Exam #1 Review for Final Exam

***Introduction to Course***

**Scientific Method:** observation, define problem/question, develop hypothesis, gather evidence to test hypothesis, retain or reject hypothesis, develop theory

**Correlation does not equal causation.**

***Behavioral Neuroscience***

Information processing in the brain: **input, processing, output. Predictive cues.**

**Neurons** for communication, **glia** for support (also build the myelin sheath)

Neuron contains **dendrites** (input area, receive info, deliver to cell body), **cell body** (central processing area, decides whether or not to continue the signal), **axon**(output area, signal travels from axon to another neuron)

**Action potential** occurs in the axon, is an all-or-none event, **graded potential** occurs in the dendrite, can get smaller over time and distance. Electrical charge hops across the **nodes of Ranvier** due to changes in polarity.

During **resting potential**, Na+ channels are closed and K+ channels are open. During the travel of electrical current (action potentials), Na+ channels open and the polarization pushes the charge down the axon. This is **diffusion*.***

At the end of the axon, we have the **presynaptic ending**, where **vesicles** (small sacs of neurotransmitters) bring the information over to the next neuron. The signal ends when the neurotransmitter is deactivated, either by **degradation from an enzyme or reuptake**.

Process summary: message received at dendrite, graded potential travels toward cell wall, action potential starts and travels to the end of the axon, neurotransmitter is released, signal sent to next neuron, neurotransmitter taken back up into original cell or metabolized.

Some neurotransmitters: **dopamine, serotonin, norepinephrine, GABA, acetylcholine, glutamate**

**Agonists** increase actions of the neurotransmitters or act like neurotransmitters, **antagonists** decrease actions of neurotransmitters or block actions of the neurotransmitters

***Behavioral Neuroscience Continued***

**Central Nervous System** (brain and the spinal cord), **Peripheral Nervous system** (connects CNS to organs and muscles. **Somatic Nervous system** conveys information into and out of CNS. **Autonomic nervous system** carries involuntary and automatic commands that control blood vessels, body organs, and glands – **sympathetic nervous system, parasympathetic nervous system**

Three major divisions of the brain: **hindbrain** (coordinates info coming in and out of the spinal cord, basic functions of life, *medulla, reticular formation, cerebellum, pons*), **midbrain** (important for orientation and movement, *tectum, tegmentum*), **forebrain** (higher level of brain, cognitive, emotional, sensory, and motor functions, *cerebral cortex, subcortical structures*).

How about some subcortical structures? **Basal ganglia** (caudate, putamen, globus pallidus, subthalamic nucleus, substantia nigra), **hippocampus** (memory, integration), **thalamus** (sensory relay).

And some **limbic system**. Responsible for motivation, emotion, learning, and memory. **Hypothalamus** (regulates body temperature, hunger, thirst, and sexual behavior), **amigdala, hippocampus**, etc.

LOBES! **Frontal lobe** (judgment, decision, motor planning, language), **parietal** (motor, motion perception), **occipital** (vision), **temporal** (object recognition, language, hearing)

**Wernicke’s area** (language comprehension) and **Broca’s area** (language production)

***Even more Behavioral Neuroscience! Yay!***

**Lateralization** of the brain. Left hemisphere controls actions of the right side of the body, vice versa. Hemispheres are connected via commissures, of which the corpus callosum is the largest.

**Structural methods** of brain imaging (CT – computerized tomography and MRI – magnetic resonance imaging) can correlate difference sized brain areas with different behavior

**Functional methods** can correlate activity in specific brain areas with behavior. **Positron Emission Tomography** (injection of isotope, can show most active areas, can be used during long cognitive tasks or compare long-term changes in brain activity). **Functional MRI (fMRI)** measures the resonance signal of blood (more activity in a specific area of the brain means more oxygen use, meaning more blood). fMRI doesn’t allow movement.

**Activity measures: EEG** (electroencephalography) and **MEG** (magnetic encephalography)

**Pharmacology** is the study of the change in brain function in reaction to drug usage

**External brain stimulation – Transcranial Magnetic Stimulation (TMS)**  can disrupt cortical function for a brief time

**The brain is plastic.**

***Sensation and Perception***

**Sensation**: how do we experience our world? We are sensitive to change, not to steady input

**Sensory receptor organs** translate physical energy into electrical signals to the brain

**Common senses:** intensity discrimination, reliable responses, rapid responding, mechanism for attention

The **human eye:** cornea, pupil, light adaptation, retina, accommodation, cones, rods, fovea

**Rods** are for dim light, **cones** are for color.

**Ventral (below) stream**: across occipital lobe into lower levels of temporal lobes (shape and identity)

**Dorsal (above) stream:** travels up from occipital lobe to parietal lobes (location and motion)

**Both begin in area V1.**

**Visual-form agnosia**: inability to recognize objects, also **motion blindness**

***More Sensation and Perception!***

**Six principles of perceptual organization**: *simplicity, closure, continuity, similarity, proximity, common fate*

**Depth cues (monocular):** linear perspective, texture gradient, interposition, relative height

**Depth cues (binocular)** : binocular disparity, space between the two eyes

**Waterfall effect/apparent motion** are motion errors. Ames Room is a depth/size illusion.

REMEMBER! Sensation is the conversion of energy in our sensory organs. Perception is the interpretation of it for use in our world.

**Pain**: A-delta fibers (fast acting), C fibers (longer lasting). It’s an adaptive necessity.

**Five taste buds:** salt, sour, sweet, savory, umami

***EVEN MORE SENSATION AND PERCEPTION WUT WUT***

**Consciousness** is the subjective experience of our surroundings. **Phenomenology** is how things seem to the conscious person. The problem of other minds.

Four basic principles of consciousness: **intentionality** (being directed towards an object), **unity** (resistance to division), **selectivity** (including some objects but not others), **transience** (the tendency to change).

Levels of consciousness: **minimal consciousness** (sensory awareness and responsiveness), **full consciousness** (you know and can report your mental state), **self consciousness** (your attention is drawn to the self as an object)

Thought suppression doesn’t really work, rebound effect, ironic processes of mental control.

In terms of subliminal signals, **priming!**

**Sleep behavior:** an altered state of EEG activity characterized by inactivity and decreased arousal.

**Short wave sleep (SWS) versus rapid eye movement (REM):**

Awake (desynchronized EEG), **stage 1 sleep (Alpha rhythm)** (slowed heart rate and respiration, decrease in muscle tension, unaware of having been asleep), **stage 2 sleep** (sleep spindles, unresponsive to external stimuli), **stage 3 sleep** (delta waves mixed with sleep spindles), **stage 4** (delta waves at least half the time)

**REM Sleep** EEG patterns resemble awake patterns, muscle atonia occurs, increased respiration and heart rate, dreaming sleep (vivid dreams)

SWS about 80% of the time, REM about 20%. Cycles are 90-110 minutes. More REM later in the cycle, more stage 4 earlier.

Sleep for **restoration and memory.**

Some sleep **disorders:** insomnia, sleep apnea, somnambulism, narcolepsy, cataplexy, night terrors

**Dreams:** intense emotion, illogical thought, sensation, uncritical acceptance, quickly lost to conscious recollection. The crazy ones are during REM, thinking dreams are mostly during stage 2 but also stages 3 and 4.

**Freud** says **manifest content** is what the dream ostensibly is, and **latent content** is its hidden meaning.

**Activation-synthesis model** : dreams are produced when the mind tries to make sense of neural activity during sleep

***MEMORY!***

The three stages of memory: **encoding** (the acquisition of knowledge), **creation of a memory trace** (storage of knowledge)**, and retrieval** (ability to use it).

Encoding methods! **Elaborative encoding (left temporal lobe, lower left frontal lobe)** is the depth of processing (meaning-based attention, anything that connects new information to old, makes sense, results in superior recall)

**Visual encoding (visual cortex)** uses visual imagery to enhance recall. **Organizational encoding (upper left temporal cortex)** assists recall via categorizing of information.

Four types of memory: **Sensory, short-term, working, long-term.** Working memory is transformed into long term via rehearsal and chunking.

Recorded via a **memory trace** or an **engram**. Not stored in a single location. Currently an area of research.

The **engram** is created over time, achieved through some aspect of protein synthesis and neural reorganization (consolidation). Some evidence for this is **retrograde amnesia**, i.e. a blow to the head can interrupt the process of consolidation for events that happened 1-2 hours before the accident! Sleep is also essential for consolidation.

**Hippocampus** is involved in memory consolidation. Anterograde versus retrograde amnesia.

**Cues for retrieval** are important. Links between engrams. Context.

**Encoding specificity, state dependency, transfer appropriate.**