2014 Flux Congress Local Organizing Committee Symposium

Integrative Developmental Cognitive Neuroscience: A Focus on Motivation

1) ***Uncertainty, Sensitive Periods, and The Motivation To Explore*** (Linda Wilbrecht)
2) ***The Interplay Between Motivation And Cognition In Adolescent Impulsive Decision-Making*** (Wouter van den Bos)
3) ***Discussion Panel*** (Jennifer Pfeifer, Adriana Galvan, Ron Dahl)

Background: Why Focus on Motivation? There is a growing set of interests in understanding social and affective aspects of *motivation* as an important component of Developmental Cognitive Neuroscience. From a developmental perspective, children's goals and motivations are often inextricably intertwined with social and emotional processes. Efforts to parse these complexities within a framework of developmental cognitive neuroscience are challenging, but also represent an exciting scientific frontier—one with enormous real-world relevance regarding how children learn particular values, priorities, and healthy as well as unhealthy motivational tendencies.

Overview: This symposium will include two specific examples of lines of investigation within this general framework as well as a panel discussion covering a wider range of related issues and questions focusing on motivation.

The first presentation, ***Uncertainty, Sensitive Periods, and The Motivation To Explore*****,** by Linda Wilbrecht, is based on a mouse model of neurobiological processes that underlie the experience-dependent development of decision-making circuits. Dr Wilbrecht was among the earliest researchers using 2-photon imaging to study structural plasticity in the living brain; her lab combines behavioral analysis, anatomical mapping and in vivo imaging techniques to understand how experience changes neural circuits and uses optogenetics to probe how subcircuits contribute to behavior. Her lab is particularly interested in the idea that adolescence may represent a sensitive period in the development of decision-making.

The second presentation, ***The Interplay Between Motivation And Cognition In Adolescent Impulsive Decision-Making,*** by Wouter van den Bos examines impulsive decision making in human adolescents, with a focus on motivational influences. Dr van den Bos, Research Scientist at the Max Planck Institute for Human Development in Berlin, is a member of the Center for Adaptive Rationality (ARC). His research focuses on the neural underpinnings of reward-based learning and (social) decision-making across development. He has several recent publications and ongoing studies examining social and motivational influences on the development of decision-making in children and adolescents.

Discussion Panel (Jennifer Pfeifer, Adriana Galvan, Ron Dahl) will consider these two examples within a broader discussion that will include motivational learning and the development of pro-social motivations.

Titles and Abstracts

Uncertainty, Sensitive Periods, and The Motivation To Explore

Linda Wilbrecht Ph.D.
Department of Psychology, University of California, Berkeley

Our lab studies developmental changes in decision-making and the neurobiological processes that underlie the experience-dependent development of decision-making circuits in mouse models. Decision-making often involves a balance between the exploitation of current knowledge and the exploration of the unknown. During transition to independence, humans and other mammals possess relatively little specific knowledge to exploit. Our data from mice suggests, that rather than viewing their decision-making as impaired, we might better understand it as weighted toward exploration, especially under conditions of uncertainty. We also hypothesize that individual differences in decision-making may be biased by the particular conditions encountered in early exploration of the world, potentially in a sensitive period when the brain is more plastic. Synaptic level imaging studies in living mice show that neurons in the developing brain also go through a process of exploration, testing out a wide variety of potential connections at a rate that declines through adolescence. We find that experience—particularly exploratory experience—alters the rate of turnover and the identity of connections made in frontal cortical circuits, potentially underlying lasting changes in their function.

The Interplay Between Motivation And Cognition In Adolescent Impulsive Decision-Making

Wouter van den Bos Ph.D.
Center for Adaptive Rationality (ARC), Max-Planck-Institute for Human Development, Berlin, Germany

Reward based decisions rely on the integrity of the striatum and on interactions between the striatum and other cortical and subcortical networks. The dominant model of neurocognitive development of reward related behavior in adolescence emphasizes the developmental discrepancy between the early developing striatum and the delayed development of the prefrontal cortex (Somerville & Casey, 2010). However, there are numerous different loops between the prefrontal cortex and striatum that are thought to have different functions (Haber & Knutson, 2010). It is currently unclear precisely how the development of these different striatal loops contribute to the development of impulsive behavior. In this study we investigate how the development of anatomical and functional striatal connections underlie different aspects of impulsive behavior in a group of participants ages 8 and 25. Connectivity analyses revealed that developmental differences in temporal discounting are related to the structural integrity and functional connectivity of separable cortico-striatal and subcortical-striatal white matter tracts.