

Course Outline

1. Introduction. Alzheimer's Disease
Brain Anatomy. Cerebrospinal fluid.
Hydrocephalus. Development and
maturation. Blood supply. Stroke.

2. Neuron. Cell body, dendrite, axon.
Glia. Myelin. Membrane potential.
Excitation. Action potentials. Carpal
tunnel syndrome. Multiple sclerosis.

3. Synapse. Transmission between
neurons. Excitation and inhibition.
Synaptic integration. Stretch reflexes.
Body sensations. Herpes Zoster.

4. Movement. Muscle activation.
Motor Neuron Disease. Basal ganglia.
Parkinson's Disease. Cerebellum.
Vestibular Sensations. Balance.

5. Perception. Hearing. Localization
of sounds. Hearing impairment. Vision.
Visual fields. Recognizing faces and
objects. Illusions.

6. Consciousness. Sleep, meditation,
coma, epilepsy. Locked-in Syndrome.
Attention. Consciousness. Theory of
mind. Split brain studies – interpreter.

7. Memory and Emotion. Reflexes
and motor skills. Episodic vs semantic
Memory. Amnesia. Types of emotion.
Depression. Anxiety. Addiction.

8. Language and Thought. Language.
Types of aphasia. Frontotemporal
dementia. Executive functions. Brain
networks (attention and default).

Contact Information

Terry Picton

Email:

terry.picton@gmail.com

Webpage:

<http://creatureandcreator.ca/>

http://creatureandcreator.ca/?page_id=1017



The Anatomy Lesson of Doctor Deijman

Rembrandt van Rijn, 1656

Session 1. Introduction to the Human Brain

- (i) Looking at the brain from the outside: major parts of the central nervous system; skull; four views of the brain (dorsal, lateral, medial, ventral).
- (ii) Cerebrospinal fluid; production and absorption; meningitis; hydrocephalus; basal ganglia; hippocampus and limbic system.
- (iii) Examining the brain with Magnetic Resonance Imaging (MRI); coronal sections; brain movie – front to back.
- (iv) Brainstem pathways and cranial nerves.
- (v) Development and maturation of the brain; prenatal changes; changes from childhood to old age.
- (vi) Blood supply to the brain; strokes (cerebrovascular accidents); transient ischemic attacks.

Session 2. Neurons: Structure and Function

- (i) Neuron doctrine; basic structure of the neuron: dendrites, cell body, axon; axonal transport and its disruption in Alzheimer's disease and formation of neurofibrillary tangles
- (ii) Glial cells support neurons; insulation of axons with a myelin sheath, formed by oligodendrocytes in the brain and Schwann cells in the peripheral nerves
- (iii) Membrane potential; separation of ions across membrane by sodium pump; excitation of voltage dependent channels and generation of "action potential"
- (iv) Myelin, nodes of Ranvier and "saltatory" conduction; demyelinating diseases such as Multiple Sclerosis; how symptoms change over time
- (v) Measurement of nerve conduction velocity; carpal tunnel syndrome

Session 3. Synapses and Neural Networks

- (i) Structure of synapse; synaptic vesicles containing neurotransmitter; postsynaptic membrane containing receptors activated by the neurotransmitter
- (ii) Release of neurotransmitter; excitatory and inhibitory post-synaptic potentials; integration of inputs; axon hillock
- (iii) Spinal cord; stretch reflexes as exemplified by knee-jerk; control of posture by adjusting sensitivity of muscle spindle
- (iv) Dorsal and ventral nerve roots; dermatomes; lumbar disc disease and sciatica; shingles; epidural anesthetics
- (v) Skin sensations; dorsal columns for fine touch; lateral spinothalamic tracts for pain and temperature;
- (vi) Cortical organization; sensory homunculus; cortical columns.

Session 4. Human Movement

- (i) Neuromuscular junction; myasthenia gravis; activation of muscle; actin and myosin; sliding filament theory of muscular contraction
- (ii) Cortical control of movement; primary motor cortex; pyramidal tracts; upper and lower motor neurons; signs of motor neuron lesions; Motor Neuron Disease, Amyotrophic Lateral Sclerosis
- (iii) Motor control; basal ganglia; substantia nigra; L-Dopa and Parkinson's Disease; Deep Brain Stimulation
- (iv) Cerebellum; Purkinje and granule cells; climbing and mossy fibers; error correction; event timing; cerebellar ataxia.
- (v) Vestibular system; saccule and utricle; semicircular canals; nystagmus; righting reflexes.

Session 5. Sensation and Perception

- (i) Nature of sound; loudness, pitch and location; measurement of hearing; hearing aids; external, middle and internal ears;.
- (ii) Traveling waves; hair cells; transduction; auditory nerve responses; frequency coding; intensity coding.
- (iii) Localization of sounds; identification of auditory objects; streaming; auditory cortex; perception of speech and music.
- (iv) Light; luminance and color; eye structure; accommodation; retina; rods and cones; ganglion cells; lateral inhibition; color vision – trichromaticity, opponent processes.
- (v) Visual pathways; visual fields; cortical visual neurons; what and where systems; object perception; motion perception; spatial perception.
- (vi) Migraine; agnosia; prosopagnosia; visual illusions.

Session 6. Consciousness

- (i) Electroencephalography; different frequencies; sleep and wakefulness; circadian rhythms; physiology of sleep and wakefulness; reticular activating system; pontine nuclei.
- (ii) Sleep changes with age; hedonic and hypnagogic hypersynchronies; sleep apnea; sleep walking; meditation.
- (iii) Disorders of consciousness: epilepsy – generalized (grand and petit mal) and focal; fugue state of temporal lobe epilepsy; coma; persistent vegetative state; locked-in syndrome.
- (iv) Stream of thought: personal, changing, continuous, independent, selective; mind-brain theories; blue pill or red pill; filling in; perceived movement; multiple drafts theory
- (v) Attention; pop-out and conjunction search; top-down and bottom-up; binding problem; attentional focus; inattention
- (vi) Theory of mind; split-brain studies; interpreter.

Session 7. Memory and Emotion

- (i) Types of memory: explicit vs. implicit; habituation, sensitization, conditioning; synaptic changes; Hebbian learning; priming; plasticity.
- (ii) Architecture of cognition; sensory registers; working memory: phonological loop and visuospatial scratchpad.
- (iii) Semantic vs episodic memory; consolidation; false memories; encoding and retrieval; limbic system.
- (iv) Amnesia: patient HM; Transient Global Amnesia; Korsakoff's psychosis; Alzheimer's Disease; patient KC and loss of episodic memory.
- (v) Types of emotions; brain regions related to emotions; autonomic nervous system; perceiving emotions.
- (vi) Emotional disorders: anxiety; depression; drug addiction.

Session 8. Language and Thought

- (i) Semantics and syntax; speech sounds; learning of language by infants; written languages.
- (ii) Aphasia: Broca's area; Wernicke's area; arcuate fasciculus and conduction aphasia; brain localization; semantic memory; anomia; dyslexia.
- (iii) Frontotemporal dementia; frontal lobes; executive functions; general intelligence; multiple intelligences; working memory; task-setting; energization; monitoring.
- (iv) Psychopathy; moral brain; Phineas P. Gage; rostral prefrontal cortex and control of attention.
- (v) Brain networks; goal-driven and stimulus-driven attention; default network and inner thought.