Neurological Disorders

Tumors
- Growth of non-functional cells
  - **Benign** - Cells grow within their own membrane. Clear boundaries, can usually be removed surgically.
  - **Malignant** - No 'border' between cell and tissue. Infiltrating tumor, cancerous.
  - **Metastatic Tumors** - Cells coming from malignant tumors in other organs (e.g. lungs) that reach the brain and develop.
- Damage is caused by compression or infiltration
- Because neurons cannot divide they are not responsible for tumors.
- **Gliomas** - From glial cells. Malignant. Can be removed surgically and with radiation.
- **Meningioma** - From dura mater. Benign
  - Malignant and Benign → Compression
  - Malignant → Take-up space, use-up oxygen/glucose, destroy cells.

Seizure Disorders
- Uncontrollable spread of neural activity (excitatory), sometimes leading to convulsion.
- Partial seizures vs Generalized seizures
  - Partial Seizures - Focal and remain local
    - Partial seizures can be simple (no loss of consciousness) or complex.
  - **Grand Mal** - Generalized seizure with convulsions.
    - Aura (few secs) → Tonic Phase → Clonic Phase → Sleep (mins/hours)
      - Tonic Phase (15 secs) - Rigidity, loss of consciousness
      - Clonic Phase (30 secs) - Convulsion (fast → slow), stop breathing, increase in inhibition
  - **Petit Mal** - Absence seizures (generalized and complex). Stop of activity for a few seconds followed by unconsciousness.

Epilepsy - Repeated seizures
- Primary damage in the temporal lobe, specifically in the hippocampus and amygdala.
- **Status Epilepticus** - Repeated complex seizures without regaining consciousness.
- Neural Substrate - Hippocampus, among others.
- **Excitotoxicity** - Neuron death because of too much excitation through NMDA channels.
- Treatments:
  - **Anticonvulsants** - Benzodiazepines/Barbiturates
  - Surgery
  - Vagus nerve stimulation - Partial seizures

Cerebrovascular Accidents
Stroke
- 1/2 million strokes per year
- Age related
• **Hemorrhagic Stroke** - Bleeding in the brain

• **Obstructive Stroke** - Blood clot $\rightarrow$ Ischemia (loss of blood flow)
  
  Hypoxia $\rightarrow$ Shortage of oxygen (prevented with aspirin)
  
  o Two types of Obstructive Strokes:
    
    • **Thrombus and Embolus** $\rightarrow$ Loss of oxygen and glucose, osmolarity variations, bacterial infections
      
      ▪ Embolus breaks off of thrombus, occludes smaller artery

• Stroke produces permanent brain damage. Can be prevented:
  
  o Medications to reduce blood pressure
  o Brain surgery on vasculature
  o Antibiotics to prevent embolus and bacterial infections
  o Anticoagulant to prevent blood clot up to 9 hours after stroke

• **Causes of Strokes**
  
  o **Plaques** - Atherosclerosis: Build-up of material (cholesterol or calcium deposits) on walls of blood vessels
    
    ▪ Detected by Angiography - X-Ray of blood circulation
  
    ▪ Treated by surgery:
      
      • Plaque removal
      • Stent

• **Rehabilitation after Stroke**
  
  o Therapies depend on type of brain damage (speech, motor impairments, etc.)
  o Case of limb movement impairment:
    
    • **Constraint-Induced Therapy** - Inducing brain plasticity by artificially 'amputating'/restricting movement in good limb
    
    • **Brain-Machine Interface** - Linking neural activity to an external device.
      
      ▪ Perception - Artificial eye
      ▪ Motor - Artificial hand/arm

**Developmental Disorders**

• Generally induced by viruses or drugs

• Result in non-viability or retardation

• **Fetal Alcohol Syndrome** - Affects axonal growth and synaptic plasticity (e.g. LTP/LTD).
  
  Low doses of alcohol during pregnancy are sufficient.