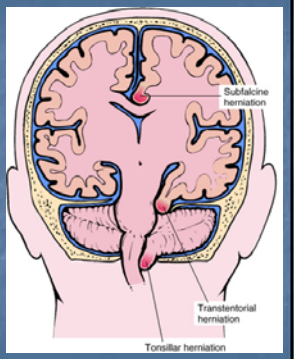
Diseases of the Nervous System

- Central nervous system
  - Brain is a prisoner
  - Basic cellular elements
    - Neurons, location means everything
    - Neuronal reaction to injury, very limited
      - Axonal growth
      - No regeneration of lost cells
      - Accumulation of junk within the cells can be harmful.
    - Glial component, supportive
      - Microglia, the police force of the CNS
      - Astrocytes, structural like fibroblasts elsewhere
        - Gemistocytes are reactive astrocytes
      - Oligodendrocytes, make myelin (the insulation)
    - Meninges

Cerebral Edema

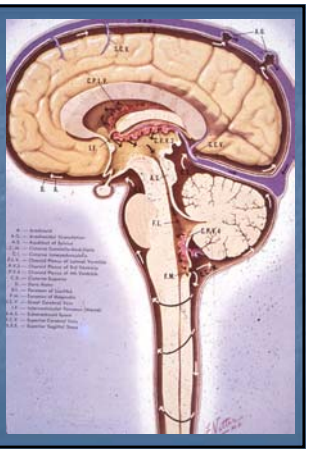
- Injury to brain
  - Tumor
  - Rubor……
- Swelling can't go anywhere
- Compression of vital structures
- Herniation
  - Sublax
  - Transtentorial
  - Cerebellar tonsils



Brainstem Hemorrhages

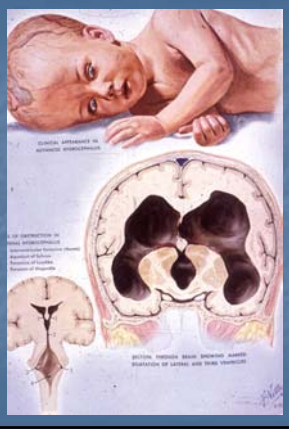
CSF Flow

- Made in the ventricles
- Flows down aqueduct
- Into 4th ventricle
- Out into the subarachnoid space
- Up to the arachnoid granulations
- Back into the blood
- Obstructions in movement will lead to hydrocehpalus



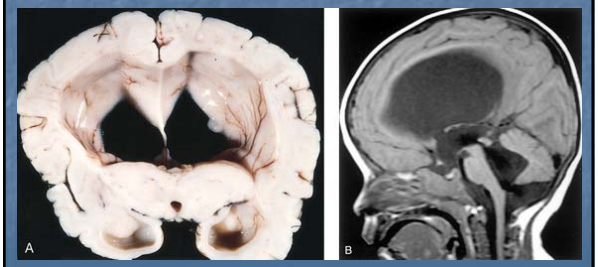
Hydrocephalus

- Obstruction to flow of CSF
- Over production of CSF
- Inability of arachnoid granulations to restore water of CSF back into circulation



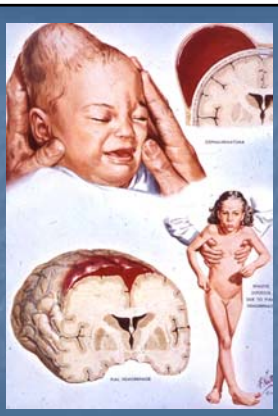
Hydrocephalus

- Noncommunicating: Can't get out of ventricles
- Communicating: CSF can't get to arachnoid granulations



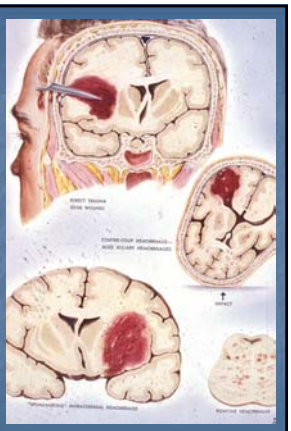
Trauma

- Birth trauma
- Hemorrhage
- Permanent loss

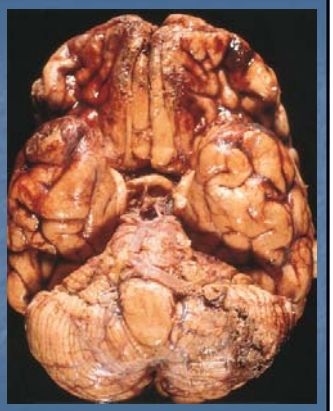


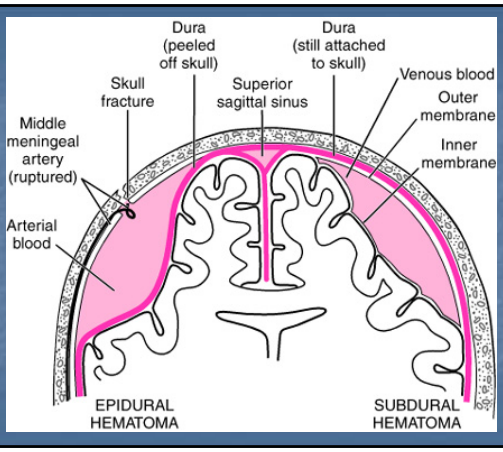
Trauma

- Closed head
  - Coup
  - Contra-coup
- Penetrating
- Hemorrhage
- Contusion
- Laceration



Contusions



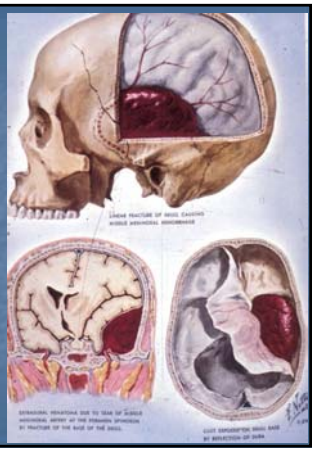


Subdural Hemorrhage

- Rotational injury tears little veins
- Slow venous bleeding

Epidural Hemorrhage

- Trauma with skull fx
- Middle meningeal a.
- Hemorrhage compresses brain



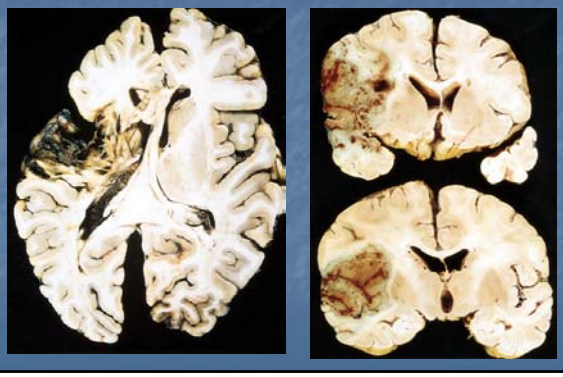
Subarachnoid Hemorrhage

- Not as commonly due to trauma, but maybe.
- Arterial bleeding
- Typically from Circle of Willis
- Blood in subarachnoid space

Vascular Disease

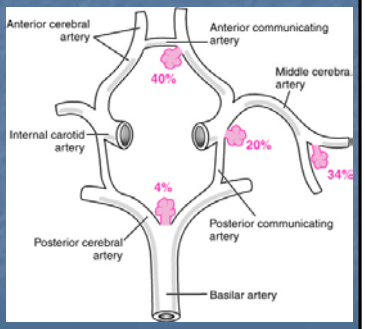
- Hypoxic
  - TIA
  - Stroke
    - Infarction
- Hemorrhagic
  - Vascular blowout
  - Trauma

Ischemic Infarcts

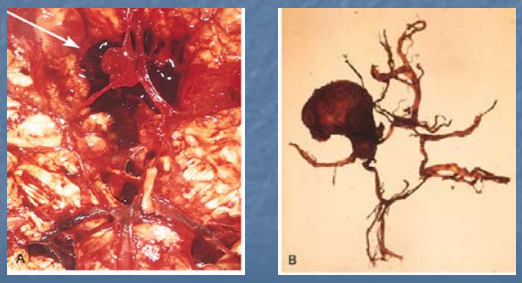


Hypertensive Hemorrhages

- Berry aneurysm
  - Subarachnoid
- Parenchymal



Berry Aneurysm



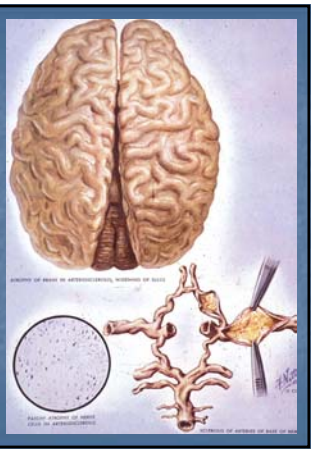
Subarachnoid Hemorrhage

Lacunar Infarcts

- Hypertensive vascular disease
- 'Watershed' infarcts

Chronic Ischemia

- Chronic vascular insufficiency
- Atherosclerosis
- Marked cerebral atrophy

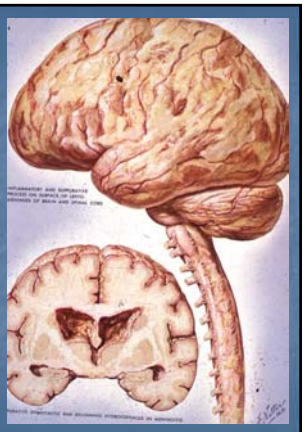


Infections

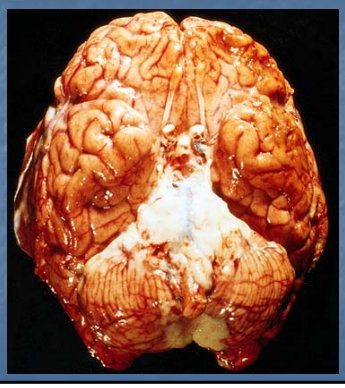
- Brain proper
- Minenges
- Bug
  - Bacteria
  - Virus
  - Spirochtes
  - Parasites
  - Prions

Bacterial Meningitis

- Exudate over cerebral hemispheres
- Bacteria grow in CSF
- CSF
  - Cell count
  - Glucose
  - Protein
- Age of patient
- Complications
  - Scarring
  - Epilepsy
  - Abscess

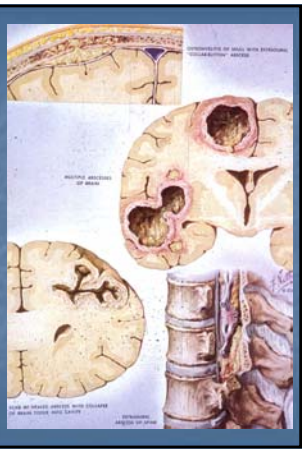


Bacterial Meningitis



Cerebral Abscess

- Septic endocarditis
- Blood borne pathogens
- Must surgically drain

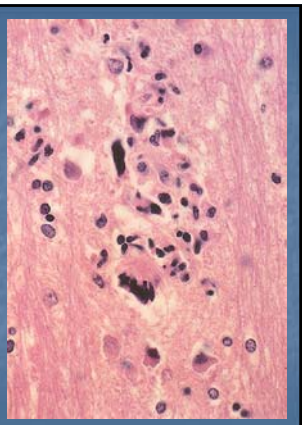


Viral Encephalitis

- Infection of brain substance
- Herpes ->
- Absent temporal lobes
- Sporadic
- Immunsuppressed
- HIV

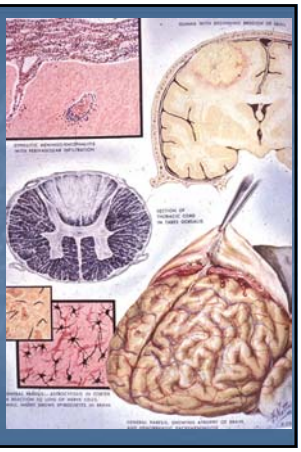
HIV Encephalopathy

- Meningitis
- Neuronal
- Both cognitive motor
- Diffuse cortical atrophy
- Microglia at site of dead neurons
- GP120 protein is directly toxic



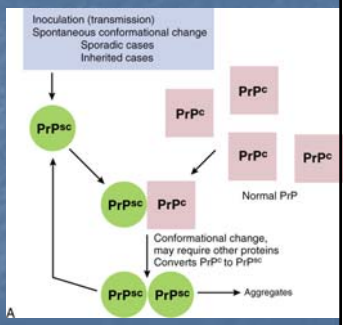
Tertiary Syphilis

- Years after initial infection
- Obliterative end arteritis
- Meningitis
- Brain proper
- Tabes dorsalis

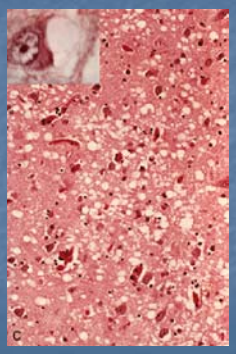


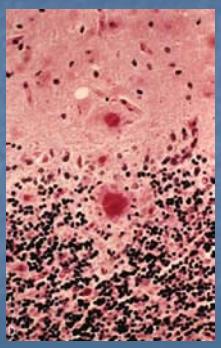
Prion Disease

- No nucleic acid
- Sporadic or genetic
- Accumulation of abnormally folded protein
- Variety of conformations of the diseased protein
- Spongioform encephalopathy
- Kuru



Prion Disease



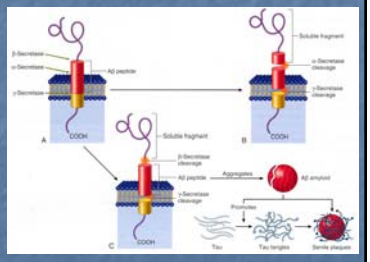


Degenerative Diseases

- Not just aging changes
- Neuronal Death
- Gray matter
  - White matter changes are secondary
- Selective or generalized loss
- Atrophy (local or global)
- Histological features
  - Neurofibrillary tangles
  - Intracellular or intranuclear inclusions

Alzheimer's Disease

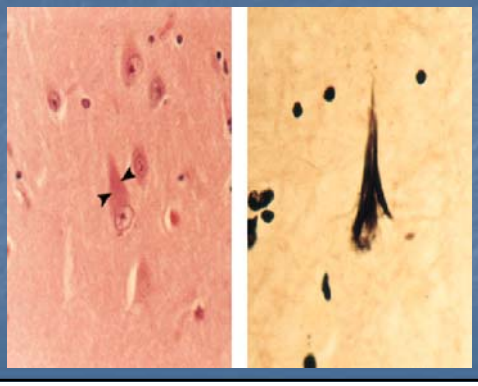
- True dementia
- Marked atrophy
- Protein alterations
  - Tau protein
  - Amyloid related protein
  - Senile plaques
  - Amyloid angiopathy



Alzheimer's Disease

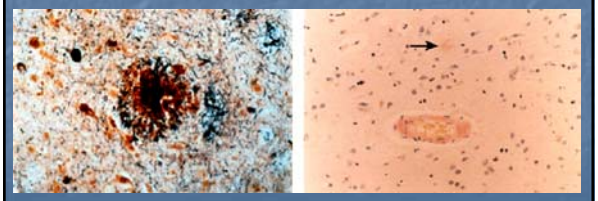
- Progressive loss
  - Memory
  - Cognitive
- 5-15 years
- Eventually loss of language
- Higher functions
- Parkinson's in a few
- Pneumonia is often cause of death

Alzheimer's Disease



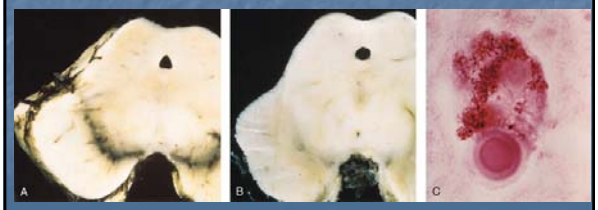
Alzheimer's Disease

- Senile plaques
- Vascular amyloid changes



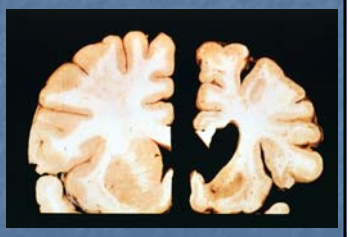
Parkinson's Disease

- Parkinsonism, collection of symptoms
  - Rigidity, stooped posture, gait disturbances, pill rolling, face
  - Drug induced
- Parkinson's Disease



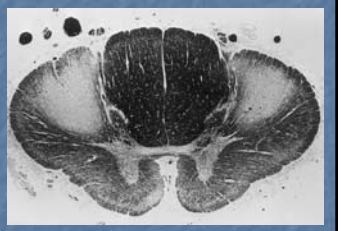
Huntignton Disease

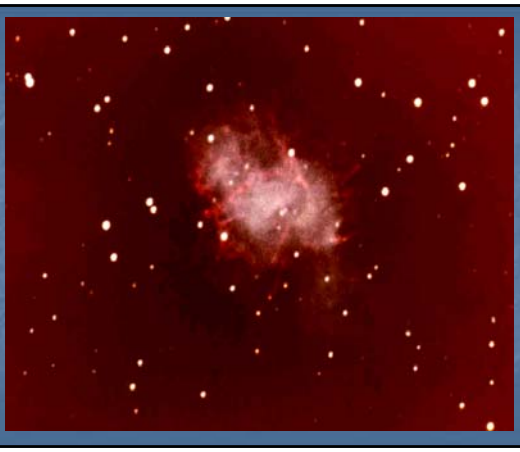
- Hereditary
- Progressive
- Extrapyramidal motor
- Choreaform movements
- Huntington gene
  - Trinucleotide repeats
  - CAG
  - Normal 6-34 copies
  - HD has 50-70 repeats
- Caudate nucleus atrophy
- Suicide and infections



Amyotrophic Lateral Sclerosis (ALS)

- Sporadic loss of motor neurons
- Spinal
- Bulbar
- Poor swallowing
- Pneumonia





Demyelinating Disorders

- White matter
- Disease of oligodendrocytes
- Autoimmune most times

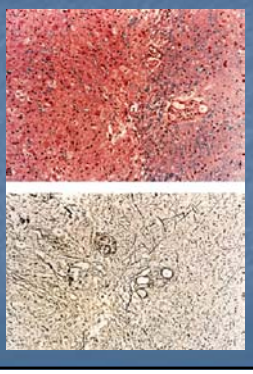
Multiple Sclerosis

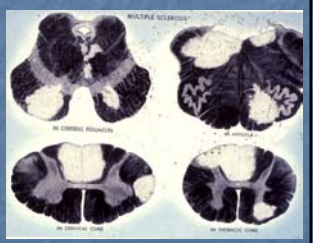
- Lesions dispersed in space and time
- Come and goes
- Symptoms
  - Optic nerve
  - Urination
  - Heat makes worse
  - Weakness
- Degeneration of white matter
- Plaques

Multiple Sclerosis

- Areas of demylinization
  - Plaques
- Active repair
- Quiescent

Multiple Sclerosis





Toxic and Vitamin Deficiencies

Thiamine Deficiency

- Beriberi
- Alcohol abuse
- Abrupt psychotic changes
- Wernicke's encephalopathy
  - Hemorrhages in mamillary bodies
  - Confusion
  - Paralysis of extraoccular muscles
  - Ataxia
- Korsakoff's
  - Inabilbity to form new memories
  - Confabulation

B12 Deficiency

- Inability to maintain myelin
- Posterior column degeneration

Ethanol

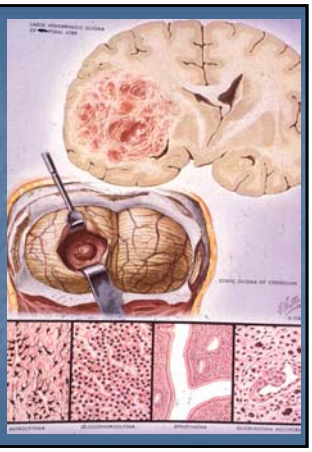
- Acutely, neural depressant
  - Inhibitions go first
  - Loss of depth perception
- Chronic
  - Degeneration of granular cell layer of cerebellum
  - Loss of Purkinje cells
  - Bergman's gliosis
- Fetal alcohol syndrom
  - Microcephaly
  - Growth retardation
  - Facial abnormalities
  - Mental retardation
    - Abnormal migration of neurons during development

CNS Tumors

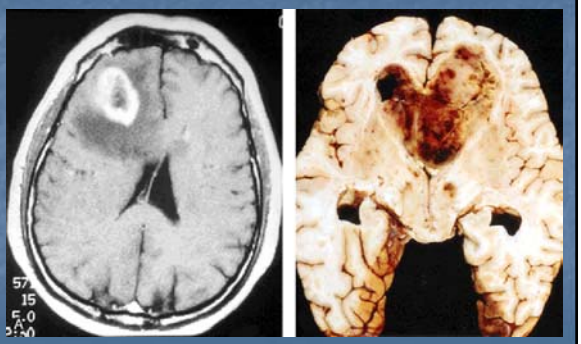
- Primary vs. metastatic
- Benign vs. malignant
- Focal vs. diffuse
- Above or below tentorum
- Not too common in adults
- About 20% of childhood malignancies
- Location is critical
- Cell type
  - None are of neuronal origin
  - Astocytoma, most
  - Oligodendrocytoma
  - Microgliomatosis
  - Ependymoma

Astrocytoma

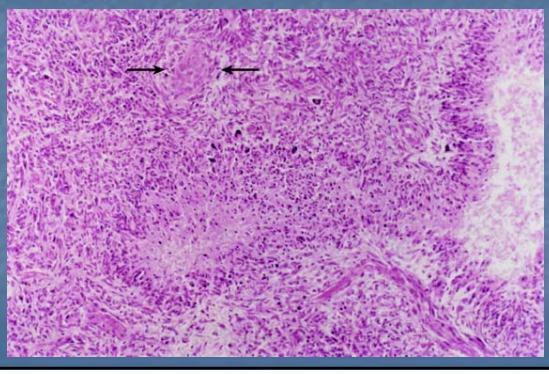
- Astrocytic origin
  - Above tentorum most times in adults
- Multiple grades
- Compresses surrounding tissue
- Hemorrhage and necrosis
- With higher grade malignant tumors,
  - Look for vascular growth



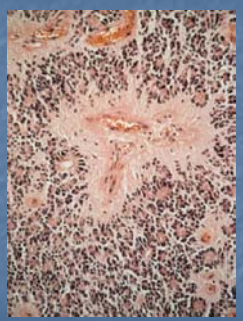
Astrocytoma



Astrocytoma



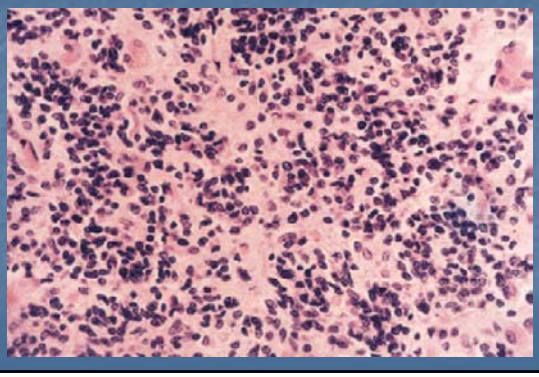
Ependymoma



Meduloblastoma

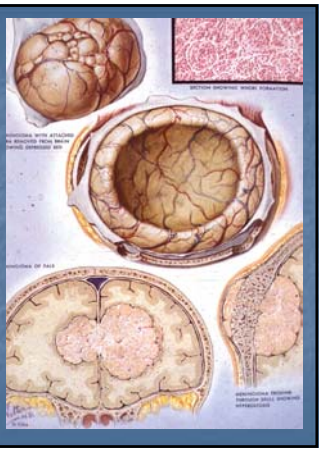
- Children
- Midline cerebellum
- Subarachnoid spread

Meduloblastoma



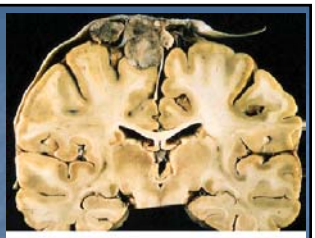
Meningioma

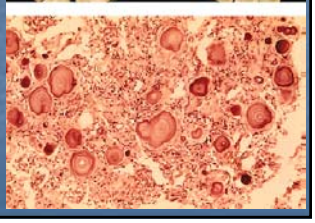
- Arise from meninges
- Benign in a biological sense
- Consider where it is
- Fibroblast looking
- Cells in whirls and clusters
- Psammoma bodies



Meningioma

- Psammoma bodies
  - Little calcifications
  - Microscopic
  - Within the tumor
  - Can spot on X-ray
  - Concentric layers ->





Peripheral Nerves

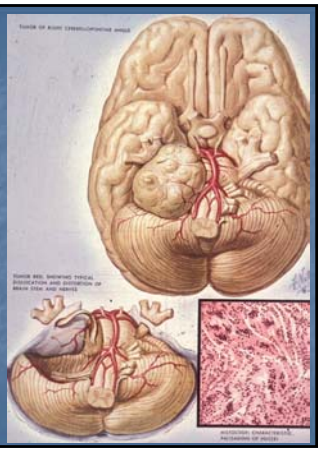
- Axon vs. Schwann cells
  - Motor
  - Sensory
- Inflammatory, autoimmune
- Toxic
- Trauma
- Vascular, especially diabetes
- Tumors

Guillian-Barré Syndrome

- Autoimmune?
- Follows
  - Infection
    - viral
    - Mycoplasma
  - Allergic reaction
- Demylinization
- Ascending paralysis
- Phrenic nerve involvement is life threatening

Peripheral Nerve Tumors

- Actually nerve sheath tumors
  - Schwann cells
- Cranial nerves too
  - V & VIII



Neurofibromatosis

- Two types
- No capsule
- Type 1
  - Genetic
  - All over the body
  - Glioma of optic n. (rare)
  - Meningioma
  - Café-au-lait spots
  - Pigmented nodules of iris

Neurofibromatosis