

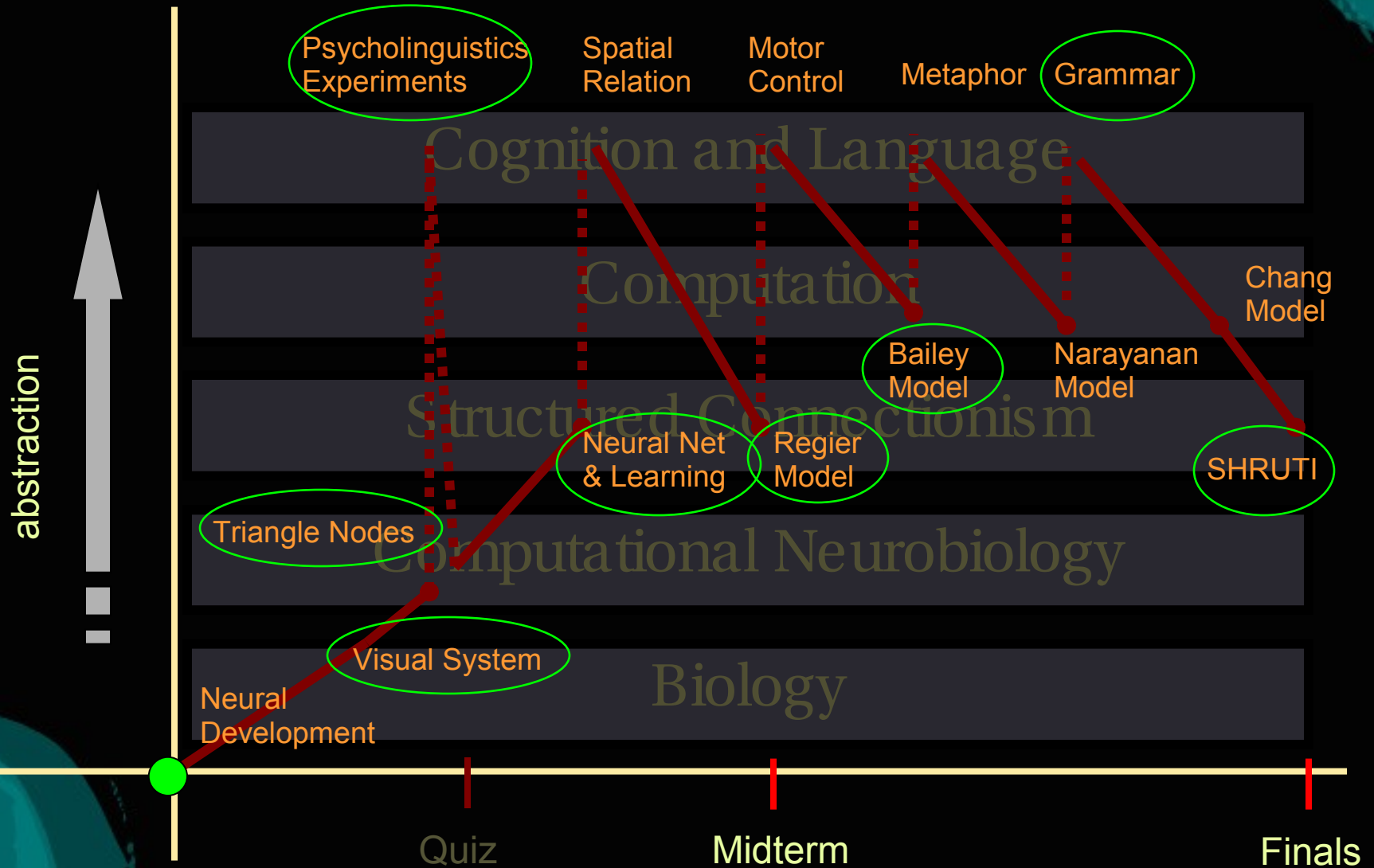
Announcements

- a3 is out, due 2/13 and 2/22 11:59pm
- Computational: part 1 isn't too hard; part 2 is harder
- quiz will be graded in about a week.

Where we stand

- Last Week
 - Psych experiments
 - Imaging studies
 - Connectionist representation
- This Week
 - Learning
 - Backprop
- Coming up
 - Neurophysiology of color

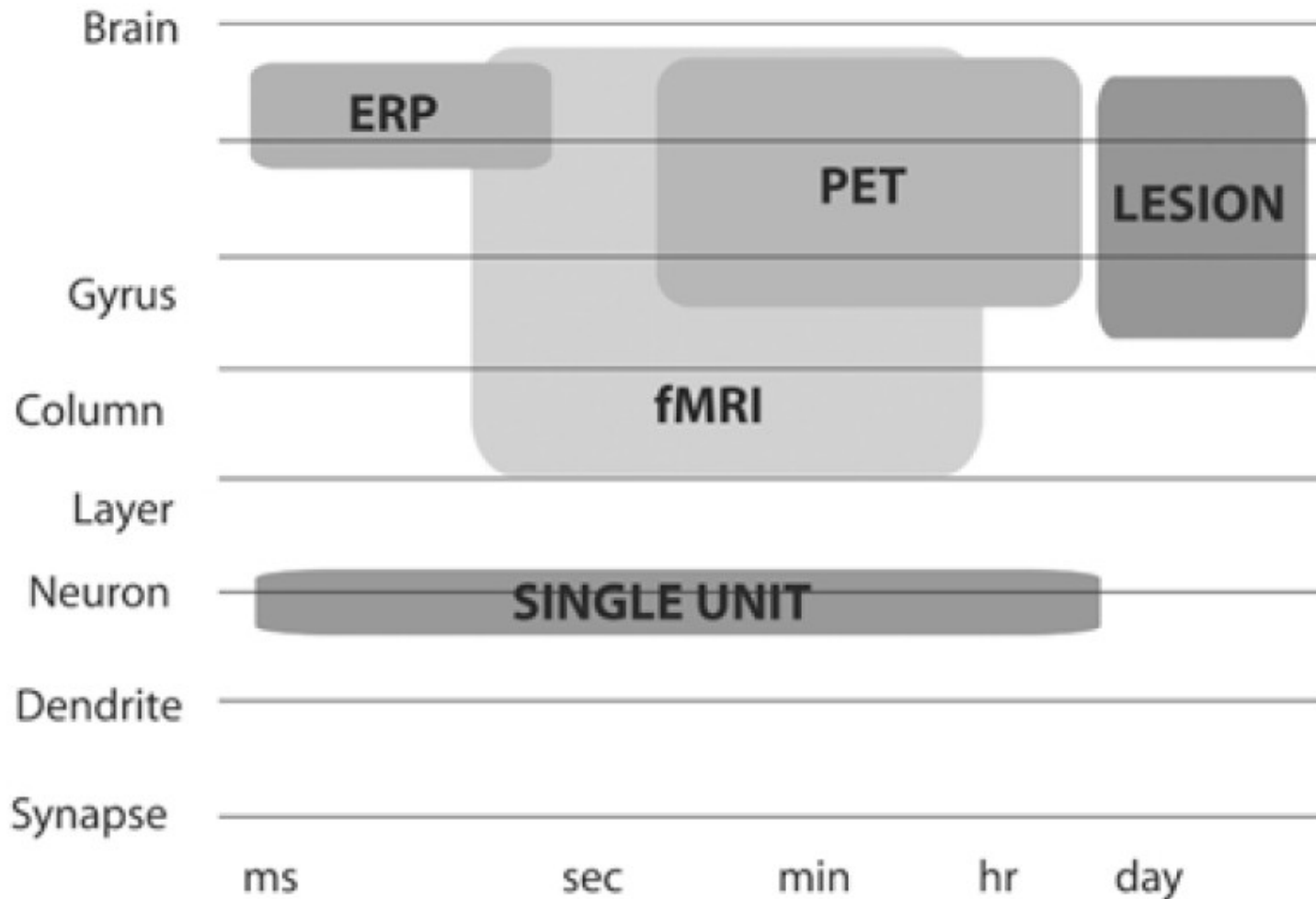
The Big (and complicated) Picture



Brain study techniques

- What is it, and how is it used?
 - lesion studies
 - PET
 - fMRI
 - single-unit recordings
 - EEG and MEG
 - EcoG
 - TMS

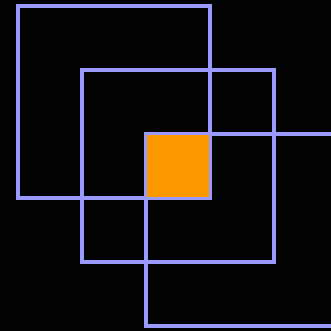
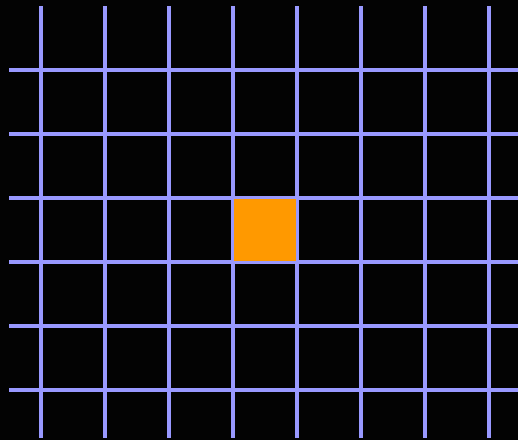
Spatial and Temporal Resolution



Representations

- What is a localist representation?
- What is a distributed representation?
- How many things can you represent with 4 neurons, in each representation?
- How many conjunctions of things can each represent?
- What is coarse coding?
- What is coarse-fine coding?

Coarse Coding

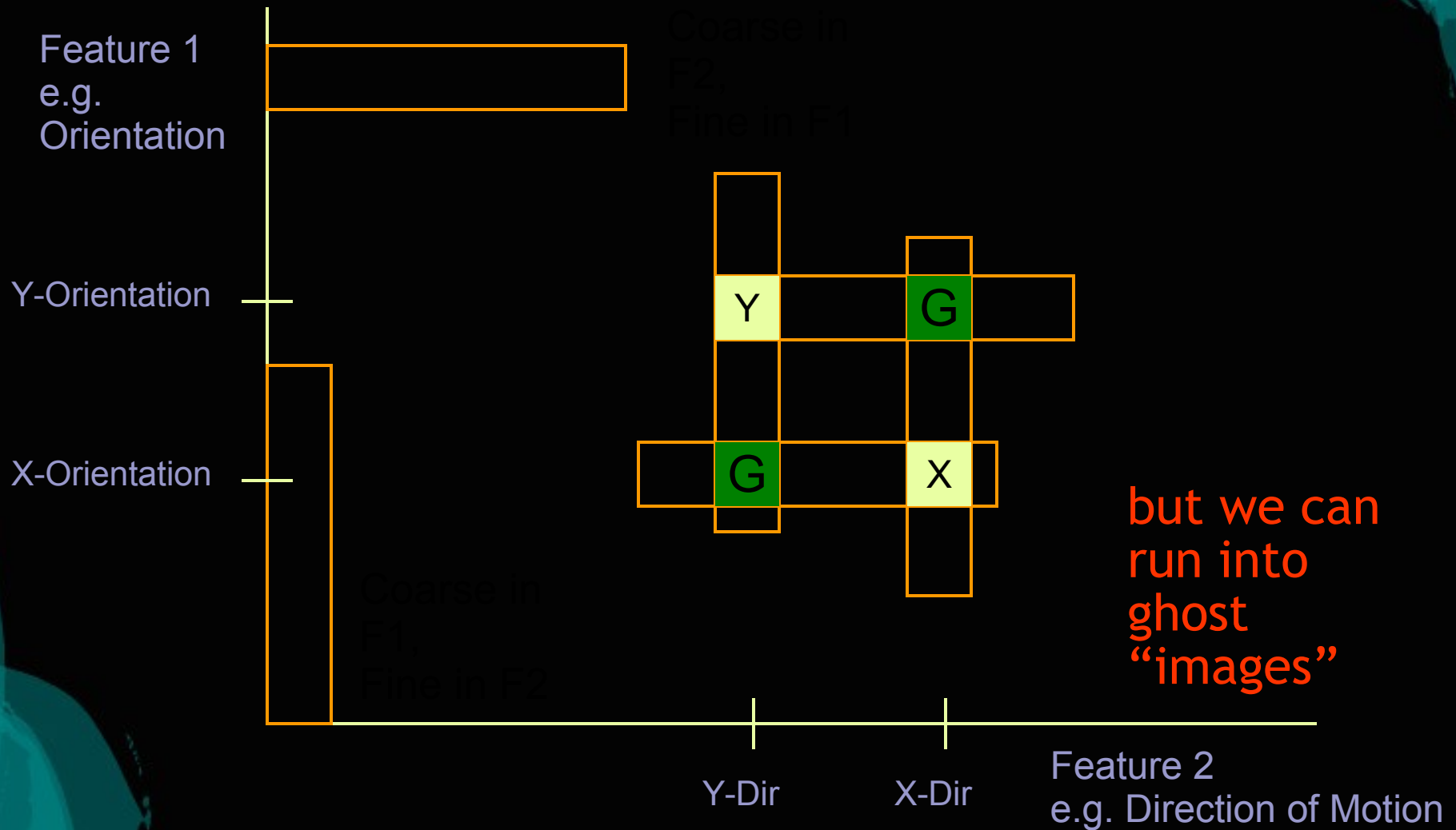


info you can encode with one fine resolution unit =

info you can with a few coarse resolution units

Now as long as we need fewer coarse units total,
we're good

Coarse-Fine Coding



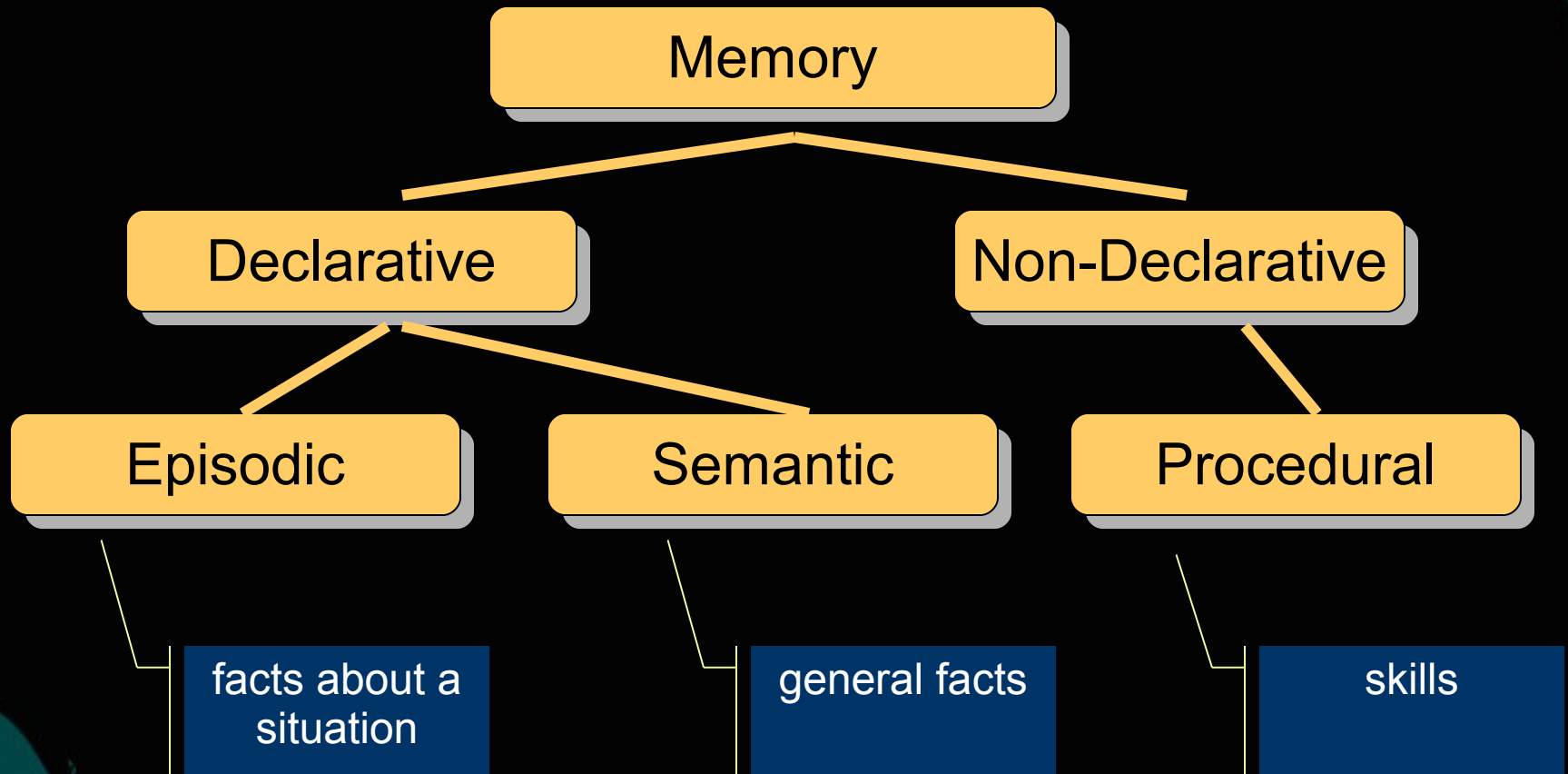
Biological memory

1. Into what categories do people divide memory?

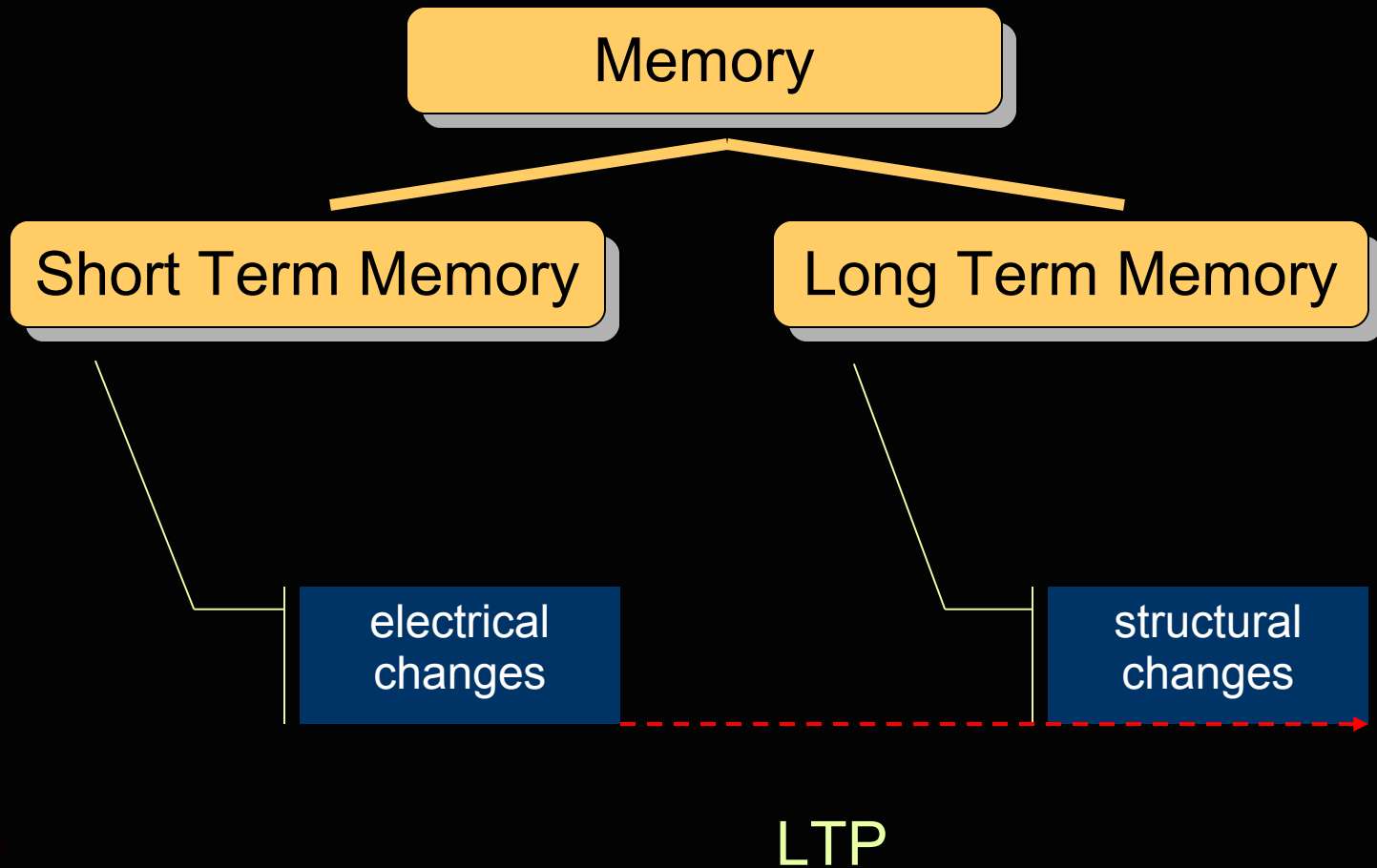
Long term versus short term versus working

Skill versus declarative (semantic and episodic)

Two ways of looking at memory:



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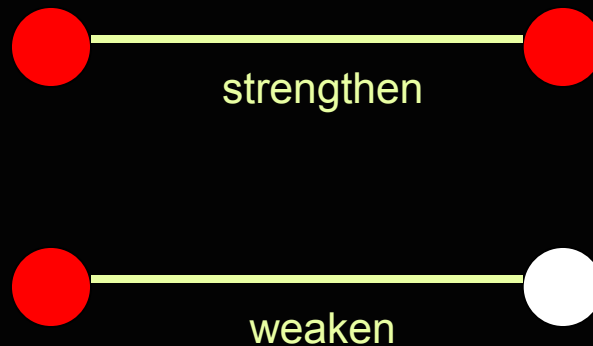


Biological learning

1. What is retrograde messaging?
2. What is the biological mechanism for short-term memory? Long-term memory?

LTP and Hebb's Rule

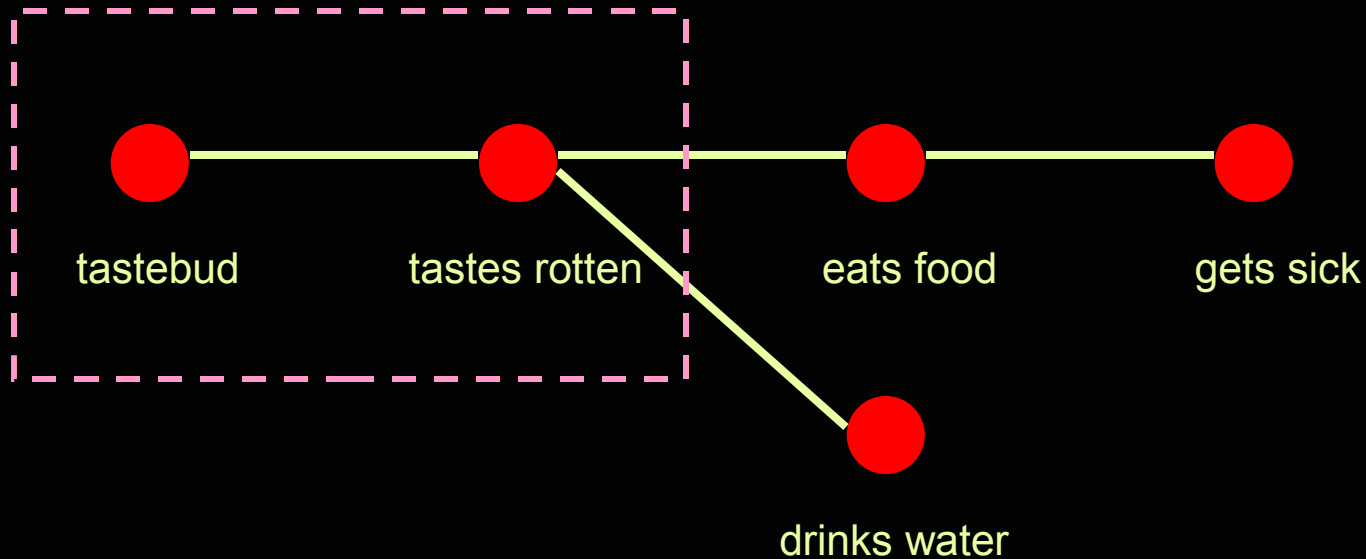
- Hebb's Rule:
neurons that fire together wire together



- Long Term Potentiation (LTP) is the biological basis of Hebb's Rule
- Calcium channels are the key mechanism

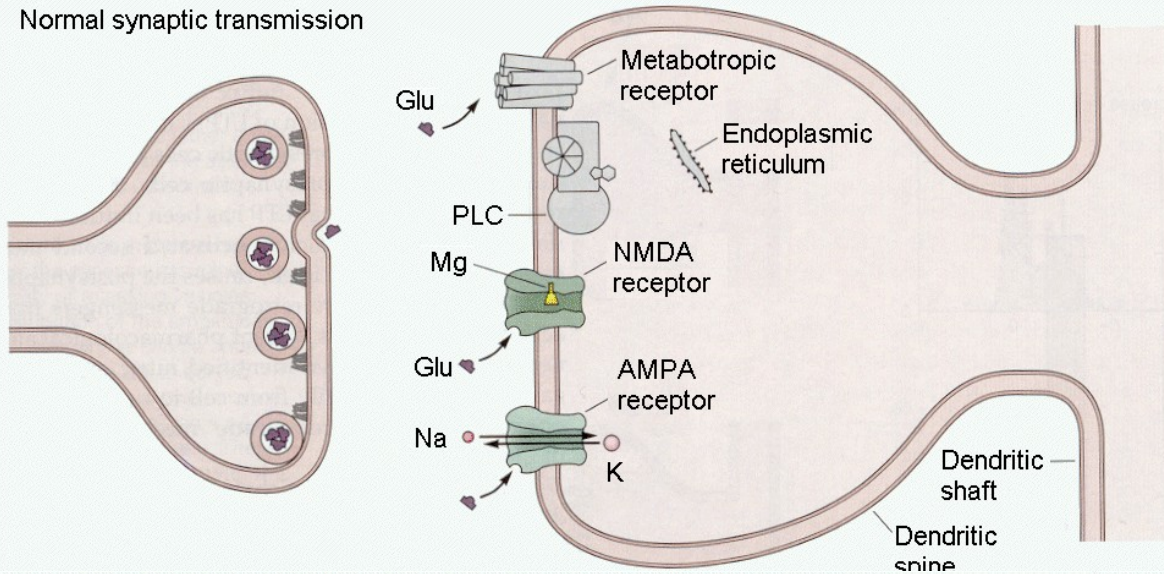
Why is Hebb's rule incomplete?

- here's a contrived example:



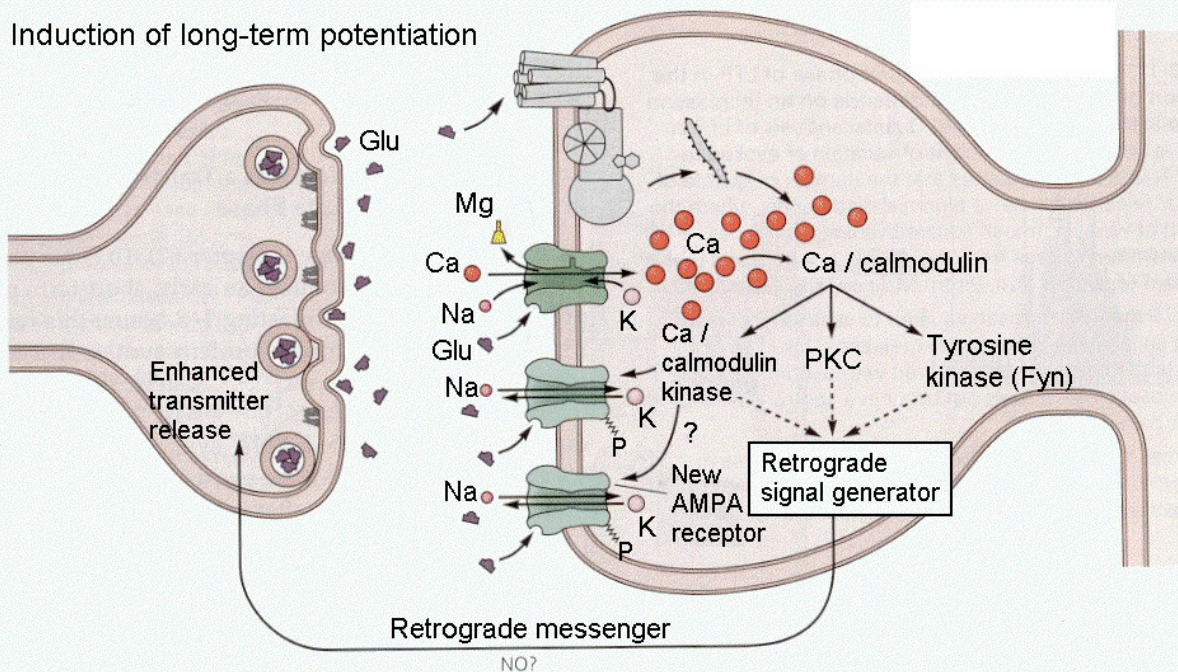
- should you “punish” all the connections?

Normal synaptic transmission



During normal low-frequency transmission, glutamate interacts with NMDA and non-NMDA (AMPA) and metabotropic receptors.

Induction of long-term potentiation



With high-frequency stimulation, Calcium comes in

Recruitment learning

- What is recruitment learning?
- Why do we need it in our story?
- How does it relate to triangle nodes?

Models of Learning

- Hebbian ~ coincidence
- Recruitment ~ one trial
- Supervised ~ correction (backprop)
- Reinforcement ~ delayed reward
- Unsupervised ~ similarity