CMPE 80A: Universal Access: Disability, Technology, and Society

Brain, memory and cognition

The Brain
- Neural/cerebral Cortex
  - Folded surface increases surface area
  - Elevated ridges (gyri)
  - Shallow depressions (sulci)
  - Deep grooves (fissures)

Brain Protection and Support
- Physical protection:
  - bones of the cranium
  - cranial meninges/membranes
  - cerebrospinal fluid
- Biochemical isolation:
  - blood–brain barrier \(\rightarrow\) Isolates CNS neural tissue from general circulation
- Cranial Meninges - 3 layers:
  - dura mater
  - arachnoid mater
  - pia mater
- Is continuous with spinal meninges

The Brain
- In most people, left brain controls:
  - reading, writing, and math
  - decision-making
  - speech and language
- Right cerebral hemisphere relates to:
  - senses (touch, smell, sight, taste, feel)
  - recognition (faces, voice inflections)
- Prefrontal cortex:
  - integrates sensory info
  - performs abstract intellectual activities (e.g., predicting consequences of actions)

Memory and Cognition
- General intelligence
- Verbal ability
- Reasoning ability
- Ability to see relationships
- Spatial ability
- Numerical ability
- Deductive ability
- Ability to remember
- Perceptual ability

Different types of memory:
- Episodic – things you have done (personal experiences)
- Semantic – facts and concepts
- Prospective – things you intend to do (go shopping, visit friends, make and keep appointments)

Cognitive Disorders
- Four major types listed in the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders)
  1. Delirium
      - Impaired consciousness & cognition for hours or days
      - Appear confused and disoriented
      - Cannot focus
      - Impaired memory and language
      - 10-15% \(\rightarrow\) acute care facilities
      - Quick recovery after treatment
      - Most prevalent in older adults, patients undergoing medical procedures, cancer and AIDS patients
- Associated medical conditions
  - Intoxication by drugs
  - Withdrawal from drugs
  - Infections
  - Brain traumas
Cognitive Disorders

2. Dementia
   - Progressive deterioration of brain functions including memory, language, judgment, attention, and other cognitive domains
   - Incidence is higher among older adults (but can occur at any age)
     - 1% among 65-74 yrs of age
     - 4% among 75-84 yrs of age
     - 10% among 85 yrs and older
     - Women > men (women live longer)
   - Causes: Abuse of drugs, infection, Alzheimer’s, Cerebrovascular events, Parkinson’s, Huntington’s

Cognitive Disorders

2. Dementia of Alzheimer’s type
   - Most common type of dementia
   - Multiple cognitive deficits that develop gradually
   - Inability to incorporate new information
   - Main symptom: Memory loss
   - Forget important events/lose objects
   - Aphasia → Difficulty with language
   - Apraxia → Impaired motor functioning
   - Agnosia → Failure to recognize objects
   - Impaired Executive Functioning → Coordination of behavior to achieve a goal
   - Neurofibrillary tangles → Abnormal bundles of filaments in nerve cells in the brain

Cognitive Disorders

2. Vascular Dementia (Stroke)
   - Progressive brain disorder
   - Blockage or damage to blood vessels
   - Onset is often sudden
   - Variable impairments
   - Motor problems and weakness in limbs
   - Prevalence
     - 1.5% in age 70 to 75
     - 15% in age 80 or older
     - Men > Women → Higher rates of cardiovascular disease
   - Death from infection: pneumonia or weak immune system

Dementia vs. Pseudodementia

Dementia
   - Gradual onset
   - Course is uncertain
   - Positive history for dementia
   - Good cooperation
   - Denies/minimizes impairment
   - Consistent on repeated exams
   - Increased neurological symptoms

Pseudodementia
   - Precise onset
   - Rapid, uneven course
   - Positive history for depression
   - Uncooperative
   - Emphasizes memory loss
   - Variable on repeated exams
   - Increased psychological symptoms

Cognitive Disorders

3. Amnestic disorder
   - Inability to learn new information
   - Inability to recall previously learned information
   - Intact global cognitive functioning
   - Multiple causes
     - Industrial solvent, mercury, lead, insecticides
     - Head trauma
     - Long-term drug use
   - Wernicke-Korsakoff Syndrome
     - Chronic heavy alcohol use
     - Thiamine deficiency → thiamine treatment will prevent further damage but does not restore memory
     - Thalamic damage

Schizophrenia

- DSM subtypes; paranoid, undifferentiated, disorganized, catatonic
- Impaired ability to perceive, understand and interpret the environment.
- Impaired function - social and motivational
- Behavioral syndrome - positive and negative symptoms
- Onset in late teens to early 20s
- Males and females equally affected but females have later onset and better functional outcome
- Genetic: 10% for first degree relative or fraternal twin, 50% for monozygotic twin
- Environmental factors certain but poorly characterized (intrauterine malnutrition, viral illnesses, perinatal insults, drug exposure)
- Early intervention important: medication & psychosocial