Questions

1. What is the main bottleneck in the visual system?
    a. V1
    b. V2
    c. Connections from the thalamus to V1
    d. Optic nerve

    Explanation: The optic nerve is the main bottleneck in the visual system because it has a limited capacity to transmit the vast amount of visual information from the retina to the brain, requiring significant data compression and processing.

2. Why is gain control an essential part of the efficient coding principle?
    a. It increases the speed of neural responses.
    b. It adjusts sensitivity to optimize information transmission.
    c. It ensures all sensory neurons respond equally.
    d. It reduces the energy consumption of the brain.

    Explanation: Gain control is essential in the efficient coding principle because it dynamically adjusts the sensitivity of sensory neurons to match the statistical properties of the input signal, thereby optimizing information transmission and preventing saturation or loss of information.

3. Which additional goals should be considered in order to extend the efficient coding principle to be applicable in V1?
    a. Temporal invariance.
    b. Translational invariance.
    c. Scale invariance.
    d. Ocular invariance.

    Explanation: To apply the efficient coding principle to V1 neurons, two additional goals must be fulfilled: (1) translational invariance, and (2) scale invariance. This can be achieved by using a different K transform.

4. Why does V1 have few cells tuned to more than two feature dimensions?
    a. Such tuning is not necessary for V1 to fulfill its function.
    b. Integrating over features is required to obtain high enough signal power.
    c. The complexity of neural processing decreases with fewer dimensions.

    Explanation: Considering the contrast between features requires high enough signal power. This can be achieved by integrating along some feature dimensions, while taking the contrast of other feature dimensions. That is the reason why a very low number of V1 neurons are tuned to more than two features at once.

5. The ocularity of V1 neurons depends on the input statistics, for example:
    a. **In bright conditions, more neurons will be binocular than in a dim environment.**
    b. **In animals with long interocular distances, there will be fewer binocular cells**
    c. **More binocular cells are tuned to horizontal orientation than to vertical orientation**

    Explanation: All of the answers are correct.