KRCP Concept Quiz 2016

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Nervous System:

- **How many Neurons are there in the human brain? How many Glial cells?**
- **What are astrocytes? Oligodendrocytes? Schwann cells?**
- **What is the cell body (soma) made up of?**
- **What are Dendrites?**
- **What is the axon? The axon terminal? How does the axon attach to the cell body?**
- **What insulates the axon of certain neurons? What are the gaps in insulation called?**
- **What are synapses? How many are there in the average human?**
- **What two types of transmission are synapses capable of? Which is the primary method?**
- **What is the difference between the central and peripheral nervous system?**
- **What is the difference between somatic and autonomic nervous control?**
- **What are the 4 scales of anatomy of the nervous system?**
- **What are the 3 main Brodmann's areas?**
- **What are the cortical layers?**
- **Describe the 3 planar sections of the brain:**
  - **Sagittal:**
  - **Coronal:**
  - **Transverse/Axial/Horizontal:**
- **Describe the directions from human perspective:**
  - **Superior/Dorsal:**
  - **Inferior/Ventral:**
  - **Anterior/Rostral:**
  - **Posterior/Caudal:**
  - **Medial:**
  - **Lateral:**
- **What is white matter?**
- **What is grey matter?**
- **What are the two hemispheres? Down what line are they divided?**
- **What are the ventricles?**
- **What does the brain stem do?**
  - **Hindbrain:**
    - **Medulla:**
    - **Cerebellum:**

- - - Pons:
  - o Midbrain:
  - o Diencephalon:
    - Thalamus:
    - Hypothalamus:
  - o Telencephalon:
    - Limbic system:
    - Basal Ganglia:
- What is the Cerebral Cortex, and what role does it play?
- Name and describe the folds and bumps in the brain, and why they exist:
- How many layers are there in the Cerebral Cortex, and what role does each layer have?
- What are Brodmann's areas? (as a whole, not every area)
- What are the 4 major lobes of the brain?

Neuroanatomy:

- Give a basic definition of Neuronal Resting Potential
- What role does the cell membrane perform?
- What are the 4 major substances that can permeate the neuronal cell membrane?
- What does intra/extracellular mean?
- What is the membrane resting potential?
  - o What is the average voltage of the resting potential?
- What are the major ion concentrations at rest?
- Describe Entropy/Concentration pressure/gradient:
- What does electrostatic pressure lead to?
- What are the ion channels? What do they allow to happen? Are there specific types of ion channels?
  - o What are passive ion channels?
- Describe the function of the Na/K pump:
- Describe graded post-synaptic potentials:
  - o Describe the difference between Excitatory Post-Synaptic Potentiation (EPSP)/Inhibitory PSP:
- What is the difference between temporal and spatial summation?
- Describe in detail the mechanisms of an action potential. What is the threshold? In what order do ions flow across the membrane?
- What is hyperpolarization? The refractory period?
- Describe propagation. What role does Myelinization play in propagation?
- What is a Node of Ranvier?
- What is Saltatory Conduction? (has nothing to do with salt)
- Describe a summary of a synaptic transmission:

- o What is the difference between chemical and electrical transmission, and which is more common?
- What is a neurotransmitter?
- What is the difference between a pre-and-post synaptic response?
- How does Ca^{2+} play a role in synaptic transmission?
- What is Exocytosis? The synaptic cleft?
- What are:
  - o Ionotropic receptors?
  - o Metabotropic receptors?
- Dopamine is found in the CNS or PNS?
- Serotonin is found in the CNS or PNS? It regulates what?

Sensation and Perception:

- The eye has many structures. Define:
  - o Iris:
  - o Pupil:
  - o Cornea:
  - o Retina:
  - o Lens:
  - o Optic nerve:
- The retina is arguably the most complex structure in the eye. It is made up of receptors of rods and cones.
  - o Rods are what?
  - o Cones are what?
    - ▪ How many types of cones? What role does each type play?
- What are Ganglion cells? Where are they located?
- What are the three types of cells in the eye, and their functions?
  - o Bipolar cells
  - o Amacrine cells
  - o Horizontal cells
- Describe lateral inhibition. What benefit does it give?
  - o How does contrast enhancement affect the way we see the world?
- What is the optic chiasm?
- The LGN is short for the Lateral Geniculate Nucleus, and over 90% of all the axons in the optic nerve connect to it. How many layers does it have?
  - o M-Cells versus P-Cells:
- The Visual Cortex is the main processing unit of the brain. The primary visual cortex, or V1, is responsible for many actions.
  - o Where is it located?

- o What are the differences between simple and complex cells? End stopped cells?
  - o What are orientation columns?
- In what manner are images projected into the brain? What pathways do images follow from each eyeball? (Left eye goes where? Right eye?)
- The anterior visual pathway comes before or after the LGN? The posterior visual pathway?
  - o The dorsal pathway (magnocellular pathway) relays what type of visual information?
  - o The ventral pathway? (parvocellular pathway)
- What is the binding problem regarding perception? How have we (or have we not) explained this?
- What is:
  - o Object constancy:
  - o View-invariant recognition:
  - o Shape encoding:
  - o Grandmother cell vs Ensemble coding:
- What are some examples of failures in perception?
- Give an example of how a computer could "read" a person's mind, and what applications it may have.

Attention:

- What are the functions of attention?
- Describe the signal attention theory:
- Define an attentive search:
- What is the array size effect?
- What is a target? A distractor?
- What is the feature integration theory?
- What benefits does selective attention give us?
  - o Describe the cocktail party effect
- What is a dichotic listening task?
- What is the Posner cueing task?
- Describe voluntary vs reflexive attention
- Describe Overt vs Covert attention. Who first discovered and described this? How did he discover this?
- What 4 parts of the Cortex play a role in attention?
- What are the 3 main phases of automatization?

Memory:

- H.M. had his hippocampus (in the temporal lobe) destroyed and then removed, resulting in catastrophic anterograde amnesia. What does this mean?
- There are 3 stages of memory. Describe what these are:
    - Encoding:
        - Acquisition:
        - Consolidation:
    - Storage:
    - Retrieval:
- There are two types of memory, short term and long term.
    - How quickly does short term memory decay?
    - Describe the fragility of short term memory:
    - How much "storage space" is there for long-term memory?
    - What is the difference between declarative and Non-declarative memory?
- Atkinson and Shiffrin described their "modal (multi-store) model" in what 4 steps?
    - Why is it outdated?
- Baddely came up with a more functional model.
    - _____ memory?
    - What were the key differences?
- What are the primacy and recency effects?
- Describe the "flashbulb" memory concept:
- The _____ (part of brain) is essential in memory consolidation.
- Squire described the Standard Consolidation Theory, which states that the memory is first stored in the _____ (answer above) and then during sleep is then transferred to _____ in various places throughout the _____.
- Place cells are located where?
- Grid cells are located where?
    - Grid cells are called such because:
- Place and Grid cells are the brain's _____, and they help us determine our _____.
- Amnesia is defined as loss of memory. There are several specific types.
    - Retrograde:
    - Anterograde:
- Alzheimer's is a nasty disease that prevents the brain from first consolidating memory, and then eventually accessing other memories. It begins in the _____ and starts with episodic memory in the _____ cortex.

Learning:

- Learning is _technically_ defined as:

- **Memory is _technically_ defined as:**
- **Describe Hebbian learning:**
    - **What is associative learning?**
    - **"Cells that _____, _____"**
        - **Elaborate on this concept:**
- **Long term potentiation (LTP) is:**
    - **EPSP plays what role?**
    - **LTP takes place where?**
    - **What is associative LTP?**
        - **Cooperativity:**
        - **Associativity:**
        - **Specificity:**
- **Long term depression (LTD) is:**
    - **IPSP plays what role?**
    - **LTD takes place where?**
    - **NMDA receptors open _____ and facilitate transmission of what 2 chemicals? (one goes out, another comes in)**
    - **What happens when the new chemical comes in?**

Artificial Neural Networks:

- **Describe in detail the 3 types of learning:**
    - **Supervised**
    - **Unsupervised**
    - **Reinforcement**
- **These are a very crude form of a biological neural network. They consist of _____ that have an _____/_____ and perform a simple computation based on _____ functions.**
- **Each connection has a weight which does what?**
    - **This mimics what biological function?**
- **Describe the 3 main structures:**
    - **Fully connected:**
    - **Feed-forward:**
    - **Recurrent Network:**
- **Describe an input function. What are the essential variables in the function?**
    - **The weighted sum of this function leads to an _____.**
- **Name the main types of Activation Functions: (3 were covered in class, 1 was used in perceptron practical):**
- **Describe the structure of a Perceptron:**
    - **Input/output:**

- o **Step/sign function:**
- o **Single Layer or Multi layer?**
- o **What type of network?**
- **Describe the algorithm in words of a perceptron:**

Methodology in Research:

- **What is the difference between Correlational and Experimental research design?**
- **What roles do computer models play in research?**
  - o **Pros?**
  - o **Cons?**
  - o **Future development?**
- **What are Lesion studies?**
  - o **What types of dissociation are there?**
- **Name 4 types of structural imaging:**
  - o **What are the benefits of each?**
  - o **What are the drawbacks of each?**
  - o **Which are invasive/non-invasive?**
- **What is the difference between a low-Tesla MRI and a high-Tesla MRI?**
  - o **What does a high-Tesla MRI allow us to achieve?**
  - o **What is the gradient field?**
  - o **What is the radio frequency coil?**
  - o **What are protons/spins?**
  - o **What is the Larmour frequency?**
  - o **Describe diffusion with MRI/DTI**
    - ▪ **Anistropic diffusion is:**
  - o **What is the difference between T1, T2, and T2* weights?**
- **What is functional imaging?**
- **What is the difference between spatial and temporal resolution?**
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Evolution and Development:

- **Humans have the largest what?**
- **A byte can represent how many DNA base pairs?**
- **How many gigabytes of genetic data does the average human have?**
- **Describe in detail the steps of the Radial Unit Hypothesis:**
  - o **Cells first:**
  - o **Then they:**
  - o **The cortex is formed in what manner?**
  - o **Neurons migrate in what direction during development?**

- o When prolonging this stage, what is the result?
- What are the four phases of the neurological development cycle?
- What percentage of neurons are in the human Cortex?
- The VAST majority of other neurons are located where?
- _____ of axons lasts longer or shorter than other neurological development processes?
- Axons myelinate in what order?
  - o Frontal and Parietal comes _____
  - o Sensory and Motor comes _____
- Myelination of the frontal Cortex lasts until about when?

Genetic Algorithms:

- Binary strings can represent what biological structure?
- Each genotype is called a _____?
- A collection of individuals is called a _____?
- Each string/genotype/individual is assigned a _____ value based off of phenotype.
- How do we determine our fitness value?
- What two types of operators determine reproductive methods?
- What are the main types of selection?
  - o How do each work?
  - o Pros and cons of each?

Language:

- What are mirror neurons?
- What is the primate brain area F5's function?
- What role does Broca's area play?
- What are the 5 steps of language acquisition?
  - o What stages in human life do they develop?
- What are the 3 types of errors that children make in language development?
- What is the critical period?
- What are the advantages of multilingualism?
  - o What are the disadvantages?
- What do you call someone who speaks 3 languages?
  - o *Trilingual*
- What do you call someone who speaks 2 languages?
  - o *Biningual*
- What do you call someone who speaks 1 language?
  - o *American.*

- **The field of _____ is the study of language.**
    - o **Two subdivisions:**
- **Define:**
    - o **Syntax:**
    - o **Semantics:**
    - o **Lexicon:**
        - ▪ **Morpheme:**
    - o **Prosody:**
    - o **Pragmatics:**
- **Language is lateralized in what side of the brain?**
    - o **_____   _____ cortex**
    - o **_____   _____ gyrus**

<u>Reasoning and Intelligence:</u>

- **Define deductive reasoning:**
    - o **Premises, Conclusion, Qualifier:**
    - o **What is the atmosphere effect?**
    - o **Categorical reasoning?**
    - o **Conditional reasoning?**
        - ▪ **Syllogistic reasoning?**
- **What is the Wason selection task?**
- **Define inductive reasoning:**
    - o **What are heuristics?**
    - o **What is bias?**
- **What are the 3 stages of skill acquisition? What do they do?**
- **What is the Power Law of learning? ($T = aP^{-b}$)**
    - o **T =**
    - o **a =**
    - o **P =**
    - o **b =**
- **Describe the differences between tactical and strategic learning:**
- **What role does deliberate practice play in learning/memory?**
- **What was the initial role of an IQ test?**
    - o **Relative vs Normative:**
    - o **List 5 subtests of the modern IQ test:**
- **Describe the differences between:**
    - o **Spearman's model**
    - o **Thurstone's model**
    - o **Guilford's model**

- o **Crystallized vs Fluid intelligence**
- **What is the Flynn effect?**
- **What is Construct Validity?**

Artificial Intelligence:

- **What is INDUCE?**
- **What is DEEP BLUE?**
- **Who is Dijkstra and what did he do?**

Consciousness:

- **What is consciousness (smoke a joint to answer this one boys):**
  - o **What are the differences between core and extended consciousness?**
    - ▪ **What role does the cerebral cortex play in consciousness?**
- **How can we measure consciousness on a quantitative level?**
  - o **Tools?**
  - o **Terms?**
- **Define these conscious impairments:**
  - o **Sopor:**
  - o **Somnolence:**
  - o **Coma:**
  - o **Brain death:**
  - o **Locked-in Syndrome:**
  - o **Vegetative state:**
    - ▪ **Persistent:**
    - ▪ **Transient:**
- **What is sleep, besides what we don't get enough of as engineers?**
  - o **How many stages of sleep are there?**
  - o **What role does each stage play?**
  - o **What is REM?**
  - o **In what stage(s) does REM happen?**
  - o **In what stage(s) do we dream?**
  - o **In which stage(s) do we consolidate memories?**
- **What can we learn about eye movements during sleep via an EEG?**
- **What major functions does sleep have?**
- **What (do we believe) happens during REM sleep?**
- **What neurological evidence do we have for the BINDING PROBLEM?**
  - o **Apperceptive Agnosia:**
  - o **Achromatopsia:**
  - o **Prosopagnosia:**

- o **Semantic Dementia:**
- o **Simultagnosia (Balint's syndrome):**
- o **Akinetopsia:**
- **Describe the feature integration theory:**
  - o **Is it credible? Why or why not?**
- **What is synchronous oscillation?**
- **What is free will?**
  - o **What is readiness potential?**
- **Describe Libet's experiment:**
  - o **What is the "cute" name for his discovery?**
  - o **What was his original intent?**
- **What is Soon's fMRI experiment?**
- **What are Qualia, and how do they affect our perception of consciousness?**
  - o **Describe David Chalmer's Easy vs Hard problem?**
  - o **Why might this theory be inaccurate?**
- **What experiment did Nagel do?**
- **What is the Inverted Spectrum problem?**
  - o **How does it change the way we perceive consciousness?**
- **What is Mary the COLOR scientist?**
  - o **What can we learn from this concept?**