COGNITIVE NEUROSCIENCE FOR AI DEVELOPERS (SS 2023)
Week 03 - Neurons

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Single Choice Exercise // Only one answer is correct

Q1: At which magnitude is the resting membrane potential of neurons?

    A. V
    B. mV
    C. µV
    D. nV
    E. pV

Q2: Which of the following ions is barely involved in membrane potential generation?

    A. K^+ (Potassium)
    B. Na^+ (Sodium)
    C. Cl^- (Chloride)
    D. A^- (Anions)
    E. Fe^{2+} (Iron)

Q3: Which statement is true in respect to neuron-neuron communication?

    A. Neurons are mainly connected electrically
    B. Neurotransmitters are released from the post to the presynapse
    C. Chemical connections allow signal adjustments
    D. Unmyelinated axons allow faster transmission
    E. Vesiles fuse with the presynapse upon sodium influx

Q4: Single perceptrons cannot compute

    A. Logical AND
    B. Logical OR
    C. Logical NOT AND
    D. Logical XOR
    E. Logical NOT

Q5: What statement is true w.r.t. neural anatomy?

    A. Neurons could have two or more axons
    B. Neurons always have only one dendrite
    C. Some neurons in the retina are bipolar
    D. Purkinje cells have no dendrites
    E. Oligodendrocytes are involved in the tripartite synapse

Neurobiology is the applied physics, chemics and electrical engineering. Discuss this statement with respect to the following three phenomena:

- Reversal potential
- Action potential
- Neural equivalent circuit

The Nernst equation is very important for calculating the equilibrium potential for ions. It is defined using the following formula:

$$E = \frac{RT}{zF} \ln \frac{[\text{ion outside cell}]}{[\text{ion inside cell}]}$$

Write down the individual constants and variables, their definition and their units.

R:

T:

z:

F:

[ion outside/inside cell]:

Calculate the E_{K+} at 20°C for 5 mM K+ outside and 140 mM K+ inside: