Chapter 13: Learning and Memory

The Nature of Learning

Four Principal Types of Learning

Two Principal Types of Memory

Memory Consolidation

Synaptic Plasticity

- Electrophysiological mechanisms
- Biochemical mechanisms

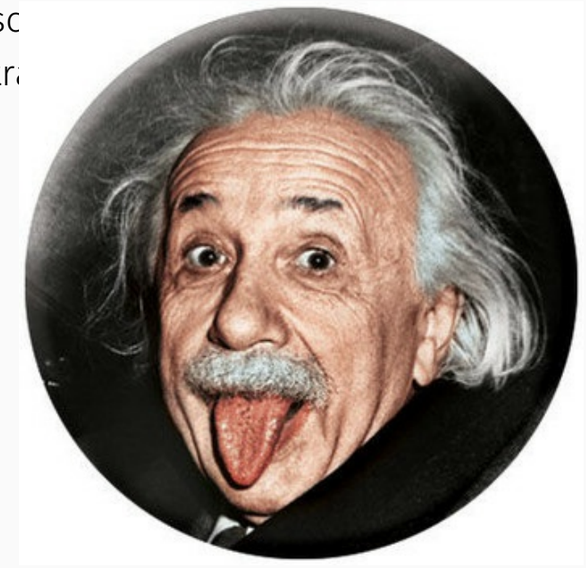
Neurobiological Mechanisms

Disorders

Neurobiological Mechanisms

Perceptual Learning - Vision.

- ventral stream encodes perceptual disc
- recognition requires activation of ventra



Neurobiological Mechanisms

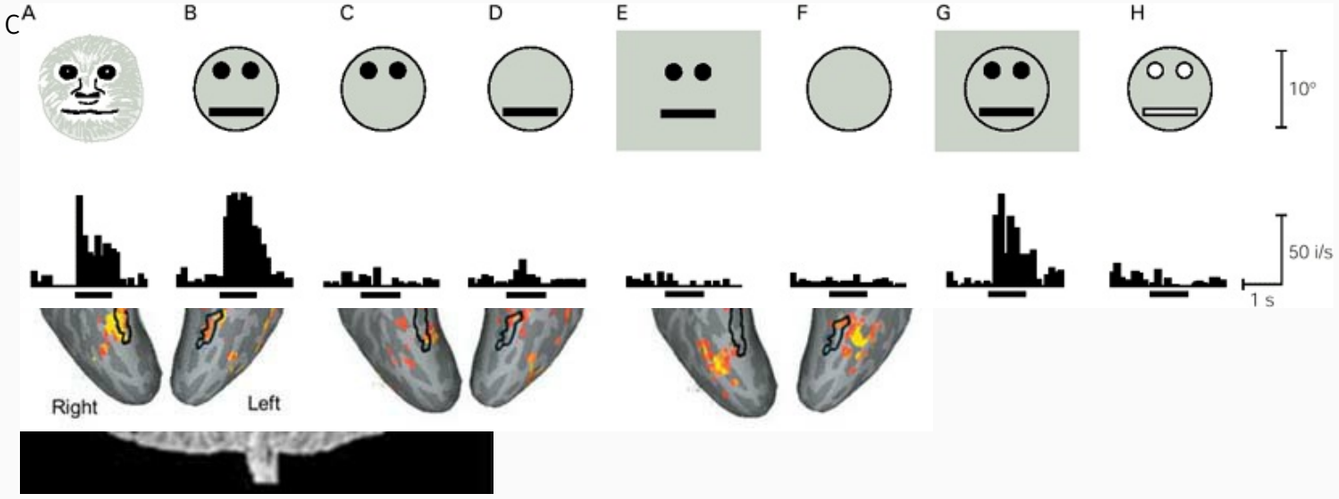
Perceptual Learning - Vision.

- ventral stream encodes perceptual discrimination
- recognition requires activation of ventral stre

Neurobiological Mechanisms

Perceptual Learning - Vision.

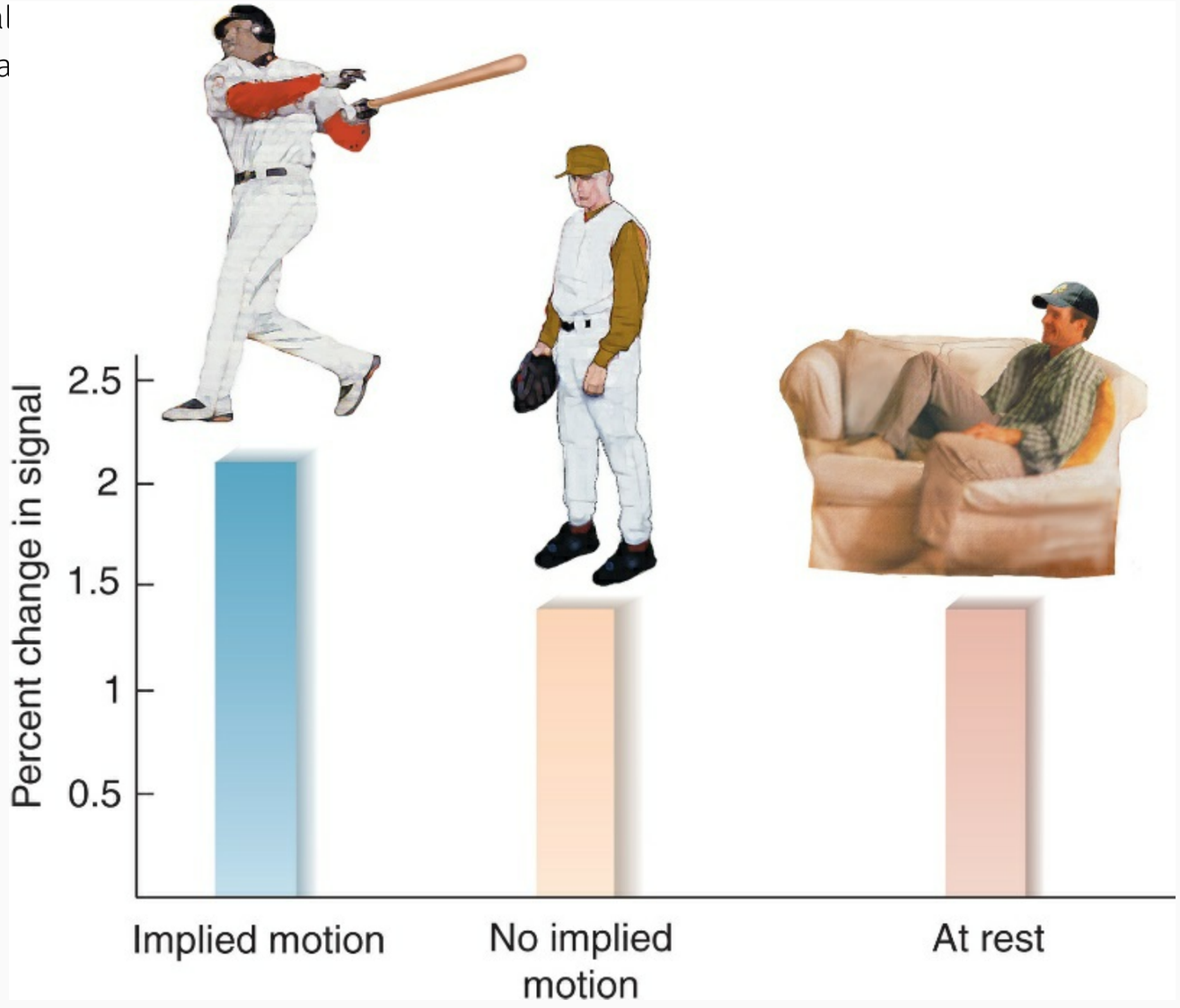
- inferotemporal and parahippocampal c



Neurobiological Mechanisms

Perceptual Learning - Vision.

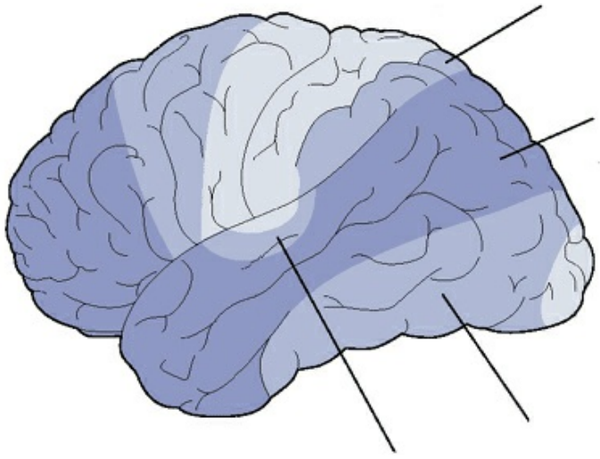
- dorsal stream encodes perceptual local
- recognition requires activation of dorsa



Neurobiological Mechanisms

Perceptual Learning - Audition, Somatosensation...

- recall of auditory information activates
- recall of somatosensory, olfactory, gust

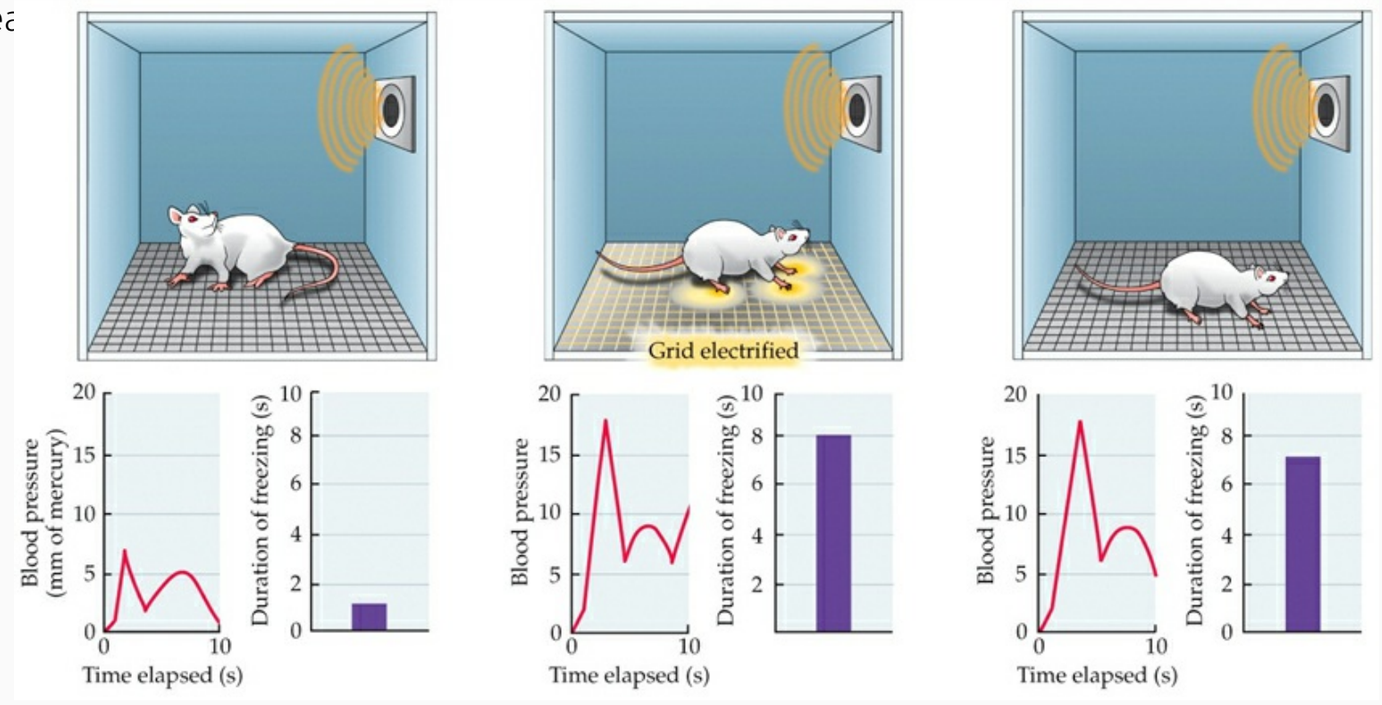


on cortices

Neurobiological Mechanisms

S/R Learning - Classical Conditioning.

- convergence in emotional circuit for fea



Neurobiological Mechanisms

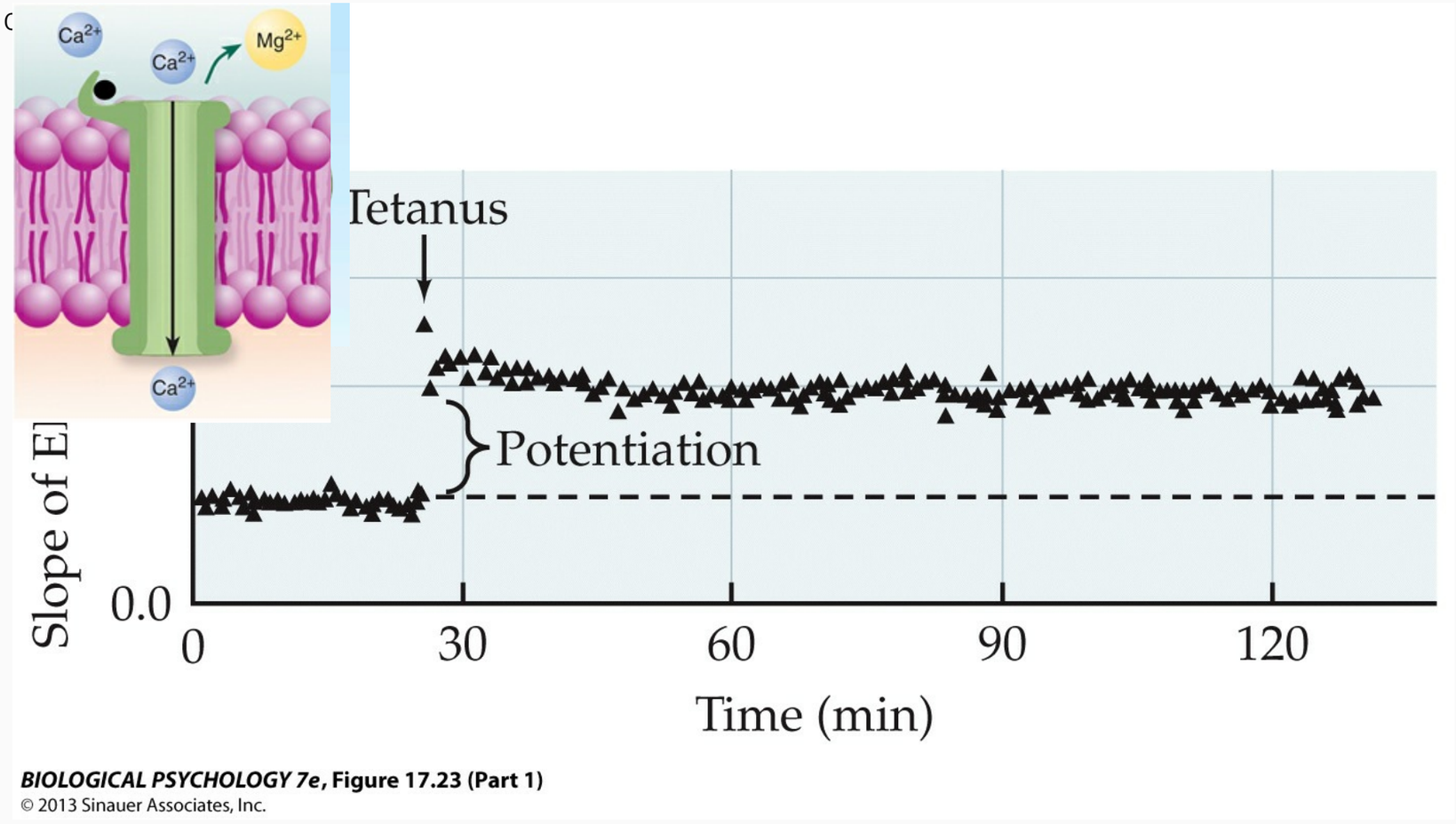
S/R Learning - Classical Conditioning.

- convergence in emotional circuit for fear conditioning

Neurobiological Mechanisms

S/R Learning - Classical Conditioning.

- NMDA receptor mediated potentiation c

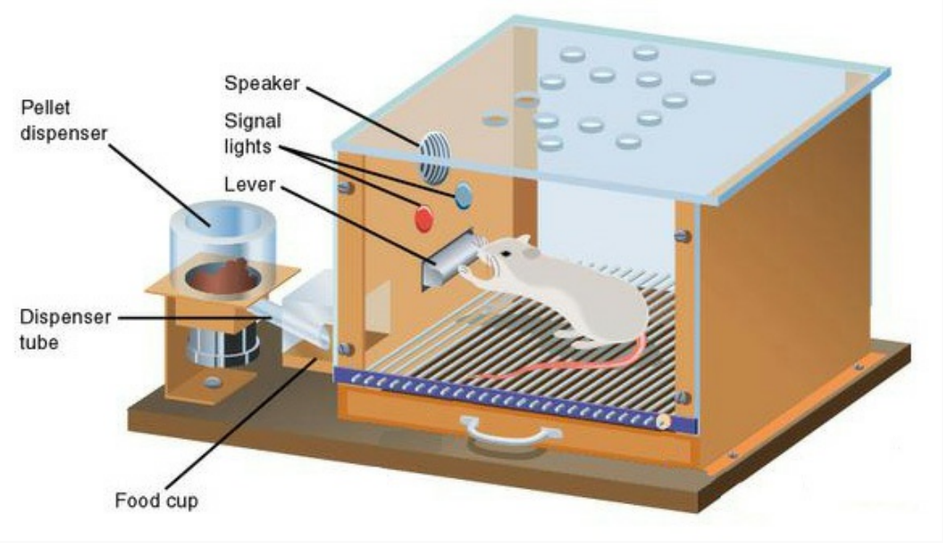


***BIOLOGICAL PSYCHOLOGY 7e*, Figure 17.23 (Part 1)**
© 2013 Sinauer Associates, Inc.

Neurobiological Mechanisms

S/R Learning - Operant Conditioning.

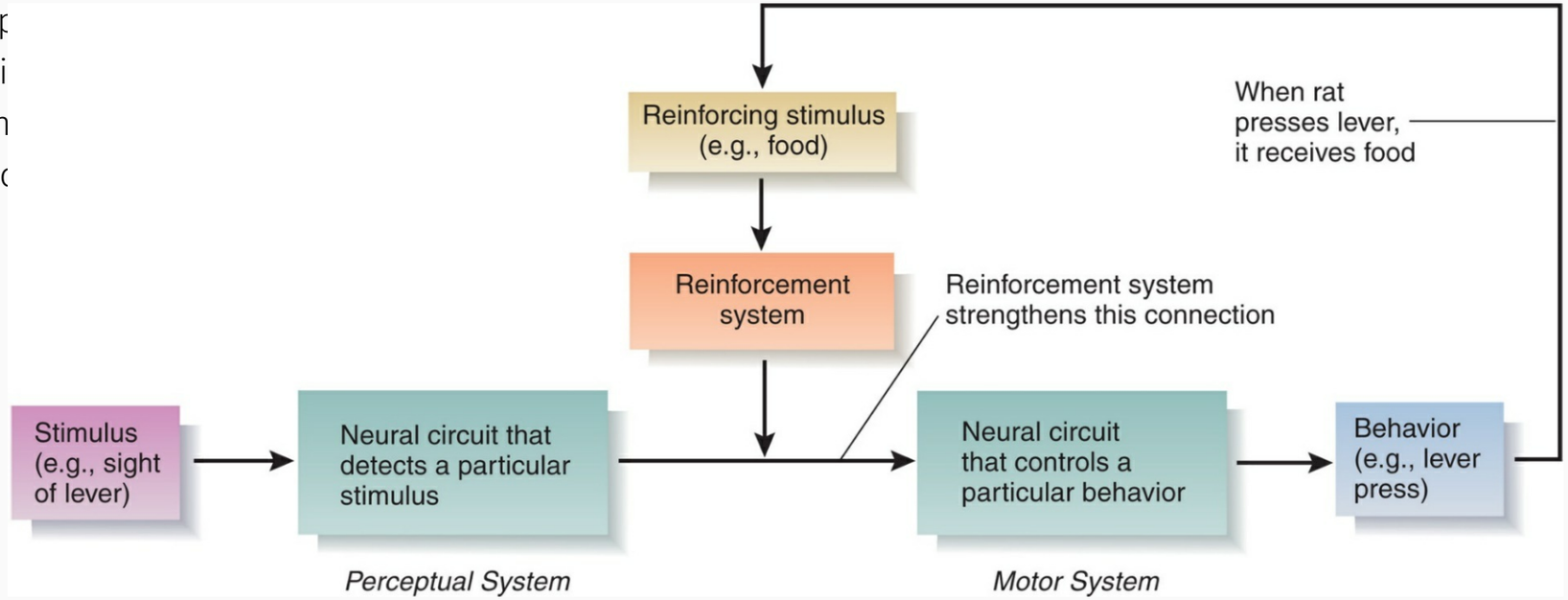
- convergence in sensorimotor connectio



Neurobiological Mechanisms

S/R Learning - Operant Conditioning.

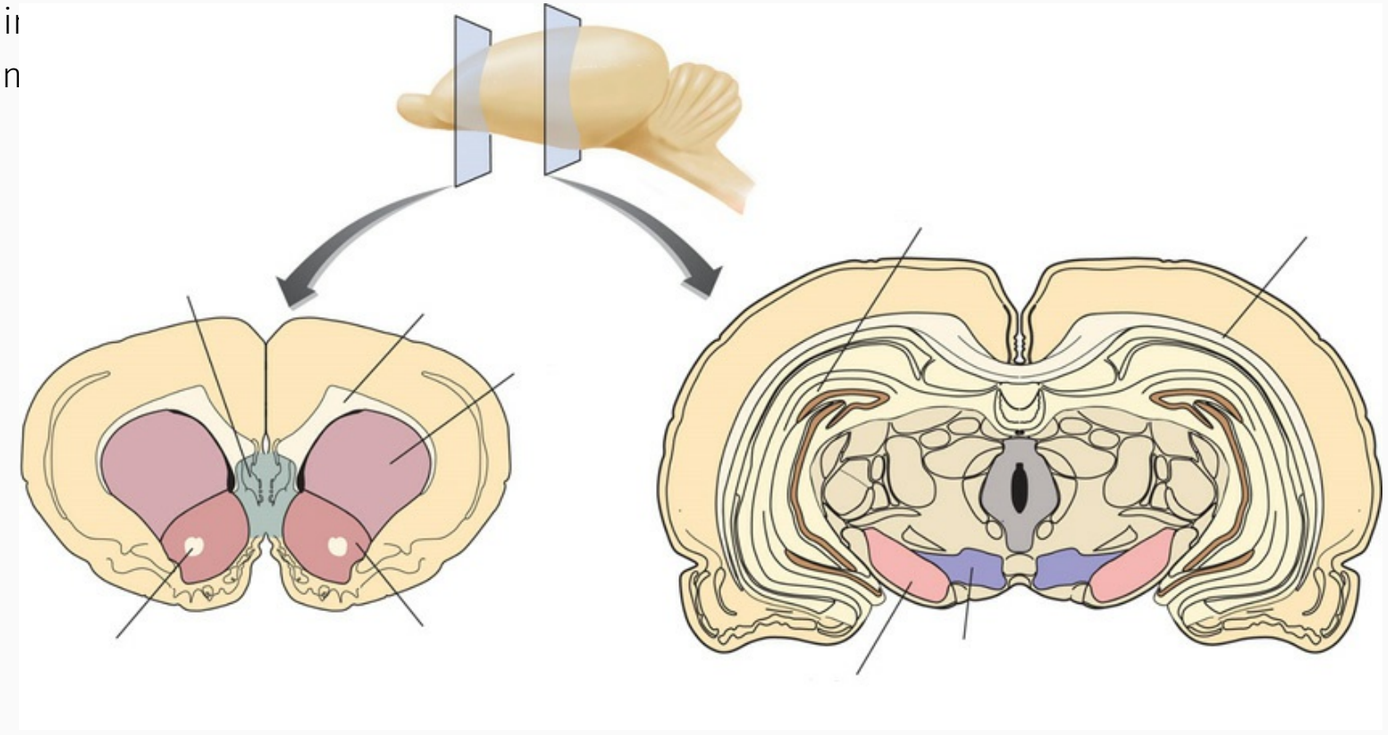
- already seen simple neural model of op
- behavioral response produces reinforci
- connection between stimulus condition
- dopaminergic neurotransmission implic



Neurobiological Mechanisms

S/R Learning - Operant Conditioning.

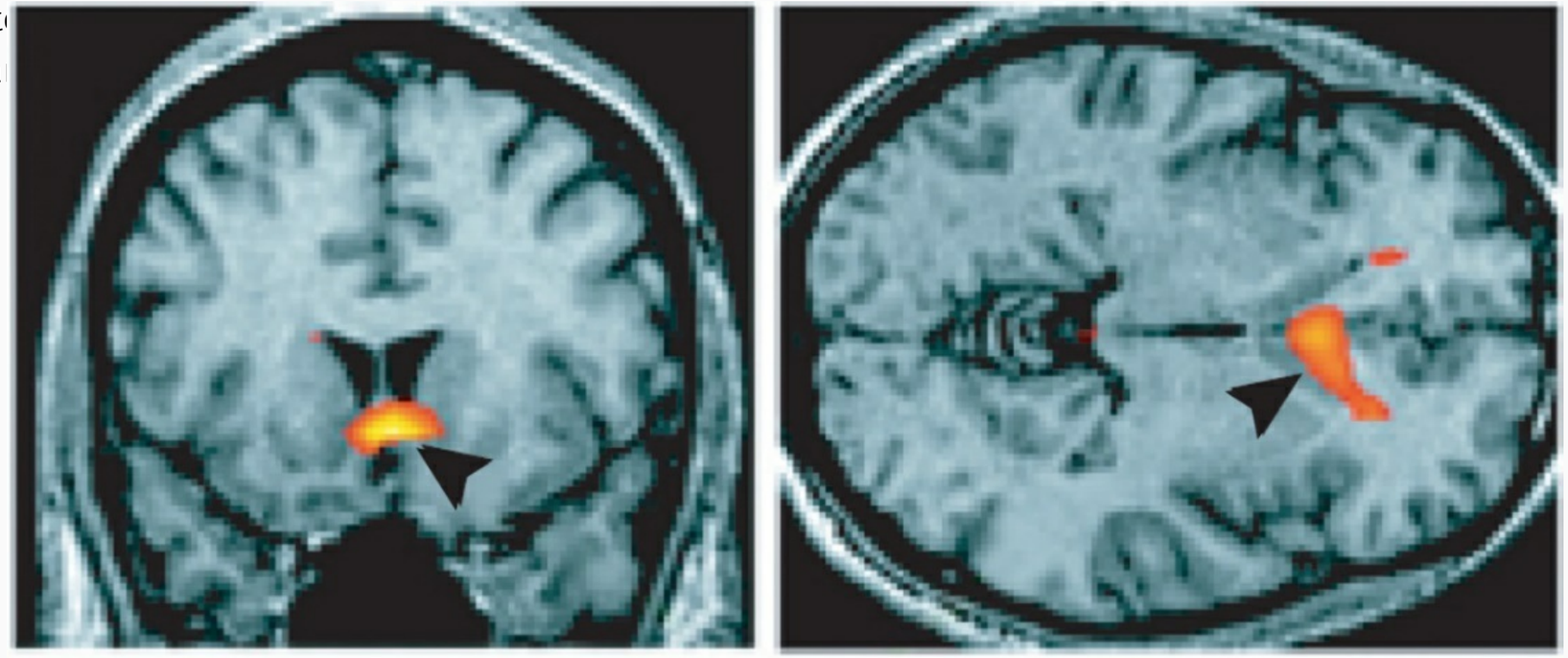
- mesocorticolimbic dopamine strongly i
- increased extracellular dopamine when



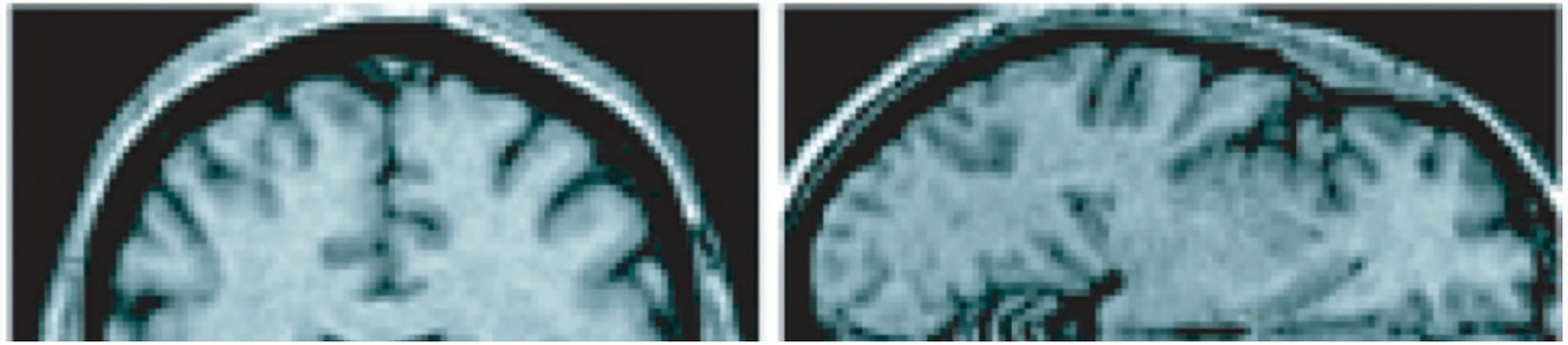
Neurobiological Mechanisms

S/R Learning - Operant Conditioning.

- dopaminergic system especially activat
- activity decreased when expected rewa



Unexpected reward



Neurobiological Mechanisms

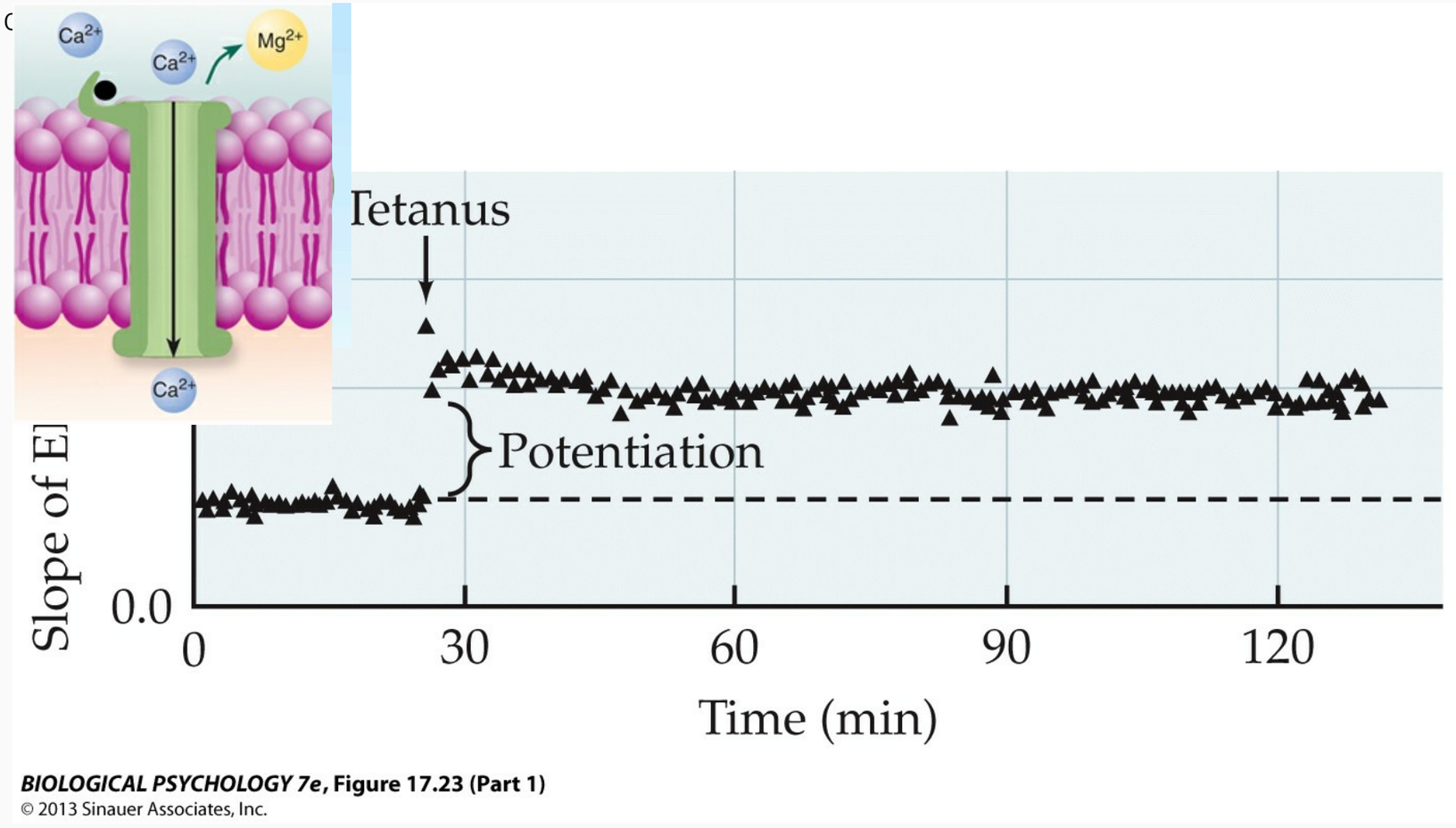
S/R Learning - Operant Conditioning.

- caudate-putamen receives input from all sensory cortices, and from premotor and motor cortices
- striatal outputs to globus pallidus
- pallidal outputs to thalamus
- thalamic outputs to motor cortices

Neurobiological Mechanisms

S/R Learning - Operant Conditioning.

- NMDA receptor mediated potentiation c

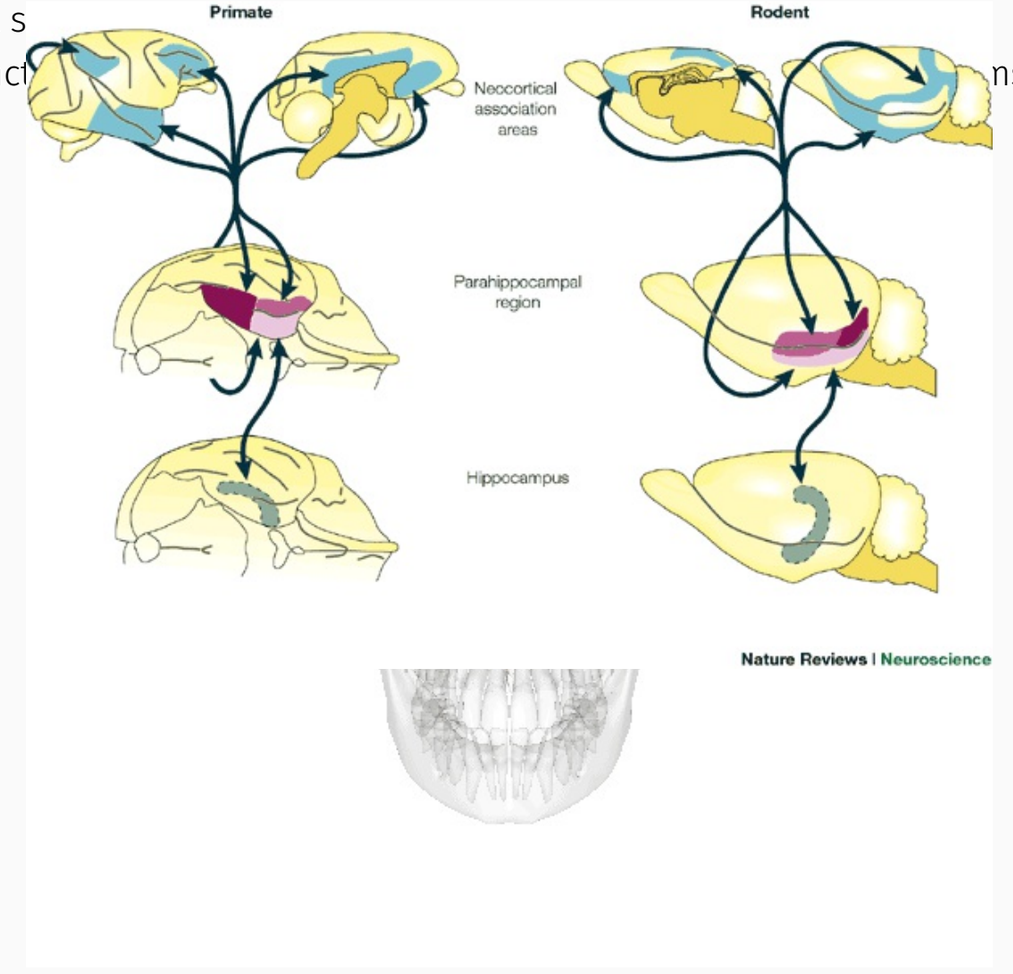


***BIOLOGICAL PSYCHOLOGY 7e*, Figure 17.23 (Part 1)**
© 2013 Sinauer Associates, Inc.

Neurobiological Mechanisms

Relational Learning.

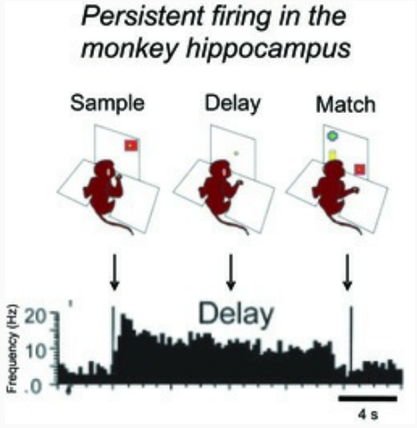
- hippocampus receives inputs from all s
- temporal cortex and hippocampal funct ns of declarative memory



Neurobiological Mechanisms

Perceptual Learning - Episodic Memory.

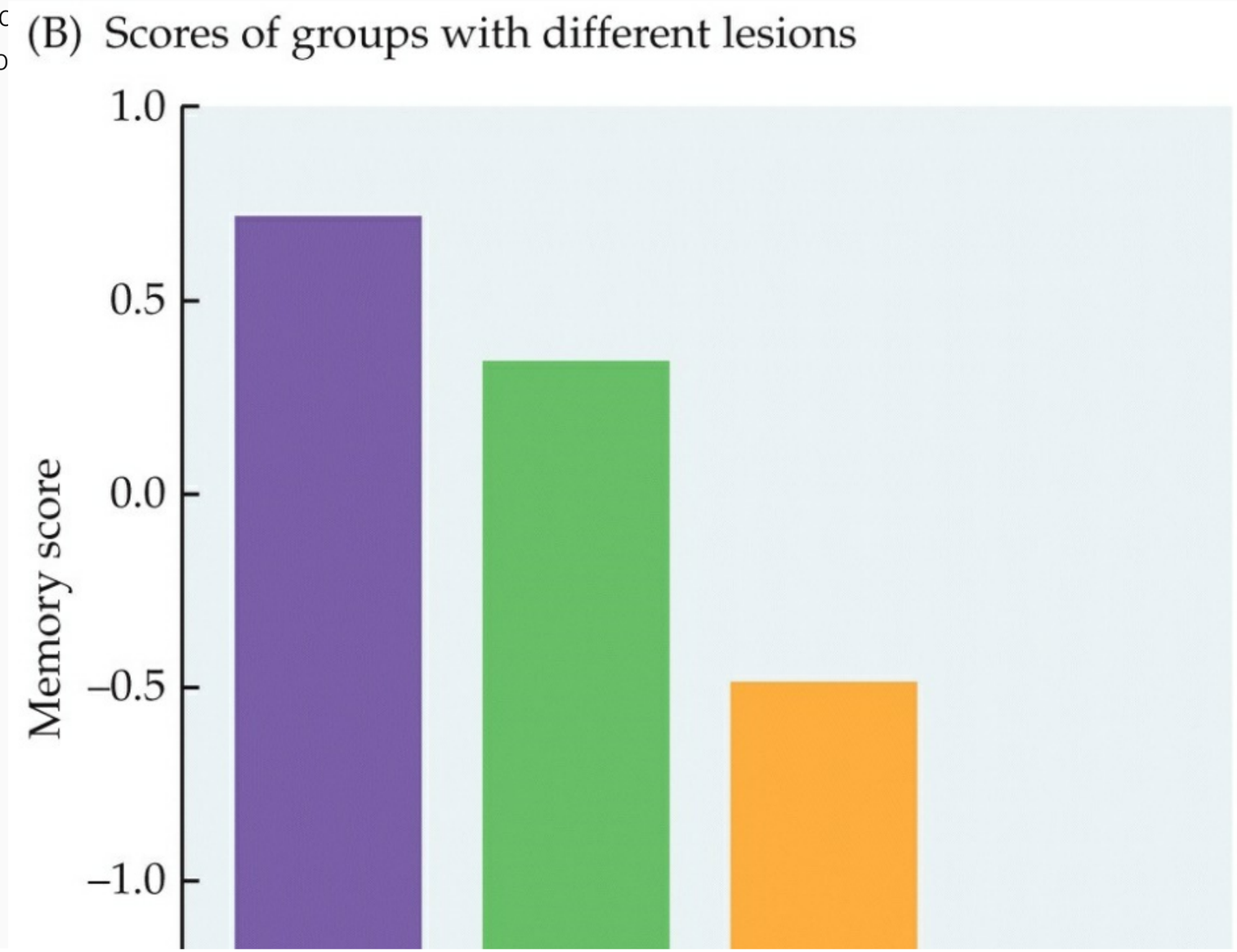
- delayed matching to sample
- delayed non-matching to sample
- parahippocampal place area



Neurobiological Mechanisms

Relational Learning - Episodic Memory.

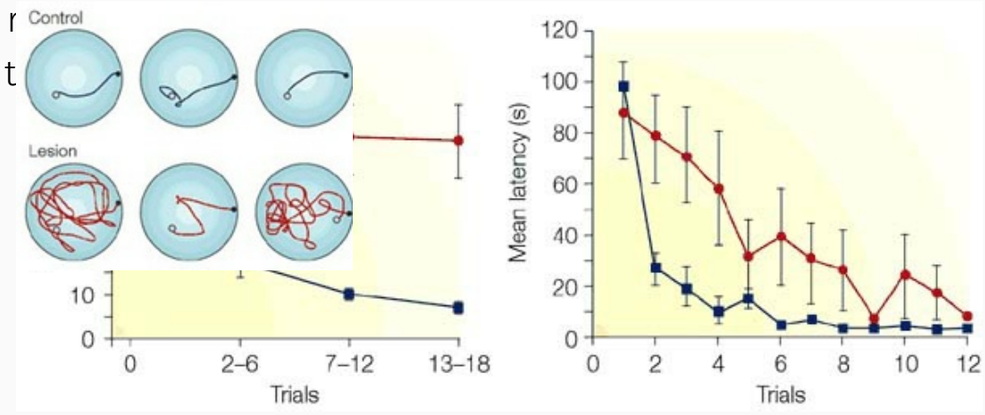
- monkeys impaired on delayed nonmatc
- greater deficits if entorhinal, parahippo



Neurobiological Mechanisms

Relational Learning - Spatial Relations.

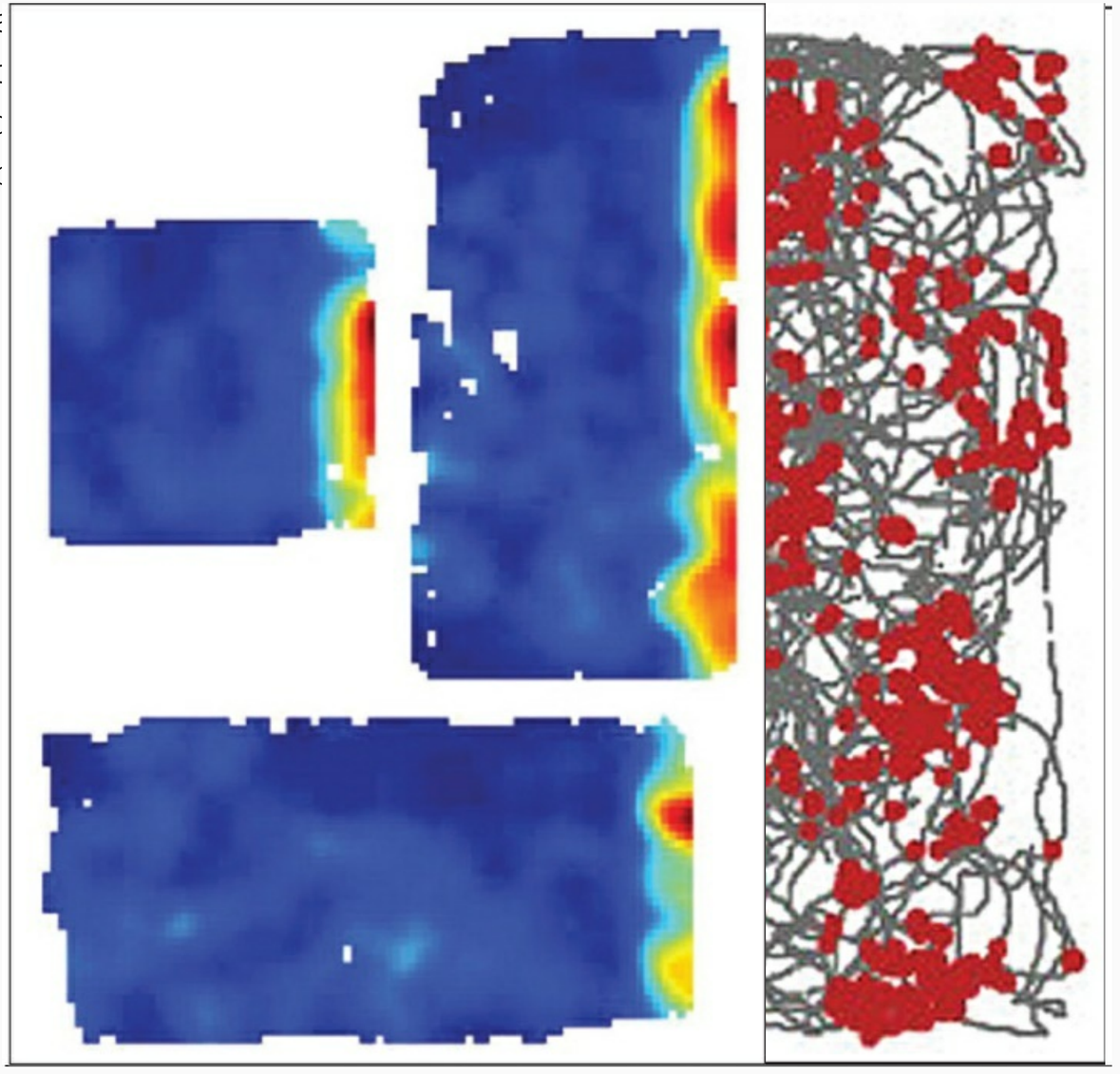
- during acquisition, intact rats improve r
- during probe trials, intact rats explore t



Neurobiological Mechanisms

Relational Learning - Spatial Relations.

- place cells fire when rat is in a particul
- grid cells fire when rat is in a grid of loc
- border cells fire when rat is near bounc
- head cells fire when rat is looking in a p



Neurobiological Mechanisms

Relational Learning - Spatial Relations.

- rats trained to run in alternating directions
- place cell activity predicted direction of turn

Neurobiological Mechanisms

Relational Learning - Consolidation and Reconsolidation.

- reconsolidation is active restructuring of memory
- short-term memory is disrupted by ECS
- long-term memory is not affected by ECS
- reconsolidation of long-term memory is disrupted by ECS

Neurobiological Mechanisms

Relational Learning - Consolidation and Reconsolidation.

- reconsolidation requires protein synthe

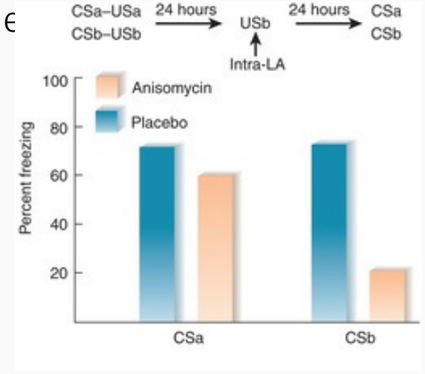


Image Credits

- slide 2: http://upload.wikimedia.org/wikipedia/commons/4/4e/Fusiform_gyrus_animation.gif Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing. http://businetjournal.com/wp-content/uploads/2014/11/1340274706_8029_Einstein.jpg
- slide 3: http://sweetclipart.com/multisite/sweetclipart/files/lamp_red_beige.png http://cliparts.co/cliparts/pcq/Kd9/pcqKd9nRi.png http://icons.iconarchive.com/icons/iconshock/real-vista-medical/256/microscope-icon.png http://www.clker.com/cliparts/8/a/3/1/11971072064000363 09metalmarious_Laptop.svg.hi.png
- slide 4: Kandel, E.R., Schwartz, J.H., Jessell, T.M., Seigelbaum, S.A., and Hudspeth, A.J. (2012). Principles of Neural Science, 5th ed. McGraw-Hill Professional. http://www.autism-center.ucsd.edu/what-causes-autism/PublishingImages/face_activation.jpg http://www.nature.com/neuro/journal/v7/n5/images/nn1224-F6.jpg
- slide 5: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing.
- slide 6: Kandel, E.R., Schwartz, J.H., Jessell, T.M., Seigelbaum, S.A., and Hudspeth, A.J. (2012). Principles of Neural Science, 5th ed. McGraw-Hill Professional.
- slide 7: http://www.mindsmachine.com/asf/11/11.01.01.jpg
- slide 8: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing.
- slide 9: http://o.quizlet.com/FUOS6IJbPRjqKVs5.PlGOw_m.png Breedlove, S.M., Watson, N.V. (2013). Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience, 7th ed. Sinauer Associates, Inc.

Image Credits

- slide 10: http://cdn-5.simplypsychology.org/skinner box.jpg
- slide 11-12: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing.
- slide 13: http://www.jneurosci.org/content/21/8/2793/F3.small.gif
- slide 14: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing.
- slide 15: http://o.quizlet.com/FUOS6IJbPRjqKVs5.PlGOw_m.png Breedlove, S.M., Watson, N.V. (2013). Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience, 7th ed. Sinauer Associates, Inc.
- slide 16: http://upload.wikimedia.org/wikipedia/commons/9/99/Hippocampus.gif http://www.nature.com/nrn/journal/v1/n1/images/nrn1000_041a_f1.gif
- slide 17: Breedlove, S.M., Watson, N.V. (2013). Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience, 7th ed. Sinauer Associates, Inc. http://www.frontiersin.org/files/Articles/21020/fncir-06-00010-HTML/image_m/fncir-06-00010-g004.jpg
- slide 18-19: Breedlove, S.M., Watson, N.V. (2013). Biological Psychology: An Introduction to Behavioral, Cognitive, and Clinical Neuroscience, 7th ed. Sinauer Associates, Inc.
- slide 20-23: Carlson, N.R. (2012). Physiology of Behavior, 11th ed. Pearson Publishing.