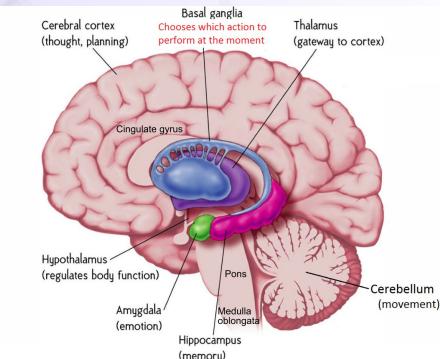


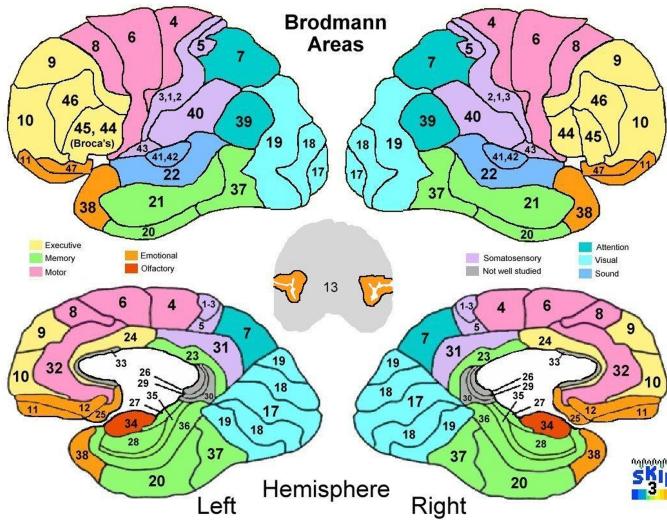
Brain Areas

Computational Cognitive Neuroscience
Randall O'Reilly

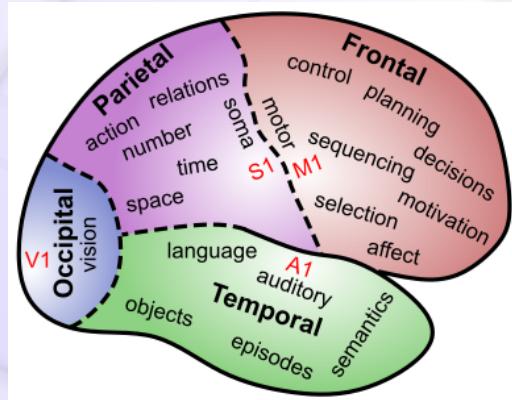
Gross Anatomy



2

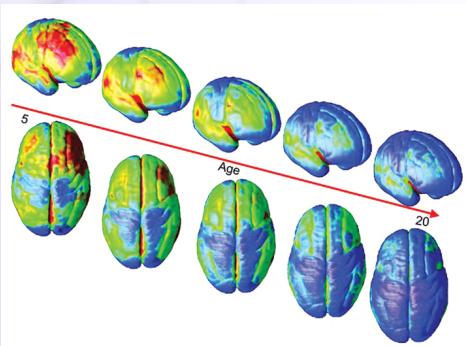


Lobular Functions



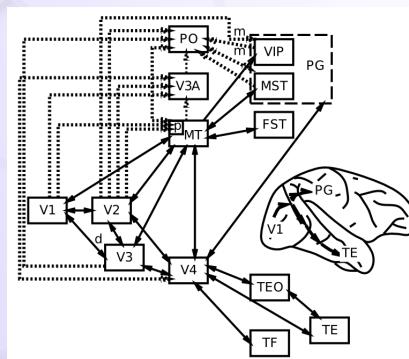
4

Brain Maturation: Synaptic Pruning



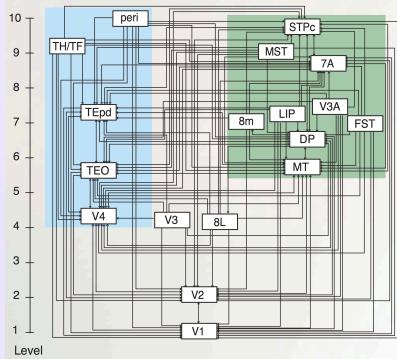
Blue = thinner = more synapses pruned = more mature
Sensory areas mature first, then "higher level" areas; PFC last of all

Visual Hierarchy: What vs Where



6

"Van Essen" Hierarchy

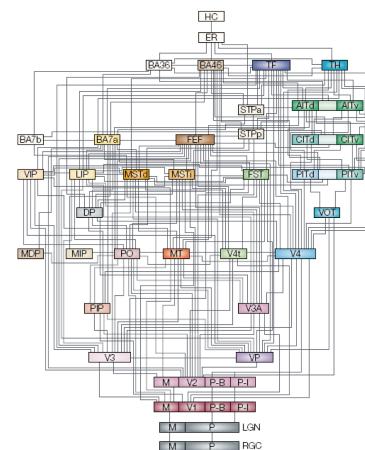


Markov et al., 2014

TE.. = Temporal
LIP, DP.. = Parietal
8L = Frontal Eye Field

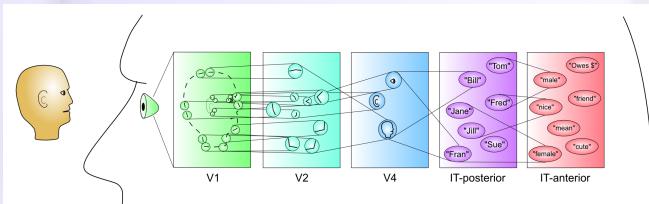
To hippocampus:
TH/F = Parahippo
peri = Perirhinal

7



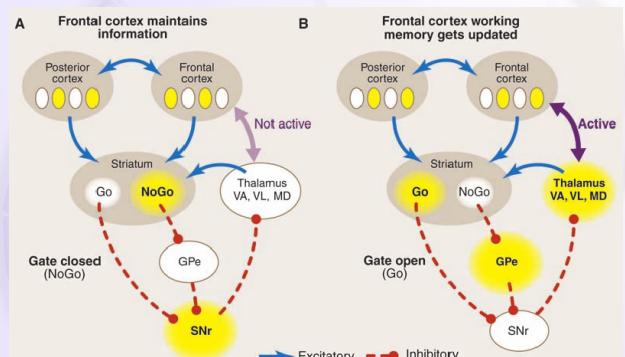
8

Hierarchy of Detectors..



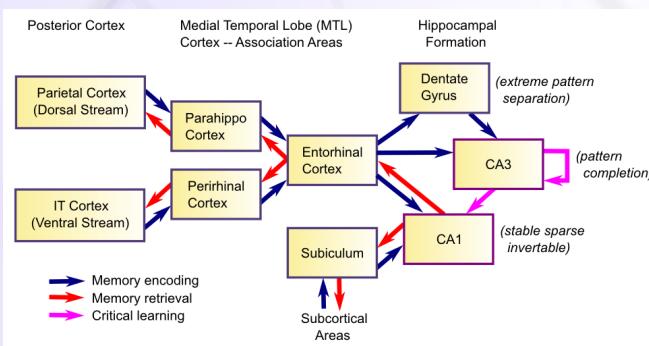
9

Motor Control: BG, Cerebellum



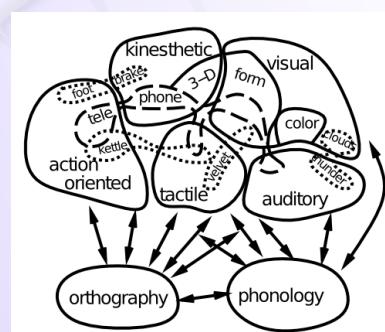
10

Memory and the Hippocampus



11

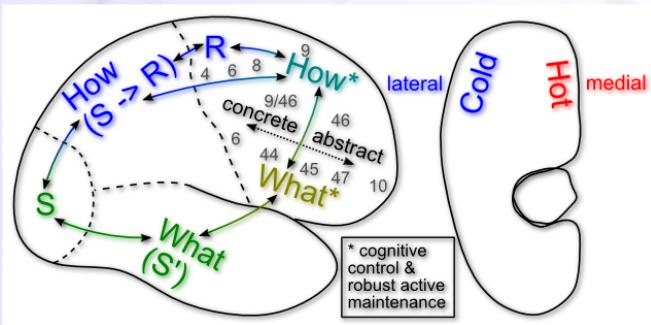
Language



- Lots of areas working together..

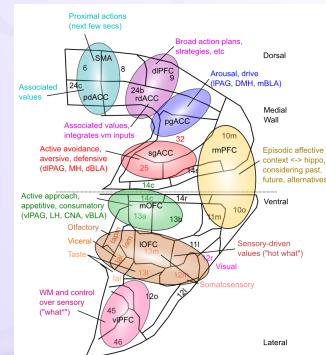
12

Executive Function



13

Medial Frontal Map of Values



14

Learning Rules Across the Brain

Area	Learning Signal				Dynamics	
	Reward	Error	Self Org	Separator	Integrator	Attractor
Primitive Basal Ganglia	+++	---	---	++	-	---
Cerebellum	---	+++	---	+++	---	---
Advanced Hippocampus	+	+	+++	+++	---	+++
Neocortex	++	+++	++	---	+++	+++

+ = has to some extent ... +++ = defining characteristic – definitely has
- = not likely to have ... - - - = definitely does not have

15

Neurotransmitter Terms

- **Agonist:** acts like a given neurotransmitter
 - **Antagonist:** blocks receptors for given NT
 - **Reuptake:** takes NT back out of synapse
 - **Neuromodulator:** a broadly-released neurotransmitter that has widespread modulatory effects on the brain

Neuromodulators and Drugs (receptor agonists)

- **Acetylcholine (ACh)**: muscles, attention, learning, memory (nicotine)
 - **Dopamine (DA)**: when to learn, based on reward prediction errors (cocaine)
 - **Norepinephrine (NE)**: attention, engagement (speed)
 - **Serotonin (5HT)**: Mood, sleep, appetite, sex, stress (SSRI, LSD = waking dream)
 - **Oxytocin**: social modulation, labor (pitocin)
 - **Endorphins, Substance P**: pain (heroin)