READING
Reading can be achieved in two ways: Whole-word and Phonetic

Surface Dyslexia: results from a damage to the ‘whole-word’ reading branch, people with this disorder can only read words letter by letter. Deficit in whole word recognition, typically it is result of damage to the left lateral temporal lobe.

Phonological Dyslexia: People with this disorder cannot read words that they do not know because they cannot read letter by letter (phonetically). Deficit in reading unfamiliar words or non-words. Typically results from damage to the left frontal lobe.

Neural Substrate of Reading
- Two pathways starting from the sight of the word
  - Ventral pathway
    - Fusiform cortex (visual word from area) → whole-word reading
  - Dorsal pathway
    - Parietal cortex → Broca’s area → phonological reading

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. Because there is no border, it is more difficult to remove.
  - Metastatic tumors: cells coming from malignant tumors in other organs (e.g. lungs) that reach the brain and develop.
- Damage to the brain from tumors is caused by compression (the tumor grows and puts pressure on the brain) or infiltration (some of the tumor cells just grow into the brain and take up/use nutrients that the brain uses. Take-up space, use up O2/glucose, destroy cells.
- Cause?
  - because neurons cannot divide they are not responsible for tumors.
  - Gliomas (from glial cells): malignant, these can be removed surgically and with radiation
  - Meningiomas (from dura mater): benign.
Seizure Disorders
- Uncontrollable spread of neural activity (excitatory), sometimes leading to convulsion. Recurring seizures = epilepsy.
  - Partial (focal + remain local) seizures
    - Can be simple (no loss of consciousness) or complex
  - Generalized seizures
    - Typically involves the entire brain
- Grand Mal: generalized seizure with convulsions:
  Aura (seconds) → Tonic Phase 15 Seconds (rigidity, loss of consciousness) → Clonic Phase 30 Seconds (convulsion (fast-slow) stop breathing, increase in inhibition) → Sleep
- Petit Mal (Absence Seizures) generalized, complex. Stop in activity (seconds) → unconsciousness. Very short, very sudden, loss of consciousness but can still stay standing.
- Epilepsy: repeated seizures
  - Primary damage in the temporal lobes (hippocampus, amygdala)
    - A lot of these temporal lobe seizures are accompanied by extreme religious experiences/feelings
  - 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, Barbituates)
  - Surgery (side effects)
  - Vagus nerve stimulation (for partial seizures)

Cerebrovascular Accidents
Stroke
- Hemorrhagic: bleeding in the brain
- Obstructive: blood clot → ischemia → hypoxia → shortage of oxygen
  - Can be prevented with aspirin
  - Thrombus & embolus → loss of oxygen/glucose, osmolarity variations, bacterial infections
Thrombus occurs when there is a block in an artery that prevents blood flow
Embolus occurs when a piece of tumor flows into the blood stream down into the capillaries and plugs them. Much harder to treat.
- Stokes 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)
    - Most powerful one is called DSPA (found in the saliva of vampire bats)
Causes
- Plaques: atherosclerosis: build-up of material (cholesterol, calcium deposits) on the walls of the blood vessels
  - Detected by angiography (X-ray of blood circulation)
  - Treated by surgery: plaque removal (cleaning of blood vessel) or a Stent (piece of mesh that you place where the vessel is occluded and it opens the walls of the vessel allowing blood flow to return to normal.

Rehab 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

Developmental Disorders
- Generally induced by viruses or drugs
- Result in non-viability or retardation

Fetal Alcohol Syndrome: affects axonal growth and synaptic plasticity (LTP/LTD) low doses of alcohol during pregnancy are sufficient to increase the risk and trigger FAS.

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 product → accumulation of waste, brain swelling, death. Eastern European Jewish population are more likely to develop this disorder. 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...). Determine gene over-expression pattern.