

SUPPLEMENTAL MATERIAL

Supplemental table 1. Neuroscience Concept Inventory items with item discrimination difficulty index.

Core Concept	Items	Item discrimination	Item difficulty
Communication modalities: Nervous systems encode and transmit information in various modalities.	Select the three main communication modalities used by the nervous system to transmit information.	0.10	0.64
	In what ways is information encoded and transmitted within neural circuits? Select all that apply.	0.20	0.56
	How does the regulated movement of ions across cell membranes contribute to communication between neurons and other cell types?	0.35	0.90
	Explain the difference between electrical signaling and chemical signaling in the nervous system.	0.19	0.69
	Your research team has designed a new drug, not found in the body, that binds to dopamine receptors and activates them. Based on this information, the drug can be classified as a(n) _____.	0.32	0.91
	Which of the following factors influence conduction velocity of an action potential? Select all that apply.	0.15	0.19
	When considering information flow in a neuron, the typical order is _____.	0.24	0.81
	What is the primary benefit of population coding in olfaction?	0.28	0.75
	Compared to neurotransmitters, hormone effects are generally _____.	0.39	0.92
Emergence: Nervous system functions are constructed from the combined interactions of smaller constituent components.	How are complex nervous system functions such as cognition and behavior typically generated?	0.55	0.85
	Which of the following statements is true regarding system-level functions in the nervous system?	0.47	0.81
	At the cellular level, what gives rise to neuronal and glial physiology?	0.37	0.66
	A recently discovered interneuron contains beta-adrenergic and serotonin receptors, both of which stimulate adenylyl cyclase activity. This is an example of _____.	0.30	0.78
	A renowned scientist aims to discover how to pharmacologically inhibit stress from negatively impacting long-term memory function. For this, she evaluates different receptor subtypes. Accordingly, her research falls under the _____ level of analysis.	0.18	0.44
	Dopamine plays a crucial role in motor control by facilitating communication between neurons in the basal ganglia. The loss of dopaminergic signaling from the basal ganglia to the substantia nigra is primarily associated with which of the following conditions?	0.27	0.80

	Which of the following statements about emotions are true? Select all that apply.	0.39	0.70
	_____ neuroscience focuses on understanding how groups of neurons work together to process information and generate behaviors.	0.29	0.51
Evolution: The similarities and differences in nervous systems between organisms are constrained and defined by their evolutionary backgrounds.	Why is the shared phylogenetic history (i.e., evolutionary development) of animals important in neuroscience research?	0.48	0.70
	What generates differences in nervous systems between species? Select all that apply.	0.30	0.49
	Why might behavioral differences between species arise from evolution?	0.49	0.86
	Proportional to other animals, humans have the largest frontal cortex. What is the significance of this?	0.46	0.89
	Which of the following statements best describes how evolutionary processes impact the nervous system?	0.62	0.85
	Preserved elements of the nervous system are often shared across different species and play essential roles in maintaining basic neural functions and behaviors. Which of the following are examples of preserved elements? Select all that apply.	0.20	0.19
	What is the primary benefit of comparative studies of the nervous system?	0.47	0.77
Gene-environment interactions: Unique patterns of gene expression underlie the organization and function of a nervous system and are altered by environmental factors.	How do genes and environmental factors contribute to the organization and function of a nervous system?	0.65	0.80
	What role does gene expression play in nervous system development? Select all that are true.	0.59	0.64
	How does gene expression influence nervous system properties at different levels?	0.62	0.80
	What is the significance of alterations in gene expression across the life span of an organism?	0.59	0.78
	Epigenetic modification has been implicated in various neurological and psychiatric disorders. Which of the following statements are true regarding epigenetic changes? Select all that apply.	0.34	0.32
	BDNF is a neurotrophic factor involved in various aspects of neural development, function, and plasticity. Mutations in the BDNF gene have been associated with conditions such as schizophrenia. This is an example of a(an) _____.	0.13	0.29
	Which of the following statements best describes the relationship between environmental factors and gene expression?	0.57	0.78
Information processing: Outputs from a nervous system depend on the	At what level, does the nervous system process information?	0.54	0.69

information it receives as well as information filtering and modulation performed by the unit.	What determines the output of a unit in the nervous system?	0.36	0.83
	What role does information filtering play in information processing within a unit of the nervous system?	0.54	0.79
	Which of the following statements are true regarding information processing within the nervous system? Select all that apply.	0.20	0.09
	Sensory systems include taste, olfaction, audition, vision, and somatic sensations. Which of the following best represents the flow of information associated with these systems?	0.34	0.75
	The _____ lobe is responsible for receiving and interpreting somatic sensations.	0.34	0.69
Nervous system functions: Nervous systems function to coordinate survival responses to the environment, permit behavior in a timely manner, and maintain homeostatic regulation.	What common function do all nervous systems share, regardless of species?	0.12	0.27
	What allows a nervous system to produce rapid responses to stimuli?	0.37	0.75
	What can arise when the normal function of a nervous system is disrupted? Select all that apply.	0.50	0.60
	Which of the following is a homeostatic function of the nervous system?	0.43	0.82
	The hypothalamus responds to sensory input to maintain homeostasis. Which of the following represents a mechanism by which this happens? Select all that apply.	0.16	0.18
	Glial cells support and protect neurons. Despite not generating action potentials or transmitting electrical signals, these cells can influence synapses and contribute to information processing. Specifically, astrocytes influence synapses and contribute to information processing by _____. Select all that apply.	0.19	0.11
Plasticity: Nervous systems reorganize their structure, function, and connections in response to experience.	What does the term "plasticity" refer to in the context of the nervous system?	0.55	0.81
	When does plasticity in the nervous system occur?	0.55	0.83
	How does plasticity contribute to the flexibility of nervous systems?	0.52	0.85
	How does plasticity contribute to the recovery of function after a brain injury?	0.46	0.84
	Which of the following factors can enhance synaptic plasticity and neurogenesis? Select all that apply.	0.41	0.40
	Which of the following best describes the concept of phantom limb plasticity?	0.31	0.39
Structure-function relationship: Structure permits and constrains	How do nervous system structures and functions relate to each other?	0.34	0.41

nervous system function, and function shapes structure.	How can activity levels and functional demands influence nervous system structure?	0.62	0.76
	What factors influence the structure and function of the nervous system?	0.63	0.74
	How does the specialized structure of a neuron's axon contribute to its function?	0.60	0.69
	Which of the following statements are true regarding neurons and glia? Select all that apply.	0.49	0.30
	The spinal cord is composed of the ventral and dorsal regions, each serving distinct functions in transmitting signals within the nervous system. What is the main difference between these two regions?	0.21	0.61
	Action potentials travel alongside the axon. The axon diameter _____.	0.56	0.80
	How does the dendritic structure impact the propagation of excitatory postsynaptic potentials (EPSPs) in a neuron?	N/A	N/A