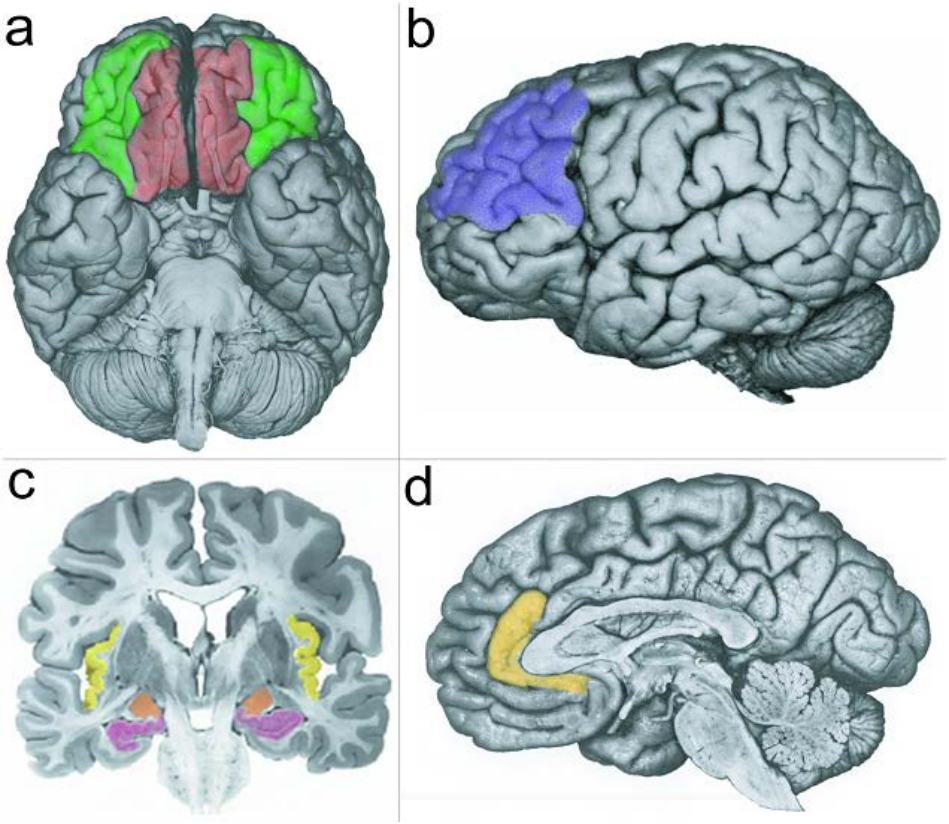
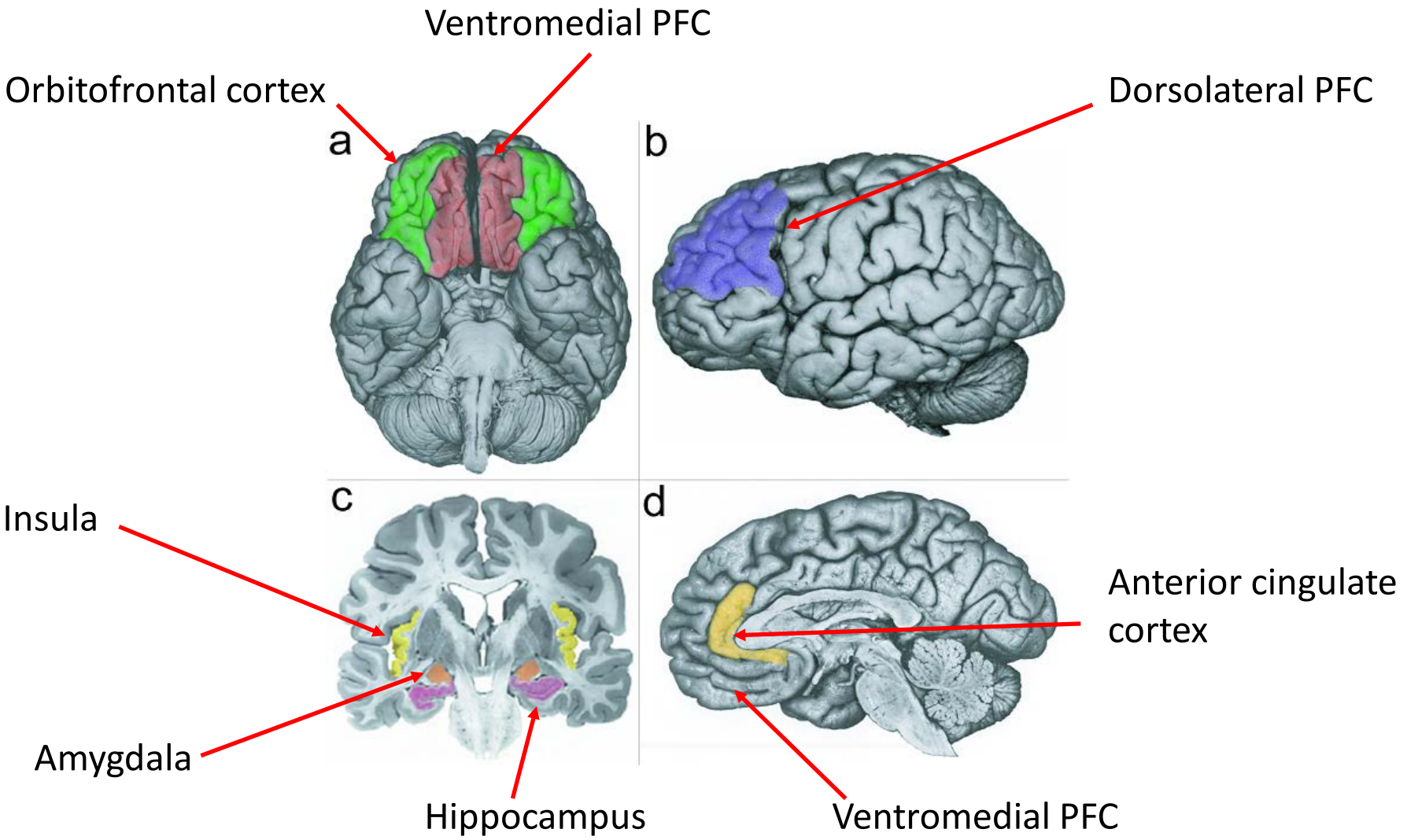
Neural Circuitry, Neuroplasticity, and Treatment of Depression

- Review: neural anatomy associated with emotion
- Neuroplasticity & treatment for depression
- Example: Prefrontal-amygdala circuit
- How to use this knowledge to inform our treatment strategies?
- How to make this knowledge useful to our patients?

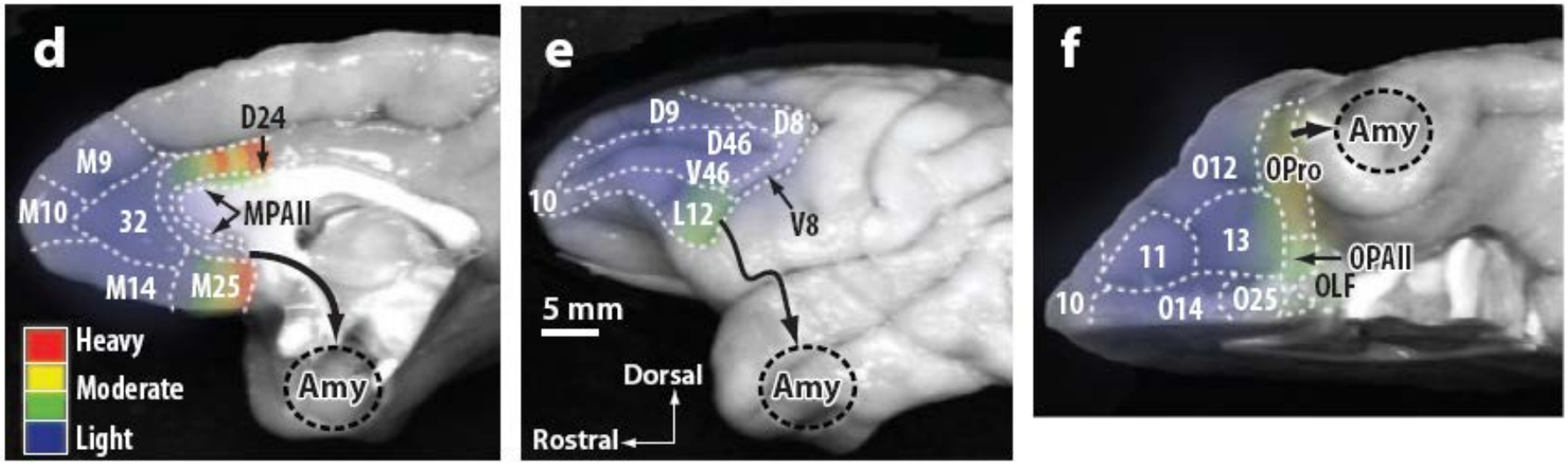
Quiz:
Functional Neuroanatomy of Emotion



Functional Neuroanatomy of Emotion

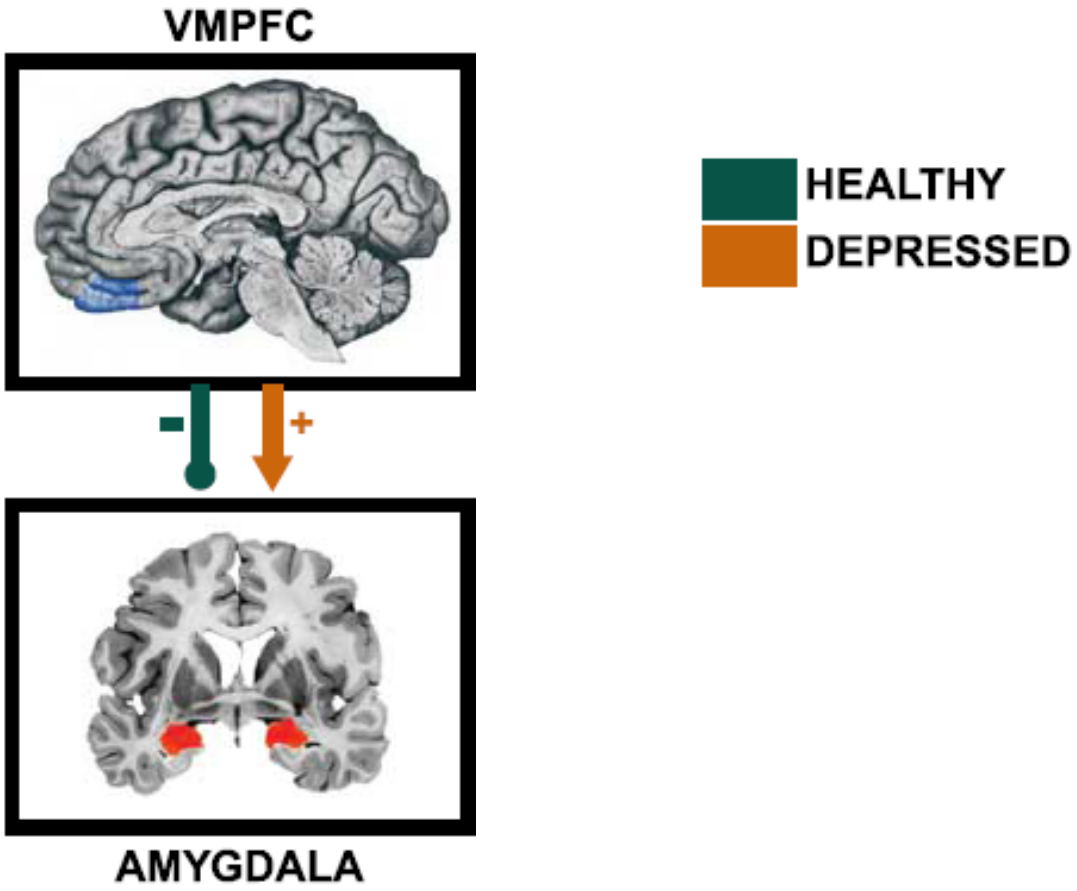


Anatomical projections from PFC to amygdala in rhesus monkeys



Ghashghaei, HT (2007) Neuroimage.
Also see Salzman & Fusi (2010) Annual Review Neurosci.

Loosening of regulatory control of PFC over amygdala



Johnstone et al. (2007) *J Neuroscience*.

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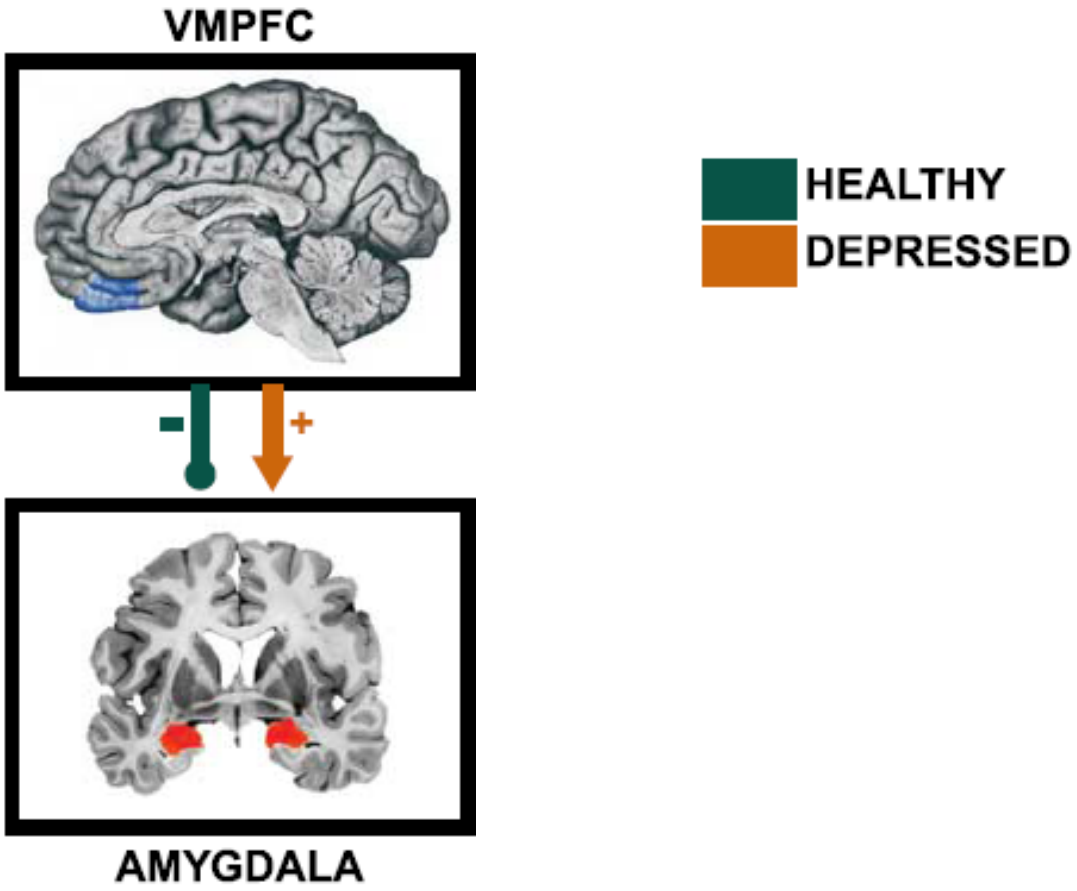
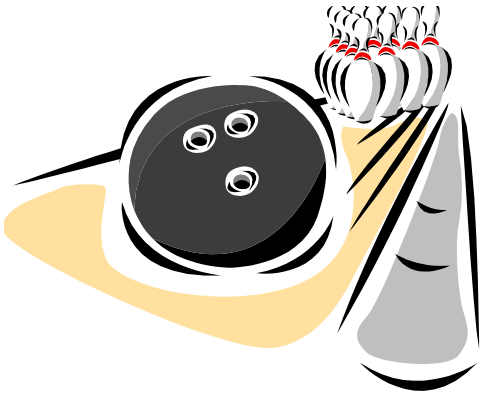


Johnstone et al. (2007) *J Neuroscience*.

Depressogenic cognition: voluntary or involuntary?

- Negatively self-focused thoughts
- Rumination
- Difficulty with cognitive reappraisal & emotion regulation
- Negative cognitive bias
  - Interpretation bias
  - Memory bias

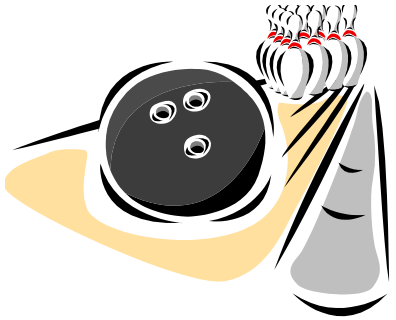
Depressogenic cognitions: The mental gutter



THIS WAS THE SECOND GIRL WHO TURNED ME DOWN. I WILL NEVER SUCCEED IN FINDING A GIRL!

Cognitive Behavioral Therapy: Practice & Repetition

- *1. Notice automatic thoughts and habits*
- *2. Self-validation*
- *3. Apply new skill*



Changing behavioral and *mental* habits requires PRACTICE

- Insight re: the automatic thought or habit is not particularly useful unless the new skill is practiced repeatedly

Practice & Repetition

- Behavior-induced structural brain changes occur
- Building new neural circuits requires REPETITION of the new behavior
- “Behavior” refers to thought as well as action
- Does this apply to CBT?

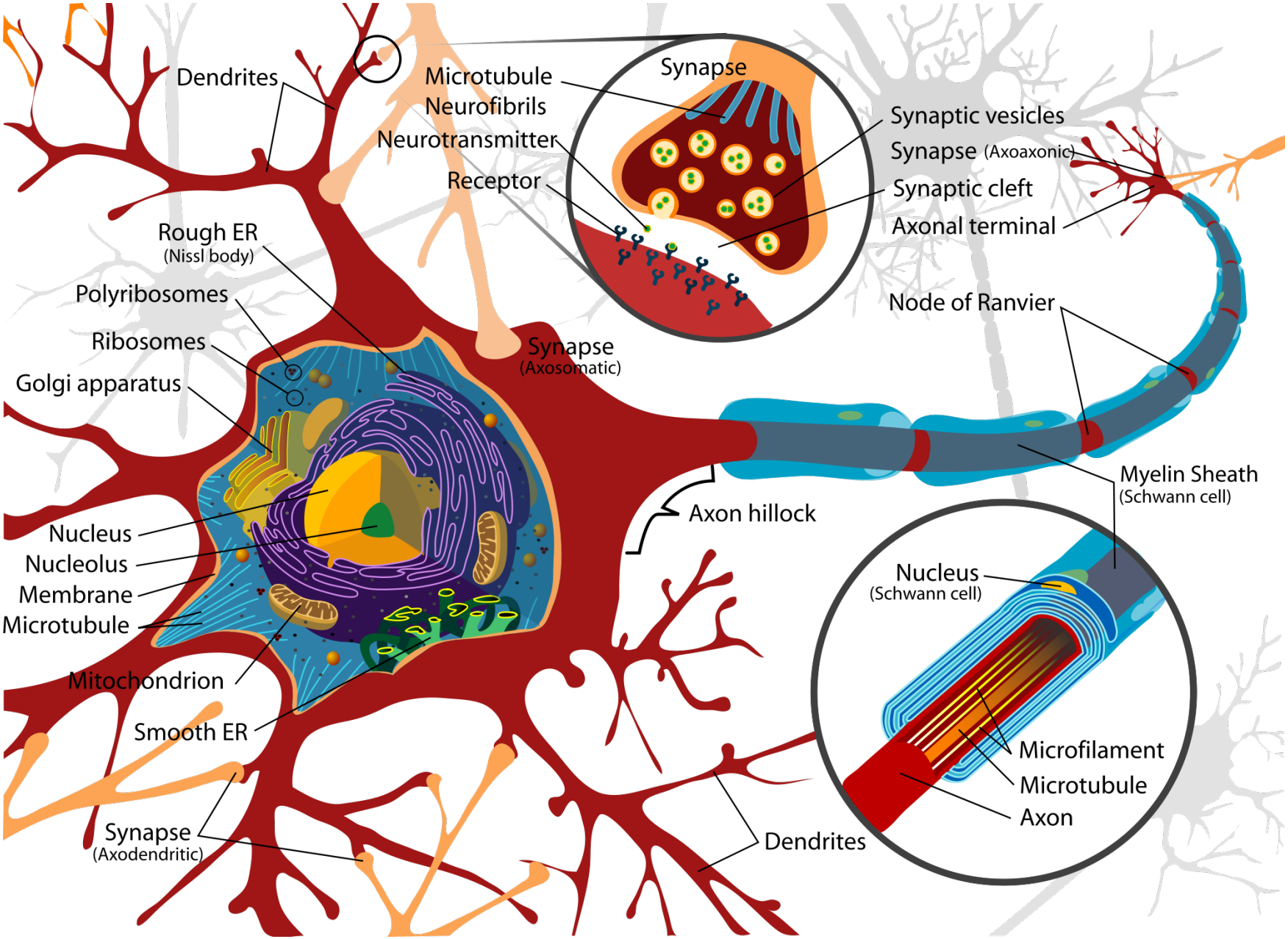
“The joint use of pharmacological and psychotherapeutic interventions might be especially successful because of a potentially interactive and synergistic—not only additive—effect of the two interventions.

Psychopharmacological treatment may help consolidate the biological changes caused by psychotherapy.”

Eric R. Kandel, M.D., 1998

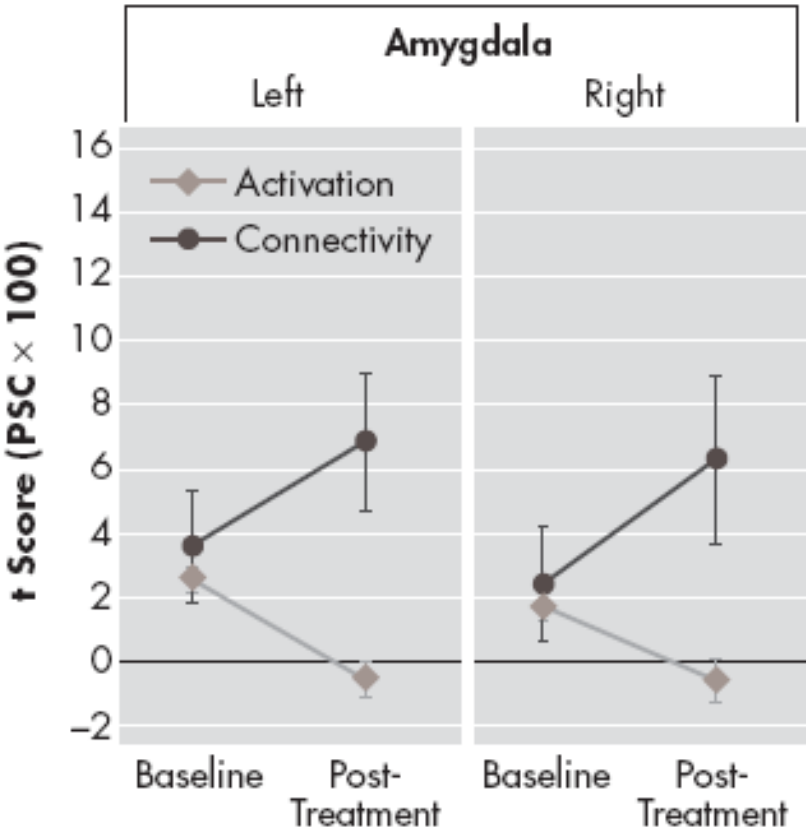
Treatment modalities for depression stimulate neuroplastic mechanisms

- Psychotherapy
- Antidepressant medications
- Somatic & neuromodulatory techniques
  - electroconvulsive therapy
  - deep brain stimulation
- Other
  - physical exercise
  - omega 3 fatty acids



From: http://en.wikipedia.org/wiki/Activity-dependent_plasticity

Increase in PFC-amygdala functional connectivity with 6 wks sertraline



Anand, et al. (2007) *J Neuropsychiatry & Clin Neurosci*.

Therapeutic learning in depression

- Effective antidepressants stimulate neuroplastic mechanisms

- Biologically-informed behavioral interventions
  - Promote therapeutic learning
  - “Sculpt” neural circuits
  - Importance of practice and repetition