PSY 302: Neurological Disorders

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 radiations (in brain)
- Meningiomas (from dura mater): benign
- Malignant, benign – compression (growth)
- Malignant – take up space, use-up oxygen/glucose, destroy cells

Neurological Disorders
- **Seizure disorders**
  - Uncontrollable spread of neural activity (excitatory), sometimes leading to convulsions. Recurring seizures = epilepsy
  - Partial (focal + remain local) seizures vs Generalized seizures
  - Partial seizures can be simple (no loss of consciousness) or complex
  - Main seizure types:
    - **Grand Mal**: generalized seizure with convulsions
      - Aura (~ secs) – Tonic Phase (rigidity, loss of consciousness, ~15 sec) – Clonic Phase (convulsions, fast – slow, stop breathing, increase in inhibition, ~30 sec) – Sleep/Coma (mins/hours)
    - **Petit Mal**: absence seizures (generalized, complex). Stop of activity (~secs), unconscious (more common in children, usually grow out of it)
  - Epilepsy = repeated seizures
  - Primary damage in the temporal lobes (hippocampus, amygdala)
  - Status epilepticus = repeated complex seizures without regaining consciousness
  - Neural substrate:
    - Hippocampus (one of most interconnected areas in brain, dense), among others.
    - Excitotoxicity: neuron death because of too much excitation through NMDA channels
  - Treatments:
    - Anticonvulsants (Benzodiazepines, Barbiturates).
- Surgery (side effects: remember HM)
- Vagus nerve stimulation (partial seizures)

**Disorders: Cerebrovascular Accidents**
- **Stroke**
  - ½ million strokes per year. Age related
  - Hemorrhagic: bleeding in the brain
  - Obstructive: blood clot – Ischemia (i.e., loss of blood flow). Hypoxia – shortage of oxygen. Prevented with aspirin
    - Thrombus (grows on wall of blood vessels and eventually blocks flow of blood) and embolus (risk of bacterial infection; blood clot does not grow on wall, it travels and hits blood vessel too small to go through and plugs it) – loss of oxygen and glucose, osmolarity variations, bacterial infections
  - Strokes produce permanent brain damage
  - Can be prevented:
    - Medications to reduce blood pressure
    - Brain surgery (on vasculature)
    - Antibiotics (embolus and bacterial infection)
    - Anticoagulant (prevent blood clot up to 9 hours after stroke. E.g., DSPA)
- Causes of stroke:
  - Plaques – Atherosclerosis: buildup of material (cholesterol, calcium deposits) on walls of blood vessels
  - Detected by angiography (i.e., X-ray of blood circulation)
  - Treated by surgery:
    - Plaque removal (‘cleaning’ of blood vessels – Stent)
- Rehabilitation after stroke:
  - Therapies depend on the type of brain damage (speech, motor impairments . . .)
  - Case of limb movement impairment.
    - Constraint-Induced Therapy: inducing brain plasticity by artificially ‘amputating’/restricting movement in good limb, and forcing the use of the impaired limb
  - Brain-Machine Interface: linking neural activity to an external artificial 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.

- **Inherited Metabolic Disorders:** deficiency in the production of an enzyme. Genetic bases:
  - PKU (Phenylketonuria): deficit in phenylalanine – tyrosine conversion.
    - Lack of myelination
    - Mental retardation if untreated
    - Detectable at birth. Preventable by appropriate diet (low protein diet)
  - Lack of vitamin B6: damage to thalamus and cerebellum
  - Lack of (milk) glucose metabolism (Galactosemia): damage to cerebellum and cortex
  - Tay-Sachs Disease: inability to breakdown cellular waste products. Accumulation of waste, brain swelling, death. European Jewish population. There is a retinal diagnosis.

- **Down Syndrome:** Congenital (‘born with’)
  - 1/700 children > 350,000 people in the US
  - Extra chromosome 21 in mother’s ovum. Over-expression of genes. Can be detected before birth
  - 10% less brain. Less neurons in frontal lobe and Superior Temporal Gyrus (Wernicke’s area)
  - Mild to severe mental retardation. Can learn to have almost normal lives. No cure
  - Research: focused on avoiding associated diseases (heart condition, epilepsy, hearing/vision deficits . . .). study gene over-expression pattern