrapie, mad cow disease
- Causes “spongiform change” (intracellular vacuoles) in neurons and glia
- Symptoms: progressive dementia



Creutzfeldt-Jakob disease

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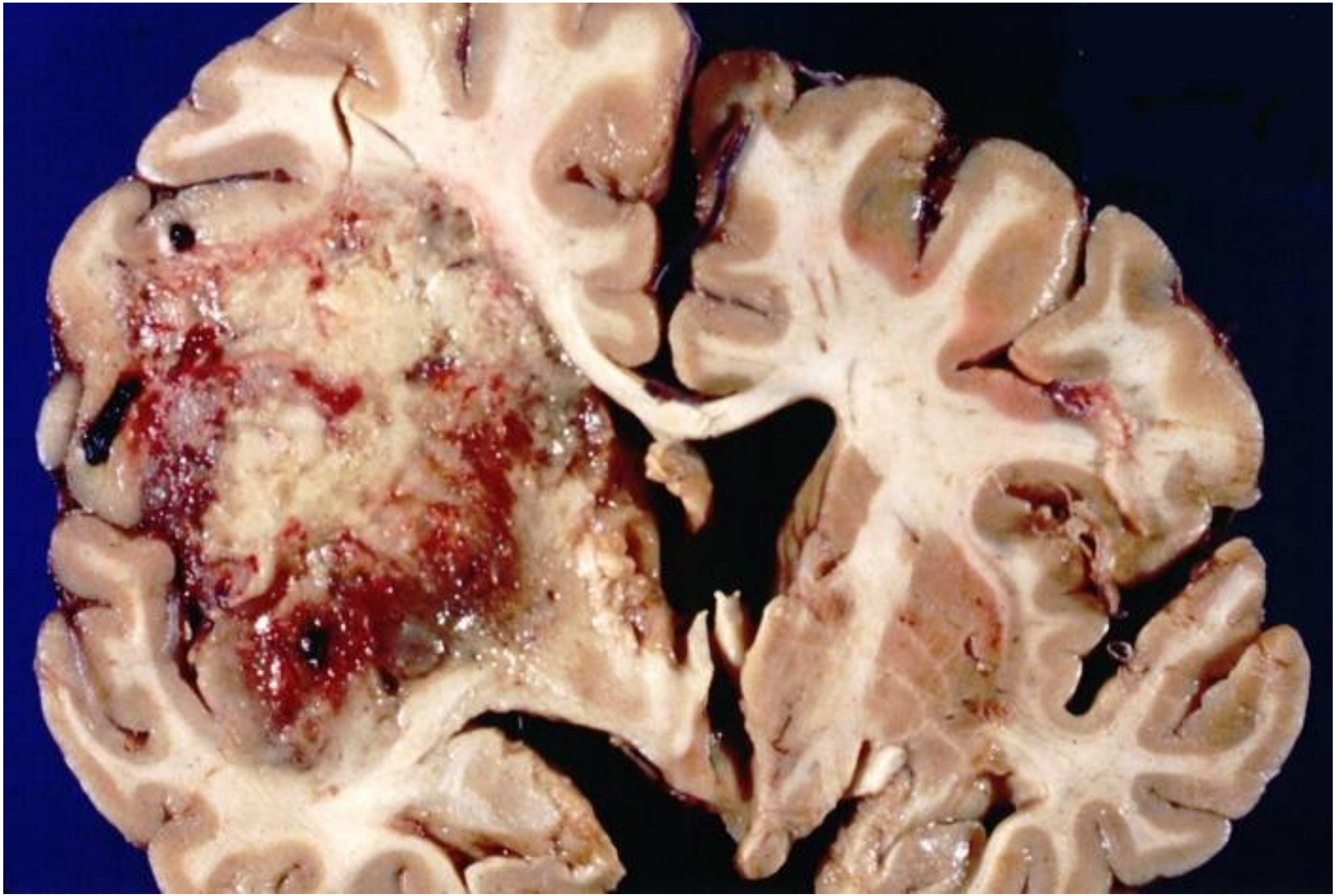
Brain Tumors

- Most are primary; about 30% are metastatic
- Classified by cell of origin
- “Benign” and “malignant” have different implications when it comes to brain tumors
- Most brain tumors in children arise in the posterior fossa
- Most brain tumors in adults arise in the cerebral hemispheres

Gliomas

- Arise from astrocytes, oligodendrocytes, ependymal cells
- Often fatal (location and infiltrative borders prevent complete excision)
- Glioblastoma (highest-grade astrocytoma) is the most common and the most malignant

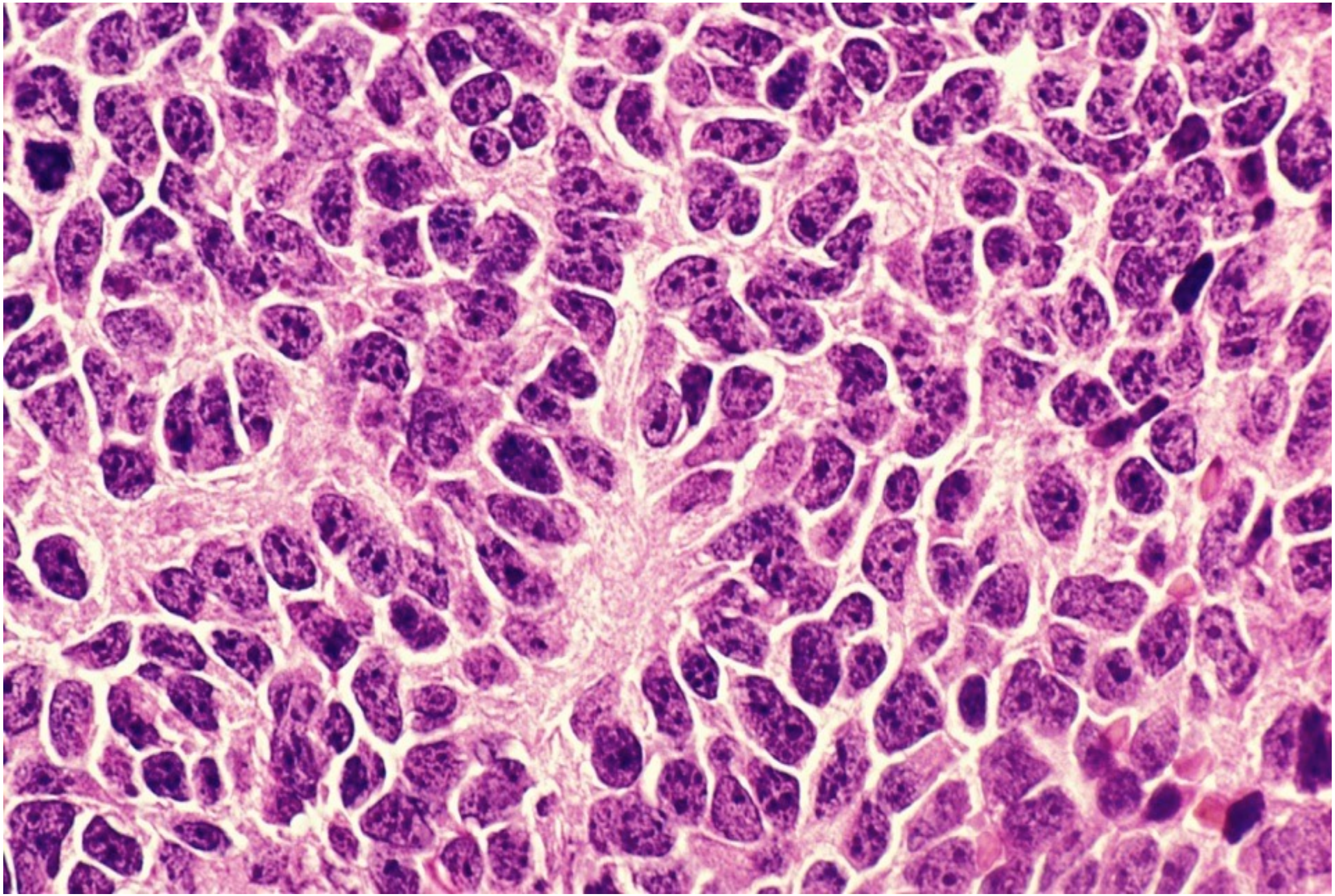


Glioblastoma (highest-grade astrocytoma)

Medulloblastoma

- Tumor of primitive neurons
- Cerebellum
- Children
- Very radiosensitive!

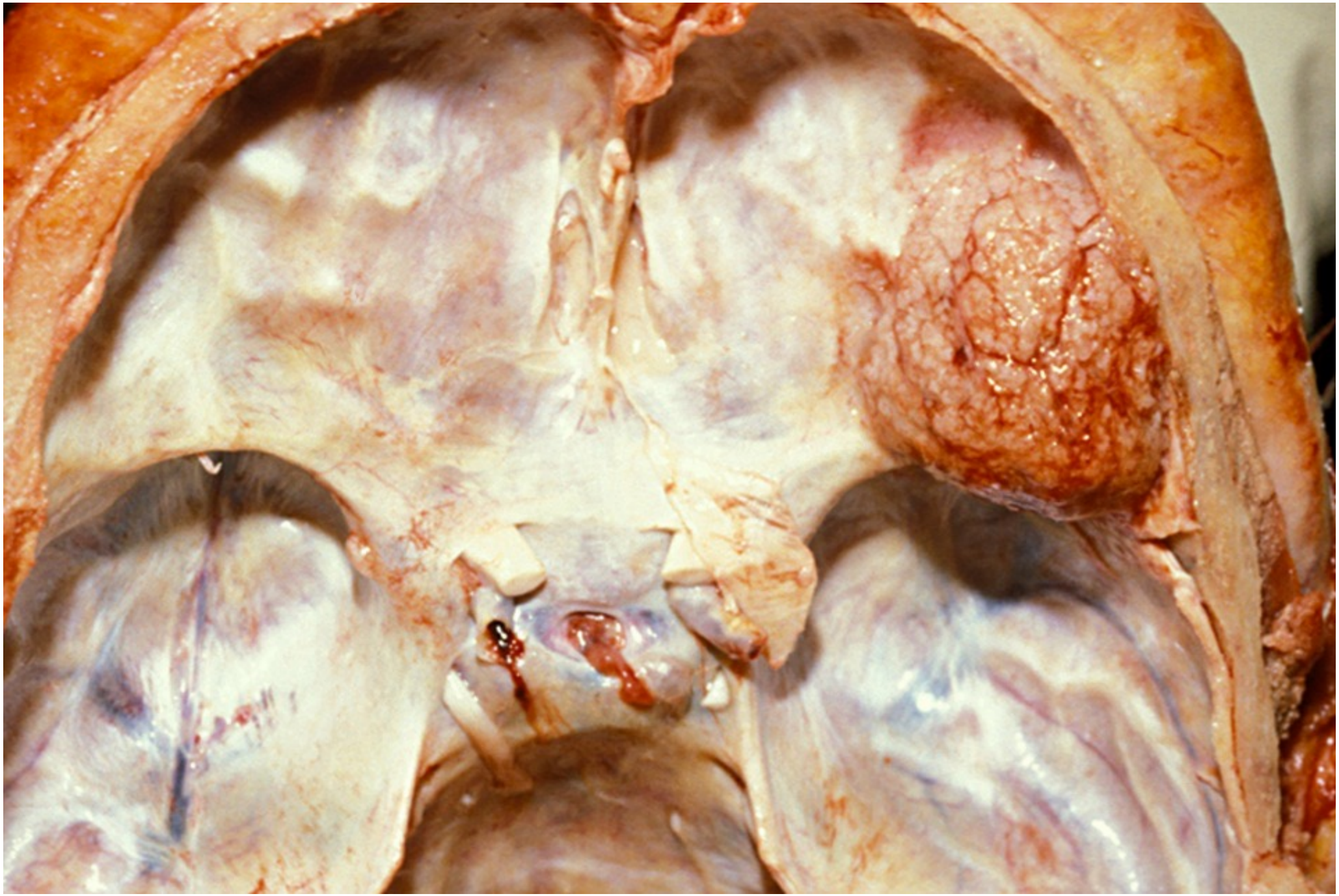
Medulloblastoma



Medulloblastoma

Meningioma

- Arises from meningeal tissues
- Symptoms caused by compression
- Cured by resection



Meningioma

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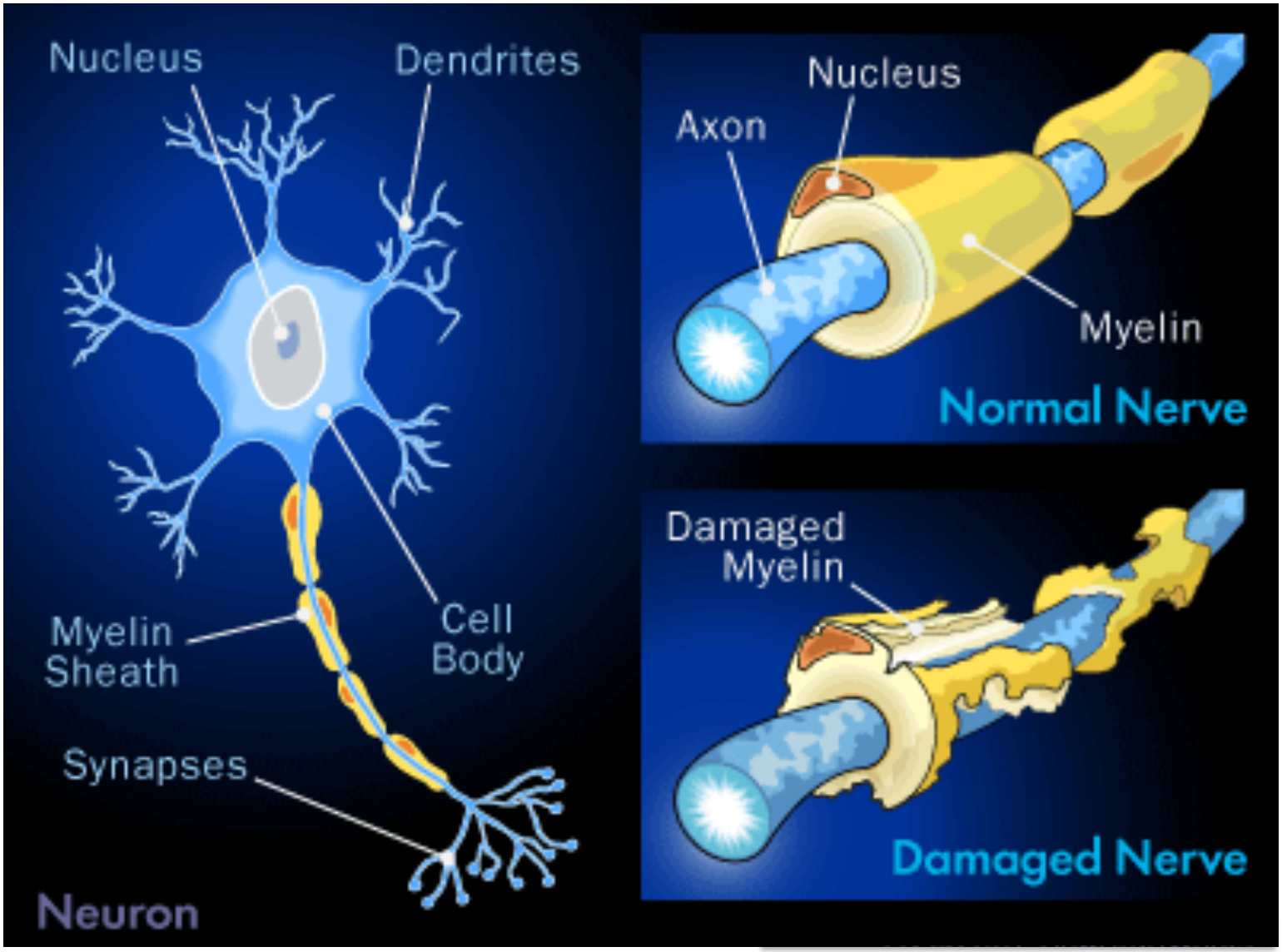
Multiple Sclerosis

- Most common demyelinating disorder
- Etiology unknown; likely autoimmune
- Variety of motor and sensory symptoms
- Relapsing-remitting course
- Plaques (areas of demyelination) in brain, cord



Multiple sclerosis

Guillain-Barré Syndrome

- Acute peripheral neuropathy
- Autoimmune attack on myelin
- Progressive, ascending weakness
- Usually self-limited (but may involve respiratory muscles, requiring respiratory intensive care)

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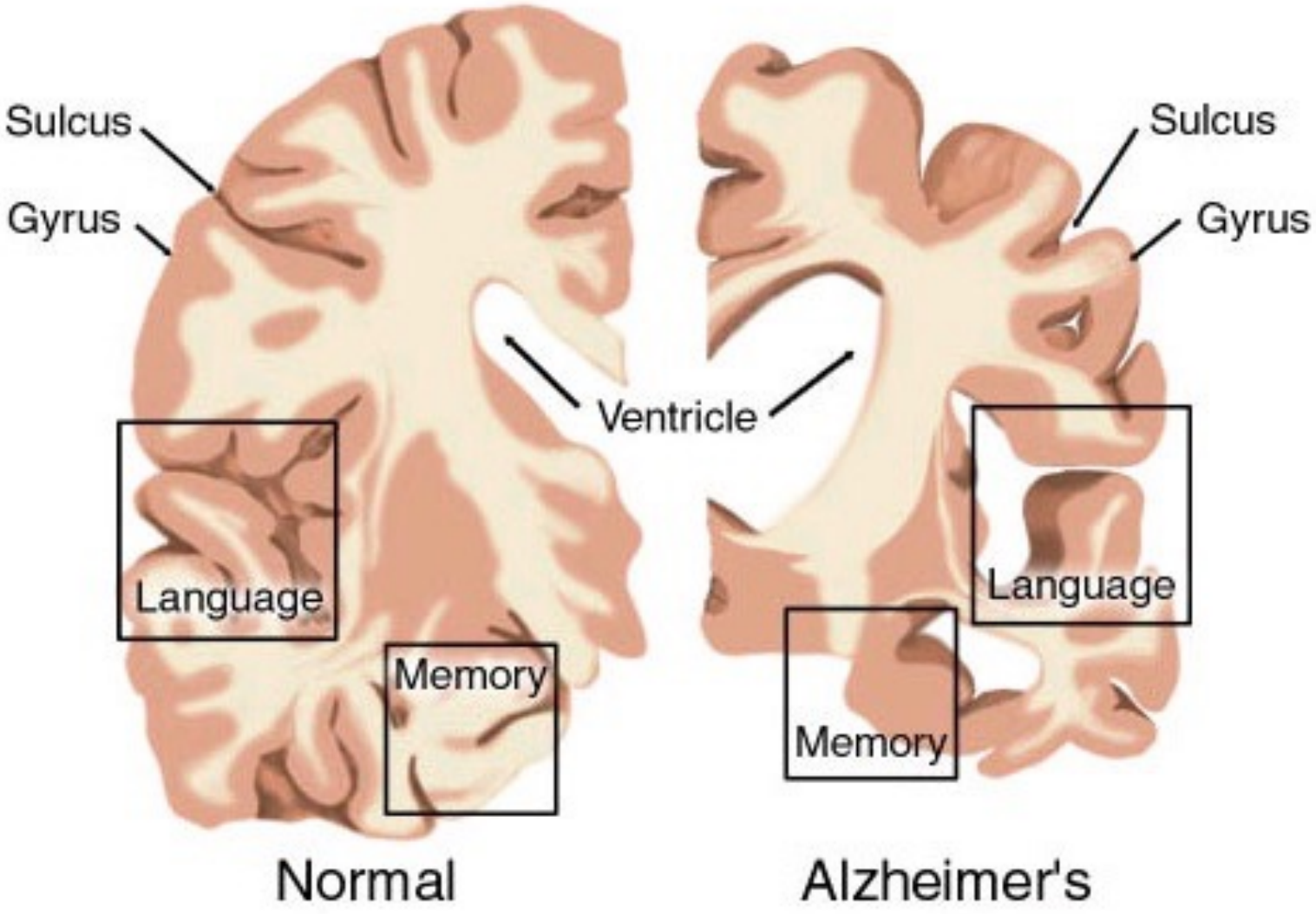
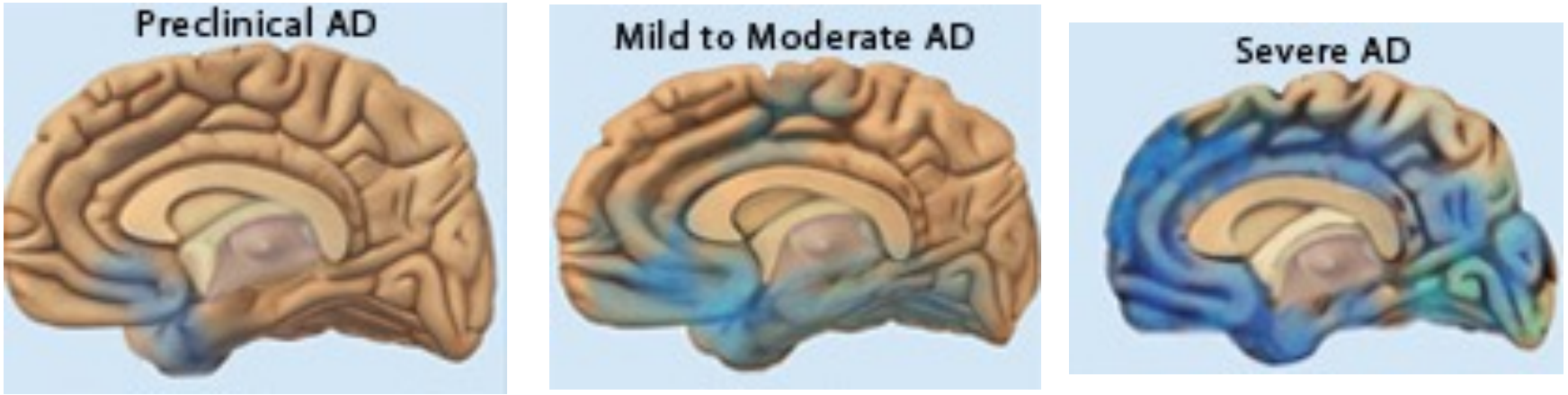
Alzheimer Disease

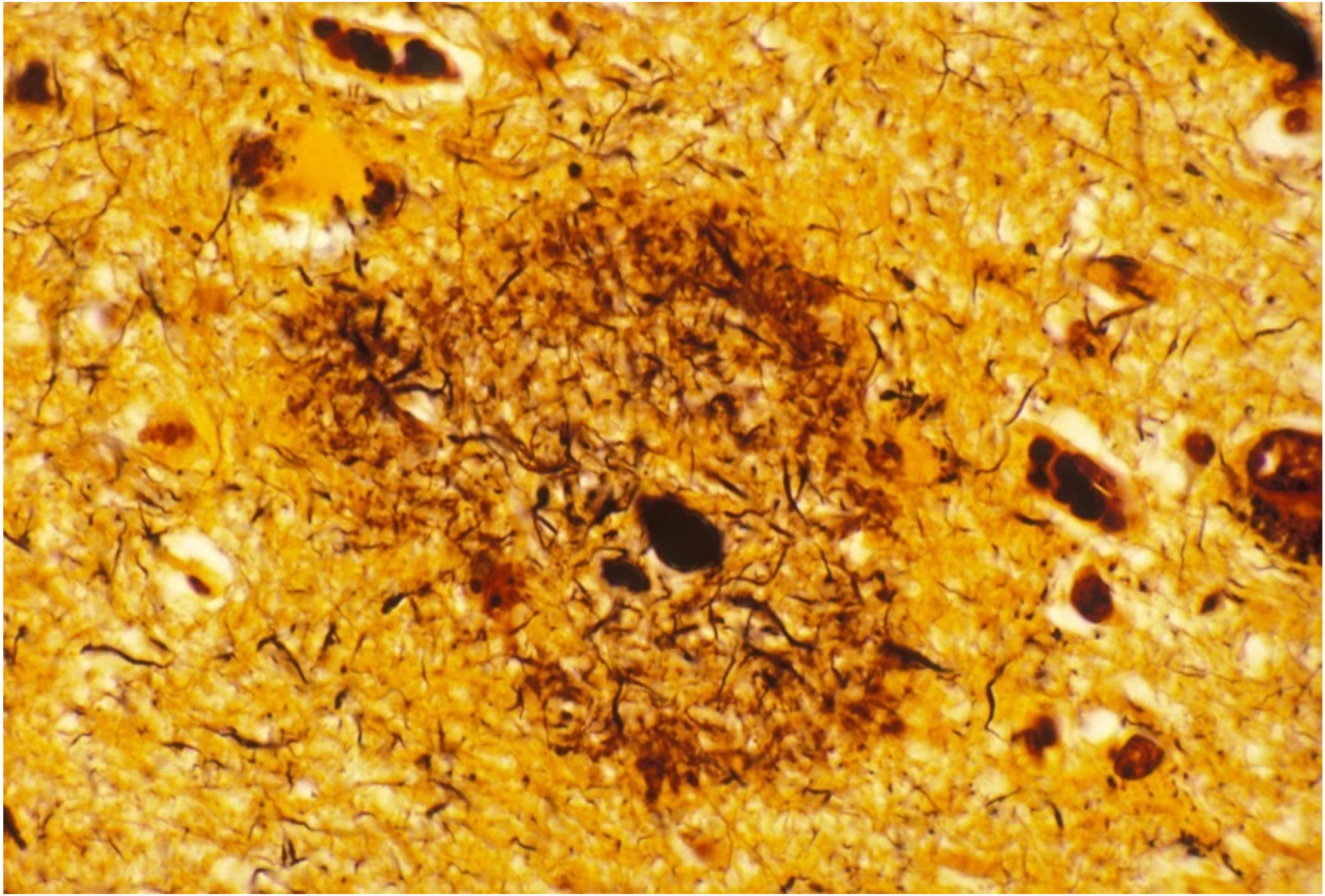
- Most common cause of dementia in the elderly
- Symptoms:
  - Early on: forgetfulness
  - Then: issues with language, motor skills, mood
  - Finally: profound disability, immobility
- Gross: Cortical atrophy, neuronal loss
- Microscopic: plaques and tangles



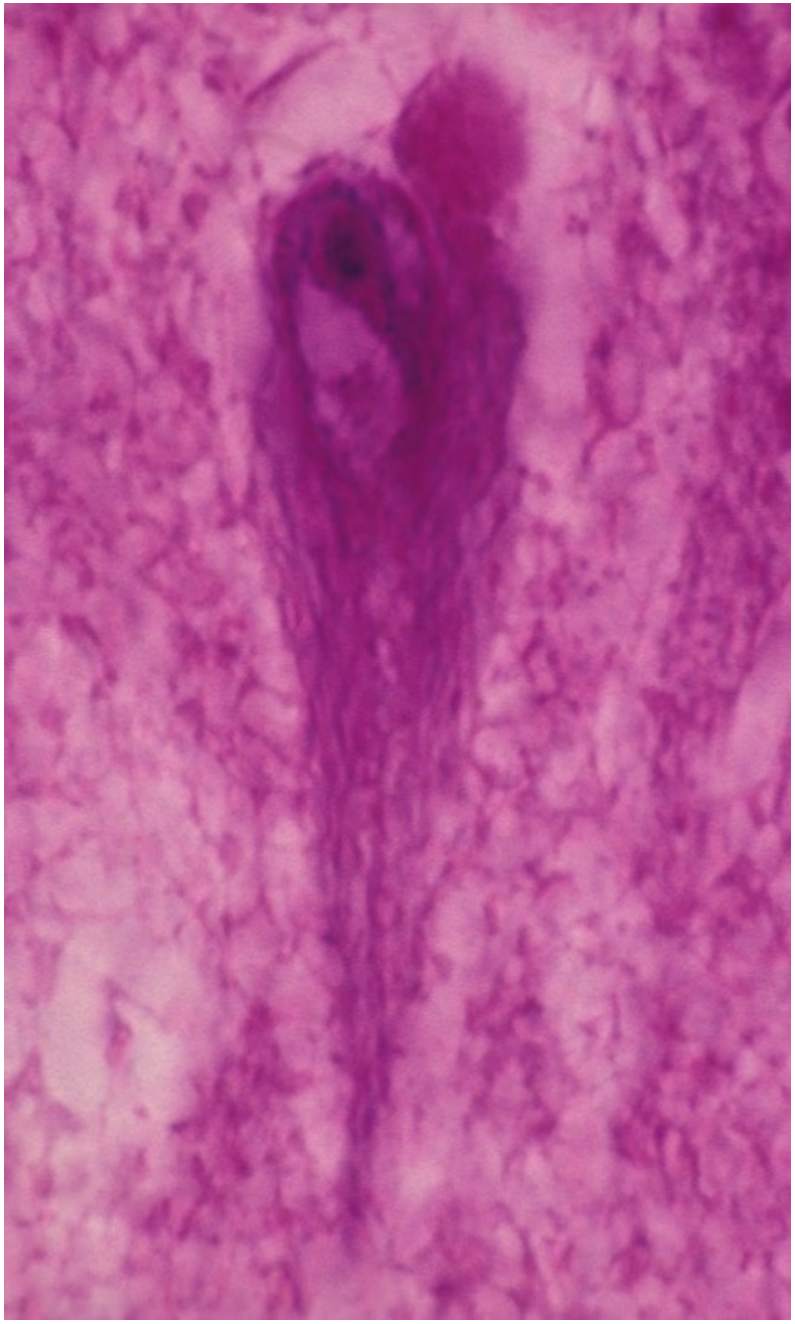
Alzheimer disease: brain atrophy

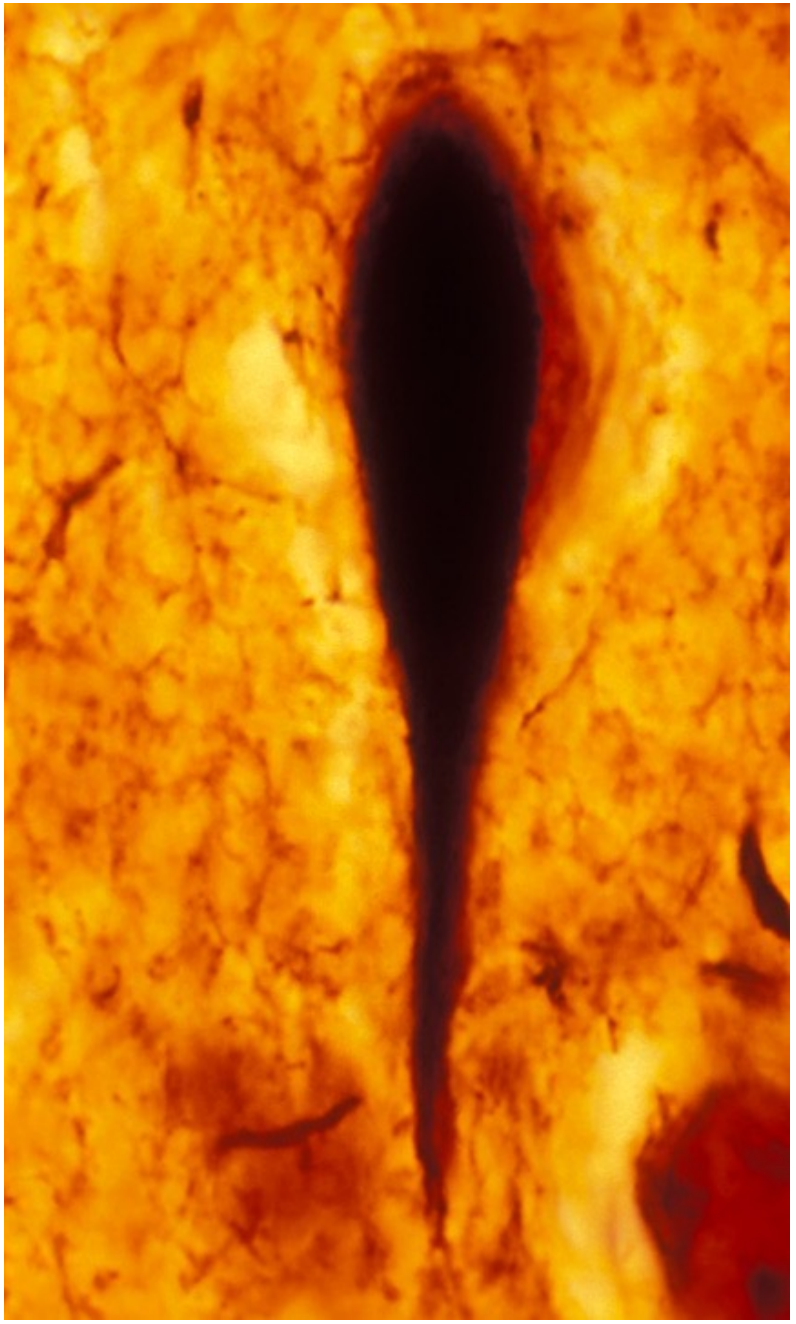


Alzheimer disease: progression



Plaques contain Aβ peptides (fragments of amyloid)

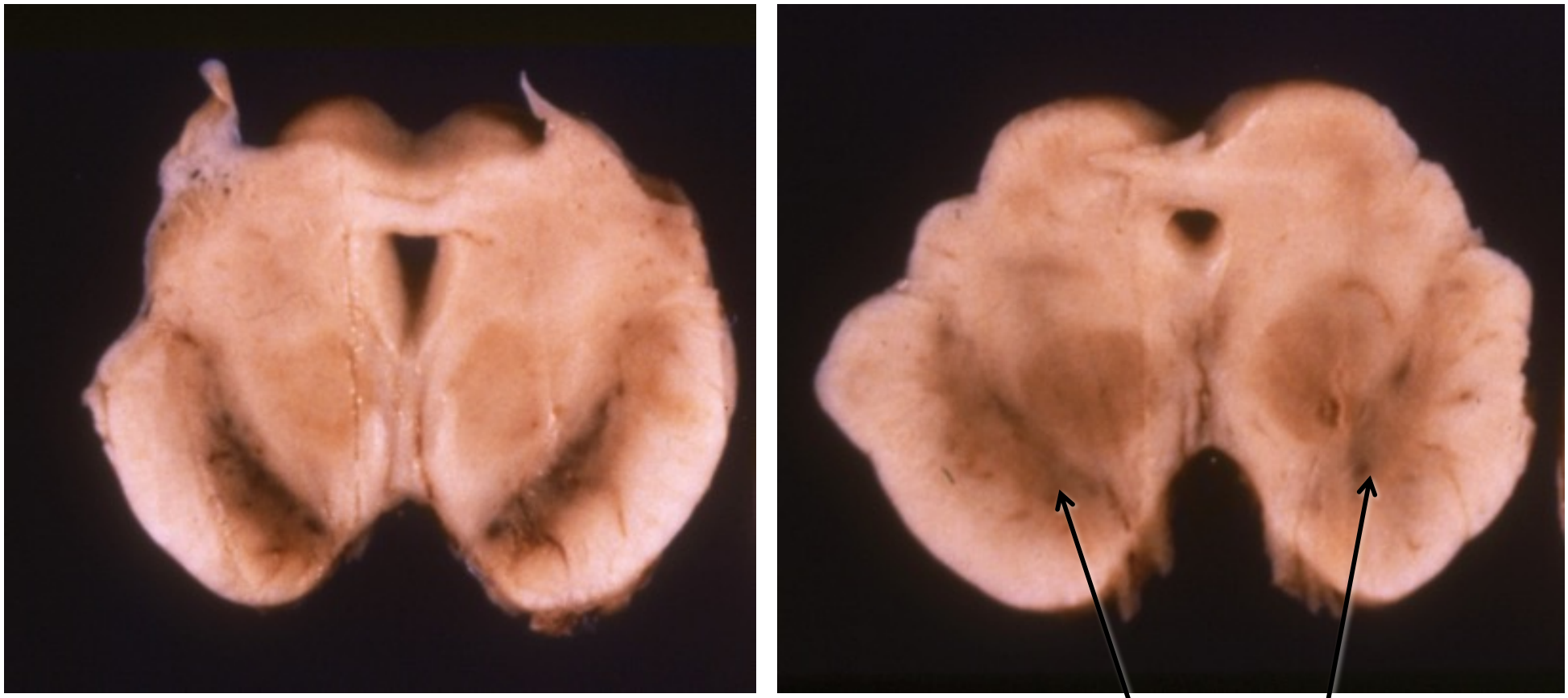




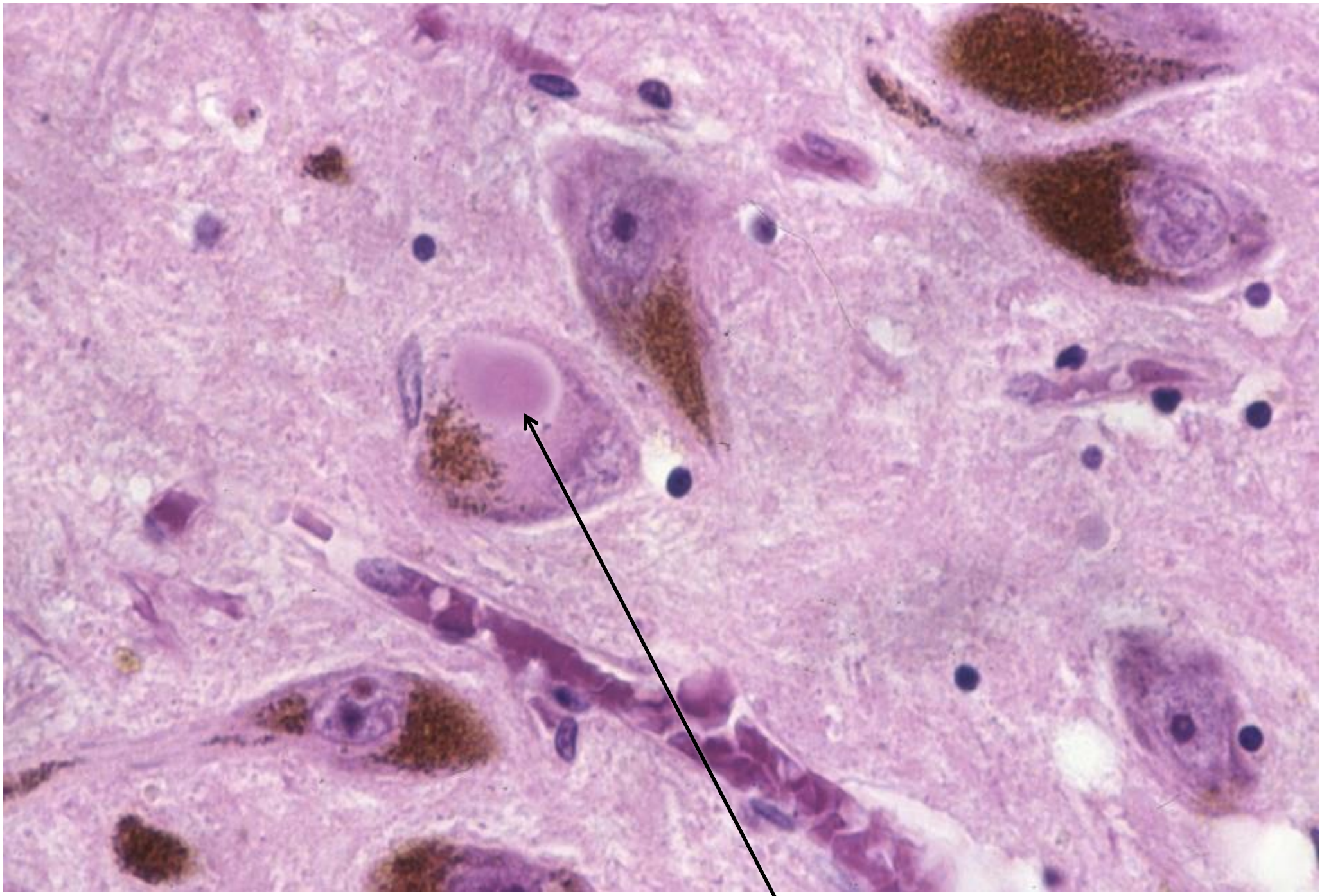
Tangles contain tau protein

Parkinson Disease

- Degeneration of pigmented neurons in the substantia nigra
- Symptoms
  - Early on: tremor, rigidity, slow movement
  - Later: cognitive problems, dementia
- Gross: atrophy of substantia nigra
- Microscopic: Lewy bodies (inclusions in neurons)



Parkinson disease (R) : atrophy of substantia nigra



Parkinson disease: Lewy body