Thoughts on How We Learn

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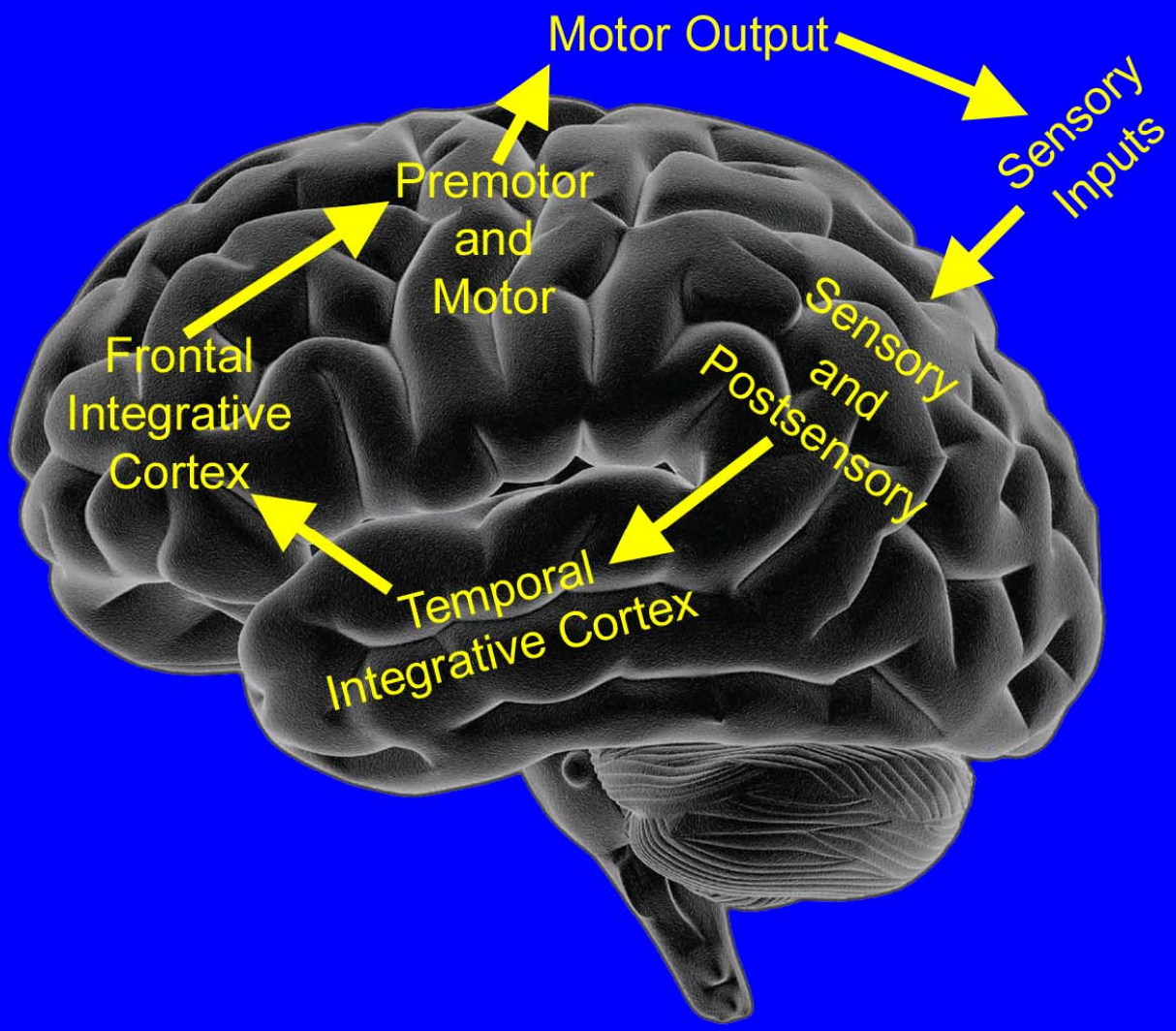
How Do We Learn?

- Understanding how the brain functions is helpful in facilitating both teaching and learning.
- A very simple model of the brain[1] can be used to demonstrate how we learn and, perhaps, make us more effective teachers.

[1]The Art of Changing the Brain, James E. Zull, Stylus Publishing, Sterling, Virginia

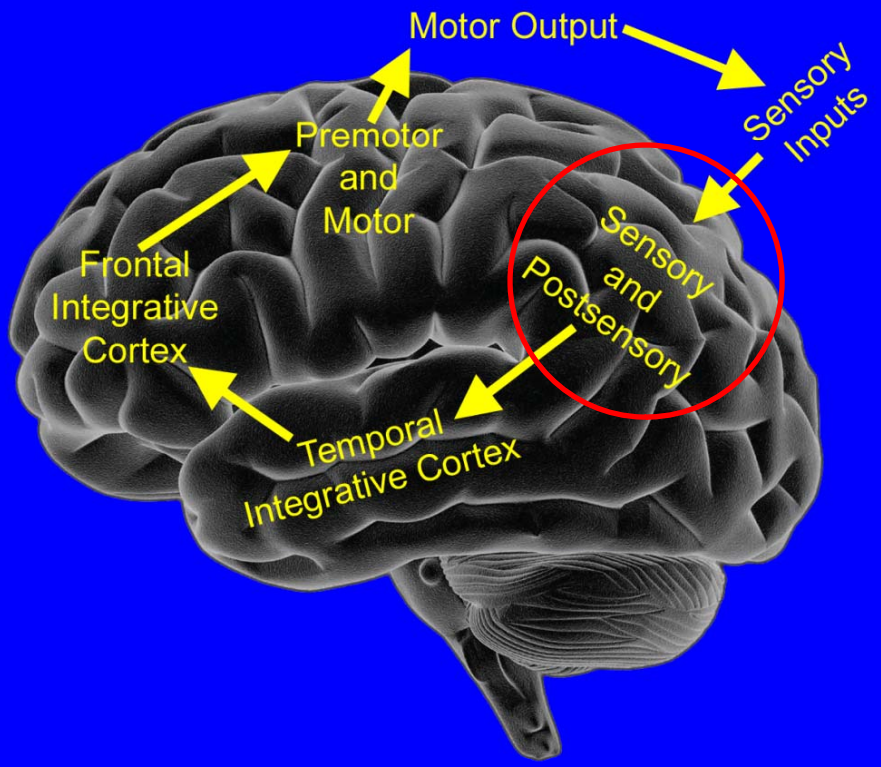
How Do We Learn?



Sensory Cortex

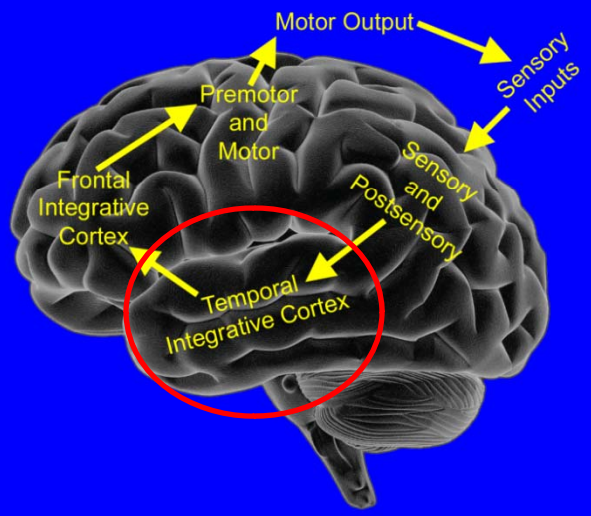
- Receives sensory input from the outside world:

- Vision
- Hearing
- Touch
- Position
- Smell
- Taste



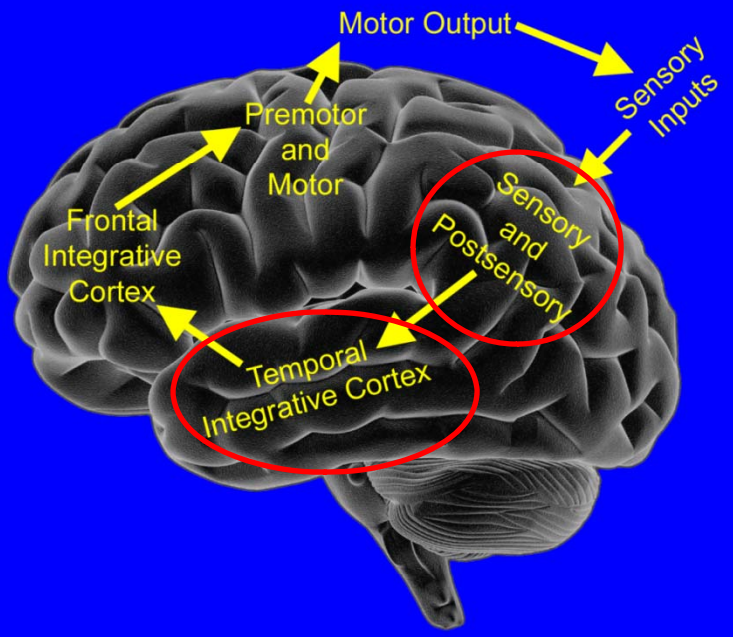
- The more senses used, the better the comprehension. Free food helps, too (stimulates smell and taste and the pleasure portion of the brain)

Temporal Integrative Cortex



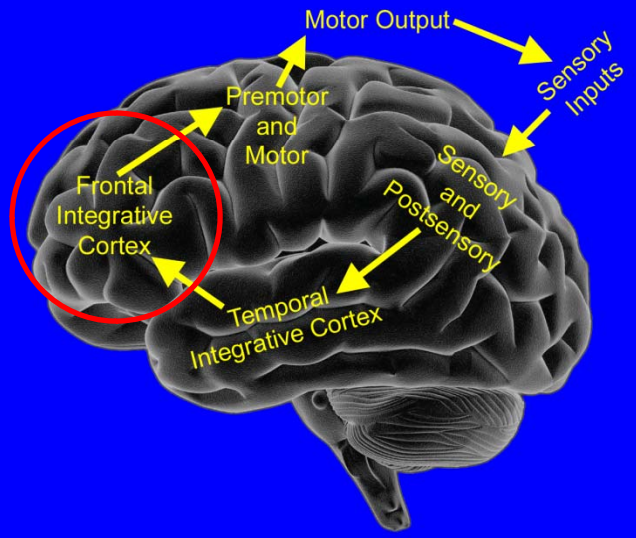
- Memory formation
- Language comprehension
- Processes visual information: Where and What
- Memory formation is facilitated if the information is similar to something already known. Analogies and similar prior cases are important for learning. We build knowledge based on our previous experiences.
- Relate the physics to something the resident already knows, or link it to an interesting clinical case.

Passive Learning



- Didactic lectures
- Read a book/internet
- Retention is typically 10-30%
- No reinforcement of information
- No development of analysis or problem solving skills

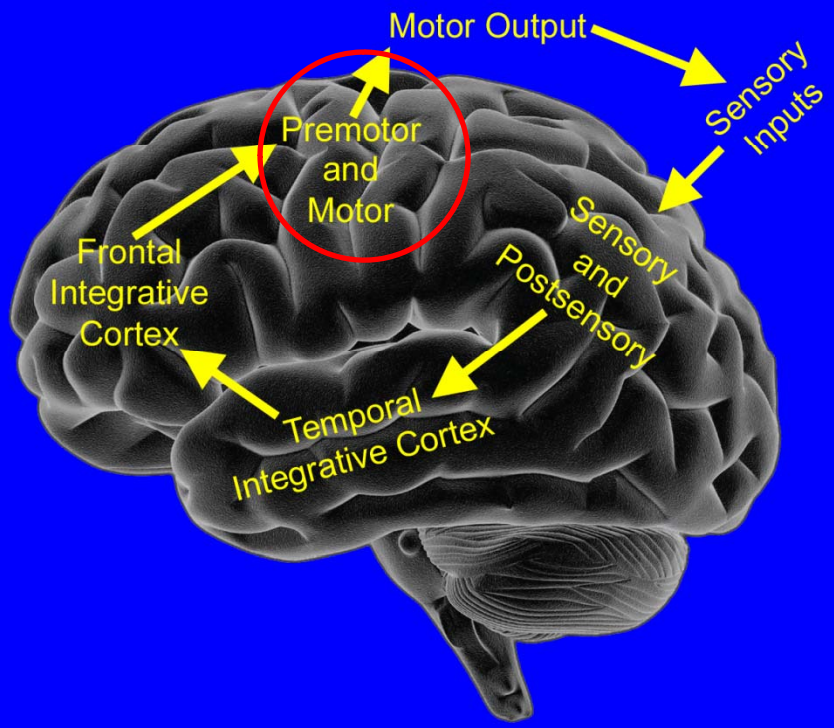
Frontal Integrative Cortex



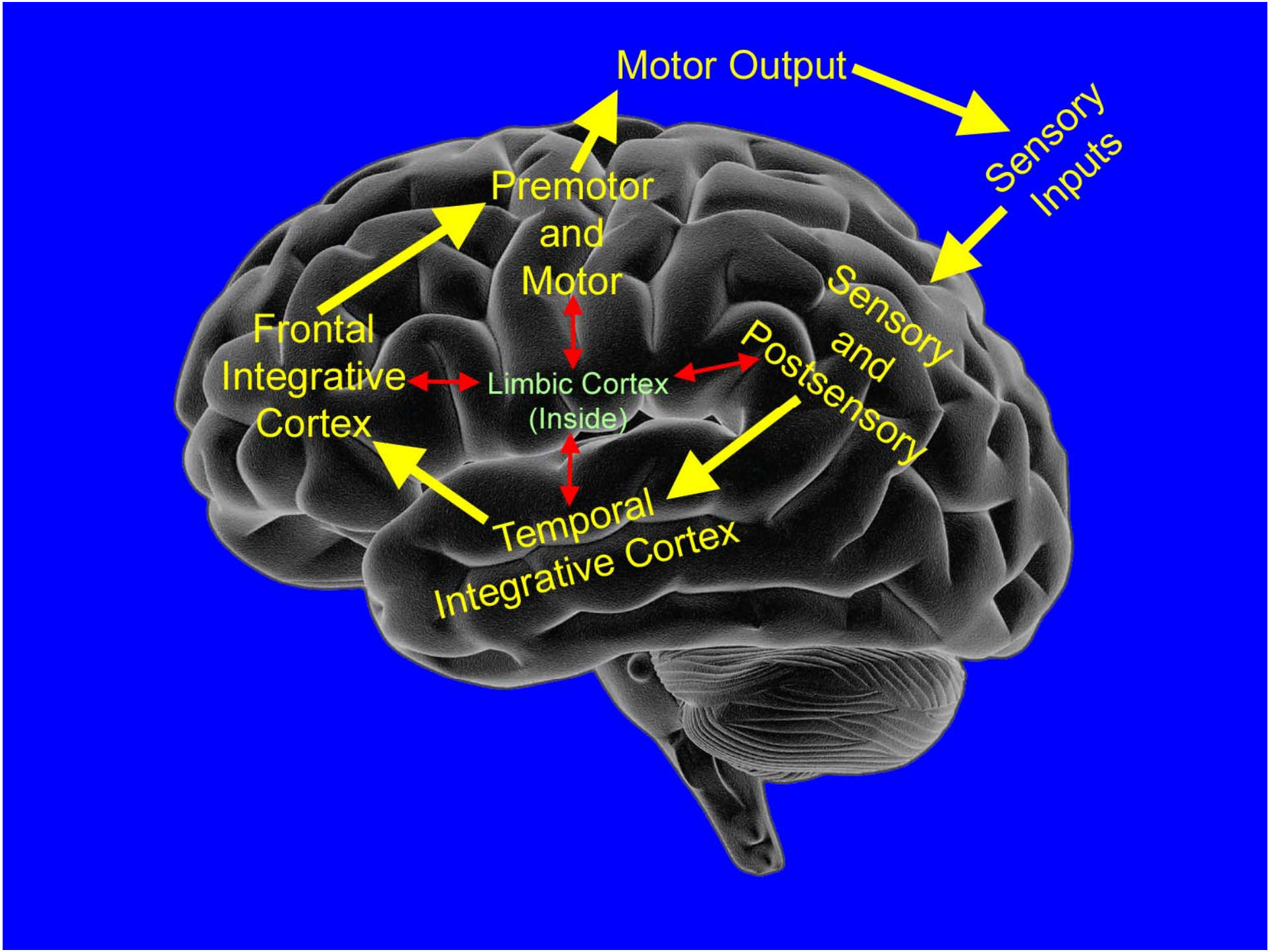
- Problem solving
- Decision making
- Assembly of language
- Making judgments and evaluations
- Directing the actions of the body

- Important for analysis and problem solving, not used in passive learning

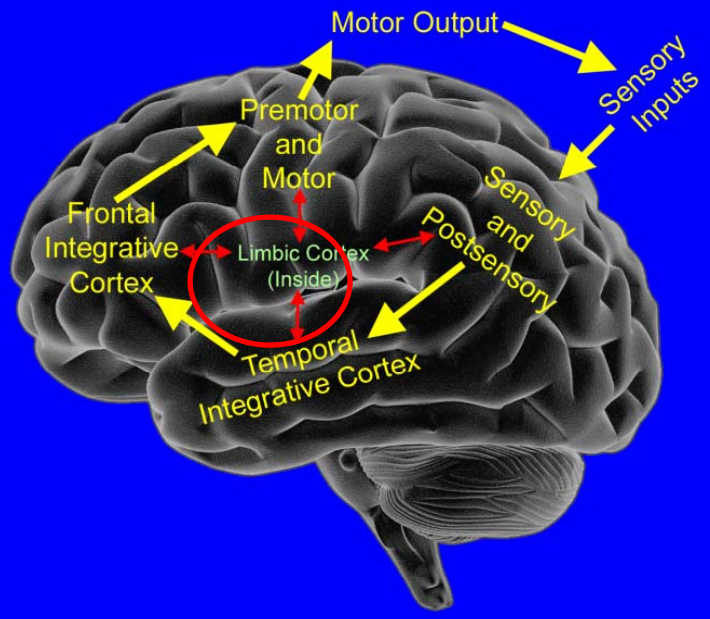
Motor Cortex



- Speech
- Writing
- Locomotion
- Stimulates the sensory inputs, completing the feedback loop, thereby enhancing comprehension (Examples: taking notes, highlighting, repeating a phrase, holding and examining an x-ray tube anode)


Motor Output
Sensory Inputs
Premotor and Motor
Frontal Integrative Cortex
Limbic Cortex (Inside)
Sensory and Postsensory
Temporal Integrative Cortex

Limbic Cortex



- Emotion center of the brain
- Pleasure (basal structures)
- Fear (amygdala)
- Can inhibit or enhance learning: “Deer in the headlights” (equations) versus “Physics is Fun” (neat demonstration). Food is an enhancer!
- Need to prevent negative emotions when teaching. Create a positive environment conducive to learning. Must always be cognizant of your audience emotion level.
- Reset it when necessary

Habituation

- Neuron firing rates diminish if the same stimulus is provided over time.
- Auditory habituation – the boring speaker
- Visual habituation – no images or the same image shown for a long time
- Occurs after 10-20 minutes
- Can be reset by a change of stimulus, such as the use of audience response, calling on a student , a loud noise or tag-team teaching

Active Learning

- Utilizes the full circle of learning in the brain, reinforcing memory and facilitating our development of analysis and problem solving abilities.
- Active learning techniques used by the author:

1. Didactic lectures using audience interaction or audience response technology
2. Q&A problem sessions – small group board review
3. Teaching file case conferences with added physics
4. Tag-team teaching – mix clinical cases with physics
5. Web-based instruction, assigned during rotations
6. Small group discussion – at the PACS review workstation (protocols, pulse sequences, artifacts)
7. Labs, demonstrations – new resident orientation

Conclusions

- Understanding how we learn can make us more effective teachers and learners.
- Active teaching/learning paradigms are most effective. Use several and be repetitive so that memories are reinforced.
- Recognize that adult learning styles vary considerably and try to always create a positive learning environment by minimizing fear and anxiety. Generation X / Y residents want full control of their education.