

Neuroanatomy Neuroscience Exam 2004

1

Neuroscience Exam #1

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4. Chapter: Neuroscience Exam 2004 1

1. Neuroscience Exam 2004 1 Questions

4.1.1. vesicle diameter

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

vesicle diameter

Please choose only one answer:

- 0.5 nm
- 5 nm
- 50 nm
- 500 nm

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [vesicle diameter It is important to have a sense for the by Dr. David](http://www.quizover.com/question/vesicle-diameter-it-is-important-to-have-a-sense-for-the-by-dr-david?pdf=1505)

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4.1.2. synapse width (length of active zone)

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

synapse width (length of active zone)

Please choose only one answer:

- 5 nm
- 50 nm
- 500 nm
- 5000 nm

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [synapse width length of active zone It is important to have a sense](http://www.quizover.com/question/synapse-width-length-of-active-zone-it-is-important-to-have-a-sense?pdf=1505)

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4.1.3. Lipid bilayer thickness

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

Lipid bilayer thickness

Please choose only one answer:

- .05 nm
- .5 nm
- 5 nm
- 50 nm

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [Lipid bilayer thickness It is important to have a sense for the by](http://www.quizover.com/question/lipid-bilayer-thickness-it-is-important-to-have-a-sense-for-the-by?pdf=1505)

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4.1.4. Vesicles released per active zone per action potential

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

Vesicles released per active zone per action potential

Please choose only one answer:

- 1
- 10
- 100
- 1000

Check the answer of this question online at QuizOver.com:

Question: [Vesicles released per active zone per action It is important to have](#)

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4.1.5. Synaptic delay (pre AP to post AP)

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

Synaptic delay (pre AP to post AP)

Please choose only one answer:

- 0.1 ms
- 1 ms
- 10 ms
- 100 ms

Check the answer of this question online at QuizOver.com:

Question: [Synaptic delay pre AP to post AP It is important have a sense for](#)

Flashcards:

<http://www.quizover.com/flashcards/synaptic-delay-pre-ap-to-post-ap-it-is-important-have-a-sense-for?pdf=1505>

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4.1.6. Synaptic cleft width

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

Synaptic cleft width

Please choose only one answer:

- 0.2 nm
- 2 nm
- 20 nm
- 200 nm

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [Synaptic cleft width It is important to have a sense for the by Dr](http://www.quizover.com/question/synaptic-cleft-width-it-is-important-to-have-a-sense-for-the-by-dr?pdf=1505)

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4.1.7. glutamate molecules/ vesicle

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

glutamate molecules/ vesicle

Please choose only one answer:

- 50
- 500
- 5,000
- 50,000

Check the answer of this question online at QuizOver.com:

Question: [glutamate molecules/ vesicle It is important to have a sense for](#)

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4.1.8. resting $[Ca^{2+}]$ in terminal

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

resting $[Ca^{2+}]$ in terminal

Please choose only one answer:

- 0.1 μM
- 1 μM
- 10 μM
- 100 μM

Check the answer of this question online at QuizOver.com:

Question: [resting \$Ca^{2+}\$ in terminal It is important to have a sense for the by](#)

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4.1.9. [Ca²⁺] near vesicle for release

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

[Ca²⁺] near vesicle for release

Please choose only one answer:

- 0.5 μM
- 5 μM
- 50 μM
- 500 μM

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [Ca²⁺ near vesicle for release It is important to have a sense the](http://www.quizover.com/question/ca2-near-vesicle-for-release-it-is-important-to-have-a-sense-the?pdf=1505)

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4.1.10. AMPA receptor protein diameter

Author: David Corey

It is important to have a sense for the relative orders of magnitude of cellular components.

Circle the answer which is closest to correct for each physical parameter for a CNS synapse.

AMPA receptor protein diameter

Please choose only one answer:

- 1 nm
- 10 nm
- 100 nm
- 1000 nm

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [AMPA receptor protein diameter It is important to have a sense for](http://www.quizover.com/question/ampa-receptor-protein-diameter-it-is-important-to-have-a-sense-for?pdf=1505)

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4.1.11. Indicate which of the following are true.

Author: David Corey

Indicate which of the following are true.

Please choose all the answers that apply:

- Microtubules possess great tensile strength that enables axons to withstand mechanical stress.
- The initial segment and nodes of Ranvier are enormously enriched in delayed rectifier potassium channels.
- The speed of slow axonal transport is only one order of magnitude faster than simple diffusion.
- Presynaptic proteins are often synthesized in the axonal terminal, while dendritic proteins are exclusively made in the soma.
- Dendritic spines are generally thought to constitute the site of long-term, stable memory in CNS neurons.

Check the answer of this question online at QuizOver.com:

Question: [Indicate which of the following are true by Dr. David Corey @MIT](#)

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4.1.12. Myelin... (circle all that apply)

Author: David Corey

Myelin... (circle all that apply)

Please choose only one answer:

- is made by oligodendrocytes cells in peripheral sensory nerves
- decreases the effective capacitance of an axon
- decreases the length constant of an axon
- decreases the effective resistance of an axonal membrane
- is lost in the disease myaesthesia gravis
- increases conduction velocity to 20-100 mm/s

Check the answer of this question online at QuizOver.com:

Question: [Myelin... circle all that apply by Dr. David Corey @MIT Introduction](#)

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4.1.13. A typical mammalian CNS synapse differs from the neuromuscular junc...

Author: David Corey

A typical mammalian CNS synapse differs from the neuromuscular junction (NMJ) in the following ways (circle all that apply):

Please choose all the answers that apply:

- A CNS presynaptic terminal typically releases 1 vesicle per action potential while a NMJ terminal releases hundreds.
- Acetylcholine is hydrolyzed by acetylcholinesterase in the cleft at the NMJ, while glutamate is cleaved by glutamate hydrolase in the cleft in CNS synapses.
- NMJ synapses have dense-core vesicles while CNS vesicles are usually clear.
- CNS, but not NMJ presynaptic terminals can be postsynaptic to inhibitory neurons.
- A muscle cell is innervated by a single motor neuron while a CNS neuron can be postsynaptic to many neurons.

Check the answer of this question online at QuizOver.com:

Question: [A typical mammalian CNS synapse differs by Dr. David Corey @MIT Introduction](#)

Flashcards:

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4.1.14. Which processes contribute importantly to the resting membrane pote...

Author: David Corey

Which processes contribute importantly to the resting membrane potential?

Please choose all the answers that apply:

- Na-K ATPase pump
- K⁺ going through voltage-gated K⁺ channels
- K⁺ going through inward-rectifying K⁺ channels
- Small negatively charged molecules inside the cell

Check the answer of this question online at QuizOver.com:

Question: [Which processes contribute importantly to by Dr. David Corey @MIT](#)

Flashcards:

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4.1.15. For channels in the open conformation, we frequently approximate I(...

Author: David Corey

For channels in the open conformation, we frequently approximate I(V) relationships as Ohmic, but we know that they are not strictly linear.

Which of the following contribute to nonlinearities in open-channel I(V) relationships?

Please choose all the answers that apply:

- Voltage-dependent gating
- Membrane capacitance
- Voltage-dependent block of pores by intracellular or extracellular ions.
- Differences in the concentration of charge carriers across the membrane.
- Voltage-dependent changes in permeability of the lipid bilayer

Check the answer of this question online at QuizOver.com:

Question: [For channels in the open conformation we by Dr. David Corey @MIT](#)

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4.1.16. The resting conductance of an ordinary neuron is due to a K⁺ channe...

Author: David Corey

The resting conductance of an ordinary neuron is due to a K⁺ channel that is always open at the resting potential.

If you double the extracellular K⁺ concentration, from 5 to 10 mM, what happens to the membrane time constant?

Please choose only one answer:

- nearly doubles
- increases slightly
- no effect on time constant
- decreases slightly
- nearly halves

Check the answer of this question online at QuizOver.com:

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4.1.17. In a thermal vent deep in the Pacific, you discover a new bacterium...

Author: David Corey

In a thermal vent deep in the Pacific, you discover a new bacterium, and decide to characterize its channels.

One of them tends to flicker open and closed, so it's easy to measure its reversal potential.

Under the following ionic conditions (given in mM), the current reverses at about +29 mV.

What ion is the channel permeable to?

ALLOW SOME PARTIAL CREDIT FOR WORK SHOWN.

[table]

Ion ;OUT;IN

Mg²⁺ ;50;5

Sr²⁺ ; 5;50

Cl⁻ ;260;65

I⁻ ;5;50

La³⁺ ;50;5

Dextrose ;0;195

[/table]

Please choose only one answer:

- Mg²⁺
- Sr²⁺
- Cl⁻
- I⁻
- La³⁺
- Dextrose

Check the answer of this question online at [QuizOver.com](http://www.quizover.com):

Question: [In a thermal vent deep in the Pacific you by Dr. David Corey @MIT](#)

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4.1.18. Which of the following is true about transmission of EPSPs along de...

Author: David Corey

Which of the following is true about transmission of EPSPs along dendrites.

Please choose all the answers that apply:

- EPSPs become smaller in amplitude and shorter in duration as they move along passive dendrites
- Potentials travel more readily away from the soma than towards it
- Inhibitory inputs shunt EPSPs more readily when they are near the cell body than when they are in distal dendrites
- At dendritic branch points the length constant can either increase, decrease or stay the same
- EPSPs from distal dendrites are often larger than expected from passive propagation both because synapses are stronger at distal locations and because they can stimulate action potentials in the dendrites

Check the answer of this question online at QuizOver.com:

Question: [Which of the following is true about transmission by Dr. David Corey](#)

Flashcards:

<http://www.quizover.com/flashcards/which-of-the-following-is-true-about-transmission-by-dr-david-corey?pdf=1505>

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4.1.19. Which of the following are true about the propagation of the action...

Author: David Corey

Which of the following are true about the propagation of the action potential down an axon (circle all that apply).

Please choose all the answers that apply:

- increasing axon diameter speeds up propagation
- increase the number of K⁺ leak channels speeds up propagation
- increasing the number of voltage-gated Na⁺ channels speeds up propagation
- the myelin sheath primarily increases propagation velocity by decreasing R_m
- because conduction between nodes is saltatory, eliminating a single node of Ranvier would abolish propagation along the axon

Check the answer of this question online at QuizOver.com:

Question: [Which of the following are true about the by Dr. David Corey @MIT](#)

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4.1.20. There is potassium channel made of KCNQ2 and KCNQ3 subunits, which ...

Author: David Corey

There is potassium channel made of KCNQ2 and KCNQ3 subunits, which is partly open at rest, and slowly opens more when depolarized.

This channel is closed by acetylcholine or muscarine, and so current through this channel is called the M-current.

Which are likely to be true about the M-current?

Please choose all the answers that apply:

- acetylcholine probably acts on the current through a second messenger
- application of acetylcholine to dendrites containing KCNQ2/3 will increase the length constant of the dendrite
- cells with KCNQ2/3 will have a harder time firing a burst of action potentials than a single action potential
- application of acetylcholine to a presynaptic terminal containing KCNQ2/3 will decrease vesicle release

Check the answer of this question online at QuizOver.com:

Question: [There is potassium channel made of KCNQ by Dr. David Corey @MIT Introduction](#)

Flashcards:

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4.1.21. How do tetanus toxin and botulinum toxin interfere with synaptic tr...

Author: David Corey

How do tetanus toxin and botulinum toxin interfere with synaptic transmission (explain in molecular detail)?

How does one produce a rigid paralysis, while the other causes flaccid paralysis?

- Toxin's heavy and light chain required to enter cell. Light chain then freed and acts as metalloprotease to enzymatically cleave different proteins of the SNARE complex (required for synaptic vesicle fusion).
Tetanus tends to hit inhibitory synapses (thus rigid, due to disinhibition of motoneuron), and botulinum toxin hits NMJs and others. (Tropism of toxin.)

Check the answer of this question online at QuizOver.com:

Question: [How do tetanus toxin and botulinum toxin by Dr. David Corey @MIT](#)

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4.1.22. To impress your parents and show them that their tuition loan was w...

Author: David Corey

To impress your parents and show them that their tuition loan was worth it all, you begin to tell them all you learned about the sites of action of cannabinoids in the brain.

Your recollection is a little foggy, however, as you still have a buzz from that very fine stuff you smoked last night.

What are some of the things you are trying to recall?

(circle all that apply)

Please choose all the answers that apply:

- tetrahydrocannabinol (also the active ingredient in marijuana) is normally synthesized by medium spiny neurons of the striatum
- anandamide is a membrane-permeant cannabinoid which can diffuse from a postsynaptic neuron to a presynaptic terminal as a form of retrograde transmission
- binding of anandamide to CB1 receptors potentiates voltage-gated Ca²⁺ channels, leading to more neurotransmitter release
- cannabinoids inhibit GABA release by neurons of the nucleus accumbens, stimulating dopaminergic neurons of the ventral tegmental area
- morphine inhibits GABA release by neurons of the nucleus accumbens, stimulating dopaminergic neurons of the ventral tegmental area

Check the answer of this question online at QuizOver.com:

Question: [To impress your parents and show them that by Dr. David Corey @MIT](#)

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4.1.23. Long term potentiation in the hippocampus, at CA3 to CA1 synapses, ...

Author: David Corey

Long term potentiation in the hippocampus, at CA3 to CA1 synapses, has the following characteristics (circle all that apply)

Please choose all the answers that apply:

- it lasts minutes to hours
- it requires the influx of Ca²⁺ primarily through AMPA receptors
- it requires insertion of new AMPA receptors in the postsynaptic membrane
- it can be a mechanism for associating signals from two neurons, as depolarization evoked by one neuron can potentiate the synapse from another neuron
- it differs from LTP at mossy fiber synapses (dentate gyrus to CA3), which is primarily presynaptic

Check the answer of this question online at QuizOver.com:

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4.1.24. You have spent years to identify the gene for a rare, dominantly in...

Author: David Corey

You have spent years to identify the gene for a rare, dominantly inherited paralytic disease.

The disease is characterized by a temporary inability to generate action potentials in the muscle after heavy exercise.

The gene you finally identify encodes an inwardly rectifying potassium channel, and the disease is correlated with a single amino acid change in its selectivity filter.

Experiments on mutant channels expressed in cultured cells indicate that the channel becomes less selective for K^+ when lactic acid builds up and the residue is protonated.

What is the single most likely etiology for the disease?

Please choose only one answer:

- Na^+ influx depolarizes the muscle to a region where voltage-gated Na^+ channels are largely inactivated.
- Because the channel is less K^+ -selective, K^+ leaks into the muscle, shifting the K^+ Nernst potential more negative and hyperpolarizing the cell
- Ca^{2+} influx stimulates continuous neurotransmitter release, and desensitization of nACh receptors
- K^+ accumulation in the T-tubules depolarizes the muscle cells

Check the answer of this question online at QuizOver.com:

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4.1.25. What are three widely used treatments for epilepsy?

Author: David Corey

What are three widely used treatments for epilepsy?

- drugs (dilatant, phenobarbital, phenytoin, tegretol, etc.)
ketogenic diet
surgery to remove focus
vagal nerve stimulator

Check the answer of this question online at QuizOver.com:

Question: [What are three widely used treatments for by Dr. David Corey @MIT](#)

Flashcards:

<http://www.quizover.com/flashcards/what-are-three-widely-used-treatments-for-by-dr-david-corey-mit?pdf=1505>

Interactive Question:

<http://www.quizover.com/question/what-are-three-widely-used-treatments-for-by-dr-david-corey-mit?pdf=1505>

4.1.26. What synaptic process or molecule is thought to be their target?

Author: David Corey

Bipolar disorder is often treated with drugs such as Prozac, Celexa, Zoloft, and imipramine.

While they apparently target synapses, an unusual feature of them is that they don't have much effect for the first 2-3 weeks. (4 pts)

What synaptic process or molecule is thought to be their target?

- They are SSRIs (selective serotonin reuptake inhibitors) and target SERT (Serotonin Reuptake Transporter).

Check the answer of this question online at QuizOver.com:

Question: [What synaptic process or molecule is thought Bipolar disorder often](#)

Flashcards:

<http://www.quizover.com/flashcards/what-synaptic-process-or-molecule-is-thought-bipolar-disorder-often?pdf=1505>

Interactive Question:

<http://www.quizover.com/question/what-synaptic-process-or-molecule-is-thought-bipolar-disorder-often?pdf=1505>

4.1.27. What new hypothesis for their action would explain the delay in eff...

Author: David Corey

Bipolar disorder is often treated with drugs such as Prozac, Celexa, Zoloft, and imipramine.

While they apparently target synapses, an unusual feature of them is that they don't have much effect for the first 2-3 weeks. (4 pts)

What new hypothesis for their action would explain the delay in efficacy?

- It is thought that they may stimulate neurogenesis through stem cell differentiation

Check the answer of this question online at QuizOver.com:

Question: [What new hypothesis for their action would Bipolar disorder is often](#)

Flashcards:

<http://www.quizover.com/flashcards/what-new-hypothesis-for-their-action-would-bipolar-disorder-is-often?pdf=1505>

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