

## **Discussing biology with our patients**

Course with Jack Nitschke and Heather Abercrombie – Jan-Mar 2016

### **Ways to help patients visualize the brain**

- One open hand for cortex & one closed hand for sub-cortex into spinal cord (wrist)
- Single closed hand -- fingers for frontal lobe with thumb under fingers for sub-cortex (fingers pop up – “popped my top” – frontal lobe’s not engaged in regulating subcortex)
- An “apple” – skin for cortex, flesh for white matter, seeds for subcortex (but also indicate that the proportions are off – cortex is thicker than skin & subcortex larger than seeds)
- drawing a picture
- picture from a book or website
- an actual model of a brain
- over-simplified: “the cortex is the thinking and speaking brain” and “the subcortex is the feeling and doing brain”
- Sub-cortex is sometimes referred to as the “reptilian” or “lizard brain,” i.e., evolutionarily very old -- neural structures we share with animals with less elaborated brains – basic processes & “drives” are supported by this area of the brain. Cortex is the much more evolutionarily advanced brain area – it regulates subcortex, but its potency in regulation of subcortex varies based on a lot of things.

### **Explaining neuroplasticity**

- Yes! our brains do change – instillation of hope!
- Our brains contain lots of cells that connect to one another, and can affect activity in one another. The connections between brain cells (or “neurons”) are constantly changing. Depending on what we experience and what we practice, some of these connections become stronger and some become weaker.
- Dendritic spines – constantly sprouting and retracting – can allow for new connections between neurons – one important mechanism that allows connections between neurons to strengthen or weaken
- Changes at the synapse, e.g., new receptors inserted into post-synaptic membrane – another mechanism allowing for connections between neurons to strengthen or weaken
- Neurogenesis is a form of neuroplasticity when newborn neurons are incorporated into circuits sculpted by our experience and/or behavior
- We can’t “surgically remove” the pathways that are associated with the suffering/difficulty, but we can create new pathways (which may inhibit the old pathways or create new associative networks)
- Metaphors for the “old” neural pathway and creation of the “new” neural pathways:
  - Roads (e.g., Super-highway/exits/frontage roads/surface roads/side streets)
  - Forest path – often used gets well-worn; not used gets grown over
  - Other types of paths, e.g., up a hill
  - Ruts -- wheels in the mud (and how do you get out of the rut?)
  - The gutter in bowling – takes practice to send the ball down the middle

### **Practice and repetition sculpt neural circuits**

- Metaphors: Bowling, basketball, learning to drive, musical instrument, chess – practice and “over-learning” promote “muscle memory,” automatized behaviors, ease, and expertise – the very same neural processes that support learning in these arenas applies to thinking styles, coping, and interpersonal behaviors.
- Experimenting and practicing new ways of thinking, behaving, or interacting REALLY DOES CHANGE THE BRAIN
- The practice inside session AND outside of session can change the brain

### **Associative learning & neural circuits**

- Our environments and experiences influence the associations & neural circuits supporting those associations
- The neural circuits supporting those associations are often pretty tenacious, but we can create new neural pathways through exposing ourselves to different environments and/or practicing new ways of behaving/thinking/awareness/experiencing.
- Good news is that they do change; bad news some of these circuits are pretty strong
- Neural networks – “software” – wiring & re-wiring
- Example: Behavioral sleep strategies – when we stay in bed when we are anxious we are building an association between bed & anxiety – get up, “do anxiety” in another room – come back to bed when sleepy to build association between bed & sleepiness (weaving fingers together & apart to visualize the associations and breaking associations and re-forming new associations)

### **Helping our patients identify reminders to practice (and not to get discouraged that it can take many repetitions for new learning to take root)**

- Every time come across some stimulus, use this stimulus as a reminder to practice. The reminder stimulus could take many different forms. For instance, this stimulus could be something related to a metaphor we’ve used, e.g., a highway. Or, this stimulus could be a mental habit or behavior. Or, it could be a sensation or a feeling, akin to tightness in the neck reminding us to relax our shoulders.
- Steps that can be practiced on the fly: Noticing a mental habit, noticing that I noticed, acceptance and/or validating self for noticing (“Yea! I noticed! This is fertile ground for neuroplasticity” or “this is neuroplasticity in action”)
- Being “in it” juxtaposed with observing it (healthy detachment) – demos: octopus hand on face and/or hands surrounding head juxtaposed with watching hands move away from body
- Took us around a year to learn to walk or throw a basketball or play chess or drive a car – any behavior that the patient is now expert – took lots of experimentation, adjustments, and practice for that behavior to become second nature
- If the patient is in a frame of mind for humor, use humor teaching these concepts. The positive emotional arousal can enhance learning.

### **Fear, anxiety, or threat**

- We are great threat detectors! It makes evolutionary sense that we are super threat detectors. Our evolutionary ancestors who were good at detecting threat didn’t get eaten.
- The brain is primed for threat learning. The “emotion centers” of the brain boost the “memory centers” of the brain during emotionally evocative events. This is why emotional memories can be so strong. (But there is also the flip-side – this a reason why traumatic memories are so fragmented – some aspects of the event(s) are over-remembered where other aspects are under-remembered)
- The over-attunement to threat can be “the brain doing its job” -- so there is nothing “wrong” with our brains, we simply want to make new associations and identify new behaviors to practice that are more effective for the situation
- Exposure therapy – Creating a new neural connection that supports the association between the feared stimulus and SAFETY

### **Cortical regulation of subcortex**

- Prefrontal inhibition of amygdala is very plastic
- Prefrontal inhibition of amygdala is often disrupted in psychopathology
- Evidence suggests that exposure therapy can affect this circuitry

### **Self-related neural processes**

- Anterior ACC and medial prefrontal cortex (e.g., subgenual PFC) activated during rest and/or tasks that increase attention toward self
- Altered activity and connectivity of anterior ACC in depression
- “The black hole of inward-focused attention”
- Behavioral activation as drawing outward of awareness, attention, and brain activation – using hands to point to mid-line structure in brain – use hands in a outward motion to demonstrate drawing outward of brain activation, awareness, and attention
- Embodied awareness (likely supported by insula) vs. ruminative self-talk – different types of awareness of self – the embodied awareness taught in mindfulness meditation possibly reduces over-activation in other self-related neural circuits