BINDRA LECTURES

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Room 522 McIntyre Medical Building

Retrospective Learning in the Brain

A hallmark of intelligence is the ability to learn associations between causes and effects (e.g., environmental cues and associated rewards). The near consensus understanding of the last few decades is that animals learn cause-effect associations from errors in the prediction of the effect (e.g., a reward prediction error or RPE). This theory has been hugely influential in neuroscience as decades of evidence suggested that mesolimbic dopamine (DA)—known to be critical for associative learning—appears to signal RPE. Though some evidence questioned whether DA signals RPE, the RPE hypothesis remained the best explanation of learning because no other normative theory of learning explained experimental observations inconsistent with RPE while also capturing phenomena explained by RPE. My lab has recently provided such an alternative. Specifically, we proposed a new theory of associative learning (named ANCCR, read "anchor") which postulates that animals learn associations by retrospectively identifying causes of meaningful effects such as rewards and that mesolimbic dopamine conveys that a current event is meaningful. The core idea is simple: you can learn to predict the future by retrodicting the past, and you retrodict the past only after meaningful events. Here, I will present the basic formulation of this theory, some experimental data focused on distinguishing predictions of ANCCR and RPE, unpublished experimental results demonstrating that behavioral and dopaminergic learning rates from cue-reward experiences are quantitatively scaled by reward sparsity, and end with discussions regarding the implications of the theory for translational applications for some neuropsychological disorders involving maladaptive associative memories.

Followed by a wine and cheese reception in the 5th Floor Lobby of McIntyre Medical Building