Neurological Disorders
“When things go wrong”

DISORDERS -figure 14.1-
● Tumors
  o Growth of non-functional cells
  o **Benign**: Cells grow within their own membrane. It has clear boundaries, can usually be removed surgically.
  o **Malignant**: No “border” between cell and tissue. Infiltrating tumor, cancerous.
  o **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**

**Meningioma**: Benign brain tumor composed of cells that constitute the meninges

TUMORS -14.2-14.3-
● Because neurons cannot divide, they are **not** responsible for tumors.
● **Gliomas** (from glial cells): malignant. Can be removed surgically and with radiations
● **Meningiomas** (from dura mater): benign
● Malignant & benign → Compression
● Malignant → Take-up space, use-up oxygen/glucose, destroy cells
● Note: do not bother with table 14.1

NEUROLOGICAL DISORDERS -14.4-
● Seizure disorders
  o Uncontrollable spread of neural activity (excitatory), sometimes leading to convulsion. Recurring seizures = epilepsy
  o **Partial** (focal + remain local) seizures vs. **Generalized** seizures
  o Partial seizures can be simple (no loss of consciousness) or **complex**

SEIZURES
● **Grand Mal**: generalized seizure with convulsions.

[Aura (secs) → Tonic Phase (15 secs) → Clonic Phase (30 secs) → Sleep (mins/hrs)]
  o Tonic Phase: rigidity, loss of consciousness
  o Clonic Phase: Convulsion (fast → slow), stop breathing, increase in inhibition
- Epilipsy = repeated seizures
- Primary damage in the temporal lobes (hippocampus, amygdala)
- Status epilepticus = repeated complex seizures without regaining consciousness
- Temporal lobe: Hippocampus + Amygdala + ...
- Neural substrate: Hippocampus, among others
- Excitotoxicity: neuron death because of too much excitation through NMDA channels
- Treatments:
  - Anticonvulsants (Benzodiazepines, Barbituates).
  - Surgery (side effects: remember HM?)
  - Vagus nerve stimulation (partial seizures)

**DISORDERS: CEREBROVASCULAR ACCIDENTS**

- Stroke
  - ½ millions strokes per year – age related
  - Hemorrhagic: Bleeding in the brain
  - Obstructive: Blood clot → Ischemia (loss of blood flow).
    - Hypoxia → shortage of oxygen. Prevented with aspirin
    - Thrombus and embolus → Loss of oxygen and glucose, osmolarity variation, bacterial infections

**STROKE -14.5-14.6-**

- Thrombus and Embolus

- Intracerebral Hemorrhage
- Stroke produces 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
CAUSES OF STROKE -14.8-

- Plaques – Atherosclerosis: build up of material (cholesterol, calcium deposits) on walls of blood vessels.
- Detected by angiography (X ray of blood circulation)
- Treated by surgery:
  - Plaque removal (“cleaning” of blood vessel)
  - Stent – treatment of obstructive stroke

How a stent works →

STROKE

- Rehabilitation after stroke
  - Therapies depend on the type of brain damage (speech, motor impairments, etc.)
  - 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 artificial device.
    - Perception: artificial eye
    - Motor: artificial hand/arm

DEVELOPMENT DISORDERS -14.10-

- 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