The Art of Changing the Brain

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What we say to students?

Okay, Ginger! I've had it! You stay out of the garbage! Understand, Ginger? Stay out of the garbage, or else!

What they hear

blah blah GINGER blah blah blah GINGER blah blah...
Learning (and forgetting) change the brain

Draginski et al, Nature, Regensburg
Change is neuron branching
Intelligence and change
Shaw et al, NIMH

**Figure 3 | Rate of change in cortical thickness.** The rate of change for the cluster of cortical points in the right superior and medial frontal gyrus, which showed a significant trajectory difference. Positive values indicate increasing cortical thickness, negative values indicate cortical thinning. The point of intersection on the x axis represents the age of maximum cortical thickness (5.6 yr for average, 8.5 yr for high, and 11.2 yr for the superior intelligence group).
WHAT MAKES CHANGE?

USE OR DISUSE

EMOTION
THE ART-PART I

USE MAJOR REGIONS OF CORTEX
The three functions of cerebral cortex

Sensing

Integrating

Action
Two kinds of integration

• Back brain: integrate information and data to produce complete pictures and facts, and store memories of images, faces, stories, etc—Red dots in green trees = apple orchard

• Front brain: integrate back brain information (pictures, memories and facts) by holding them in short term memory in order to create ideas plans, hypotheticals, etc—Ladder under red dots in green trees = predict apple picking
Flow of signaling in cortex

adapted from Calvin & Ojemann 1994
Brain Learning Cycle

- Sensory cortex
- Sense
- Action
- Motor cortex
- Connections/meanings
- Back integrative cortex
- Ideas/Plans
- Front integrative cortex
FOUR PILLARS OF LEARNING

• EXPERIENCE-GET INFORMATION
• REFLECT-MAKE MEANING
• CREATE-PREDICT
• ACT-TEST
Learning in our “relatives”
Thorpe, S.J. et al, Science, Toulouse,
THE ART-PART II

ASK “HOW ARE MY STUDENTS FEELING?”
SCREENING FOR THE NEGATIVE
after LeDoux, Emotional Brain

Concrete experience ➔ Sense organs ➔ Integrative cortex ➔ Cognitive Meaning ➔ Sensory cortex ➔ Amygdala ➔ Instinctive meaning
AMYGDALA-CORTEX CROSSTALK
The joy of learning is as indispensable in study as breathing is in running.
-- Simone Weil
DOPAMINE PATHS-REWARD IN THE FRONT? (Nolte, J.)
ACTION OF EMOTION
CHEMICALS
REWARD SYSTEM AND MOVEMENT
THE ART-PART III

USE EXISTING NEURONAL NETWORKS
USE CAUSES BRANCHING
BUILDING ON PRIOR KNOWLEDGE
WHAT IS THE ART?

1. Use all four major functions of brain
2. Ask “how do my students feel?” Are things moving?
3. Work from existing networks of neurons
4. Balance all these