CAUSES OF BRAIN DAMAGE (p.1)

1. Brain Tumors (“neoplasms”)
   60-80% arise from local tissues
   20% meningiomas
   40% astrocytomas
   < 1% of neural origin…why?
   10% arise outside of brain/head tissues
   20-40% metastatic tumors (e.g. lung, breast)
   malignant (infiltrating) vs. benign (encapsulating) tumors
   most malignant tumors are metastatic tumors
   treatments: usually radiation, followed by surgical removal if possible
   rarely use chemotherapy…why?

2. Cerebrovascular Disorders
   most common cause of death/disability (along with MIs) in USA
   intracerebral hemorrhage (a “stroke”)
   aneurysm
   AVM (arteriovenous malformation)
   Secondary to hypertension
   “penumbra”
   treatments: surgical intervention, cool brain, wait until clots off, lower BP
   cerebral Ischemia (lack of blood flow)
   secondary to thrombosis, embolism, or arteriosclerosis
   artiosclerosis vs. atherosclerosis
   TIA (transient ischemic attack)
   Treatments: anticoagulants, cool brain, angiogram (“rotorooter”)
   “glutamate cascade” effects
   when neuron(s) deprived of blood flow/O2 --- neurons become more
   active ---as more Na+ and Ca++ ions enter neuron --- release more
   glutamate --- neurons become even more active --- etc.
   hyperactive neurons eventually die (maybe several days later, after stroke)
   some brain regions more susceptible than others (e.g. hippocampus)
   developing drugs that block the glutamate cascade (NMDA RS blockers)
3. **Open-Head Injuries**
   - e.g. gunshot wound
   - localized effects
   - swelling in the brain (edema), bleeding
   - infection
   - treatments: stop swelling & bleeding, antibiotics, clean area, remove bone fragments, close up wound, skull plate

4. **Closed-Head Injuries**
   - e.g. forceful blow to head, hit head against windshield in moving car
   - more diffuse damage (“coup & contrecoup”)
   - swelling in brain a major problem, no where to go except out back of brain
   - internal hemorrhage (in subdural space, “subdural hematoma”)
   - contusion > concussion
   - multiple concussions --- dementias, increased risk for PD

5. **Infections**
   - usually spread from some other part of body (e.g. lungs) or from insect/animal bite that introduces bacteria/virus to bloodstream
   - bacterial or viral
   - meningitis vs. encephalitis
   - bacterial infections often lead to cerebral abscesses
   - 5-20% are fatal
   - 20% of survivors exhibit noticeable neurological problems
     - e.g. sensory losses, motor paralysis/weaknesses, cognitive/emotional
   - e.g. Syphilis bacteria --- “general paresis”
   - e.g. viruses: Rabies, Polio, Herpes, Mumps, Measles
   - “Bovine Spongiform Encephalitis” (BSE)(virus or prion?)
   - “Jacob-Creutzfeld Virus”
BRAIN DAMAGE (p.3)

6. **Neurotoxins**
   - e.g. heavy metal poisoning (lead, mercury)
   - ethyl alcohol (ethanol) --- FAS, alcohol-related brain damage (thiamine)
   - e.g. cleaning solvents
   - e.g. organic pesticides

7. **Genetic Factors (Neurodegenerative disorders)**
   - Down’s syndrome
   - PKU (phenylkeytoneuria)
   - Huntington’s chorea
   - Tay-Sach’s Disorder
   - Alzheimer’s Disease
   - Parkinson’s Disorder
   - Idiopathic Cerebellar Degeneration
   - Etc.

8. **Other Topics Related to Brain Damage**
   - role of a Clinical Neuropsychologist (vs. a Neurologist vs. a Neurosurgeon)
   - **Recovery** from brain damage
     - Regrowth of surviving neurons
       - Aided by Schwann cells; impeded by oligodendroglia
       - Implanting cadaver Schwann cell tubes, inhibiting oligodendroglia
     - Reorganization of existing neurons (incl. collateral axonal sprouting)
     - Blocking apoptosis, blocking glutamate cascade
     - Neurotransplantation of fetal tissue (xenotransplants, autologous transp.)
     - Neuromotor rehabilitation training
       - *Do soon* after injury, “force” *S* to use impaired body parts
8. **Other Topics** (cont.)

**Modifying factors:** Age at injury
- Handedness
- Years of education/intelligence ("cognitive reserve")
- Health-related issues
- Sudden vs. gradual injuries (e.g. gun shot vs. slow growing benign tumor)
- Quality/quantity of health care
- Social support network