Susan L. Andersen, PhD
Director, Laboratory of Developmental Neuropharmacology and
Associate Professor of Psychiatry, Harvard Medical School and McLean Hospital

Adolescent changes in dopamine: finding the balance between too little and too much

Dopamine is a major modulatory neurotransmitter that undergoes dramatic changes during adolescence. This presentation will focus on what role dopamine receptors play in motivational neurocircuitry during adolescence and how environmental influences change their expression. Specifically, evidence will be provided showing how adolescent overproduction of D1 receptors that are expressed in the prefrontal cortex explain high-risk behavior during adolescence. In contrast, reductions in this same population contribute to anhedonia and depressive behaviors that also emerge during this stage.

Jocelyne Bachevalier, PhD
Samuel Candler Dobbs Professor of Developmental Cognitive Neuroscience
Department of Psychology
Yerkes National Primate Research Center
Emory University

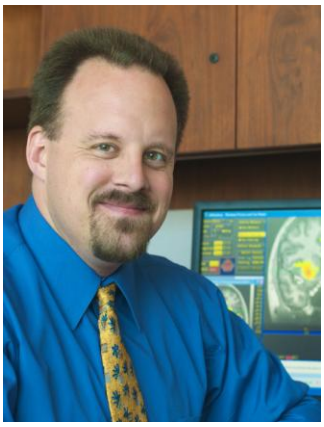
Nonhuman primate models of hippocampal-dependent memory development

This presentation will review a series of developmental neuropsychological non-human primate studies that inform us on the time course of development of relational memory processes in relation to the morphological maturation of the hippocampus. Several classes of behavioral paradigms used in monkeys and their analogs in humans will be described as well as the specific medial temporal structures that support memory demands on these tasks. The data will also demonstrate how the insult to the hippocampus in infancy becomes evident later in childhood and how the neural reorganization of the brain following these early lesions may severely impact some cognitive functions while facilitating others.

Christian Beaulieu, PhD
Professor of Biomedical Engineering
Scientific Director of Peter S Allen MRI Research Centre

Insights into white matter development from diffusion tensor imaging tractography

Diffusion tensor magnetic resonance imaging (DTI) permits the virtual identification of white matter tracts in the human brain as well as the quantitative characterization of parameters that are thought to be linked to elements of the neural micro-structure. This talk will cover: a brief overview of DTI and tractography and their links with axon density/myelination, its application for highlighting unique trajectories of tract development with age in both cross sectional and longitudinal studies of healthy children to adolescents to young adults, and correlations of regional white matter DTI parameters to various cognitive abilities.



James Bjork, PhD
National Institutes of Health

Development of motivational neurocircuitry: The importance of individual differences

Adolescent risk-taking has been attributed to an imbalanced opponent-process, where robust approach/reward neurocircuitry is unchecked by executive control circuits. However, a disproportionate amount of adolescent mortality and morbidity from behavioral causes is concentrated in youth with childhood histories of poor behavior control compared to age-peers. This presentation will feature data from several datasets showing that the most robust increases in recruitment of mesolimbic neurocircuitry by prospective or delivered rewards tends to occur in youth already at behavioral risk for drug abuse and other poor psychosocial outcomes. In addition, avenues for future developmental research on incentive neurocircuitry will be highlighted.

Sarah-Jayne Blakemore, PhD
Royal Society Research Fellow and Reader in Cognitive Neuroscience
Institute of Cognitive Neuroscience
University College London

The social brain: a key determinant of adolescent-typical

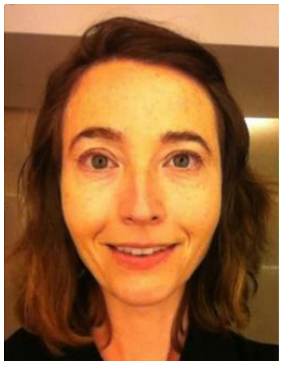
Behavior Adolescence is a period of formative biological and social transition. Social cognitive processes involved in navigating increasingly complex and intimate relationships continue to develop throughout adolescence. It is proposed that a significant proportion of adolescent-typical behaviour is driven by the potential social reward of peer acceptance. This talk will focus on the development of the social brain, the network of regions involved in understanding other people's minds. The social brain develops structurally, functionally and behaviourally during adolescence.

Heather Brenhouse, PhD
Assistant Professor, Department of Psychology
Northeastern University

Delayed effects of early life stress on cognitive and social development: Neuroinflammation plays a role

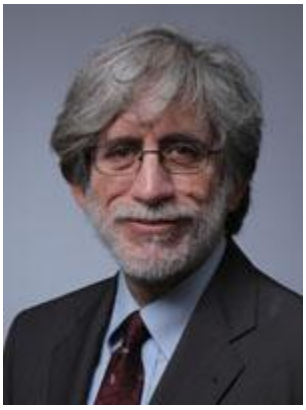
Exposure to early life stress (ELS) such as childhood abuse or trauma increases vulnerability to psychiatric disorders, including depression, drug abuse and schizophrenia. Notably, many behavioral consequences of ELS typically manifest in adolescence, which could provide an opportunistic window for treatment before the deleterious effects of ELS take hold. The developmental mechanisms that regulate delayed effects of ELS can also provide insight into the bases of typical brain and behavioral maturation. We will discuss recent work in rodents revealing that neuroinflammation during pre- and peri-adolescence is critically involved in the network of neural and behavioral consequences of ELS. This talk will explore the need to understand typical maturational changes in brain-immune interaction as we learn more about how ELS derails both neurocircuitry and neuroinflammation during a period of rapid and tumultuous development.

Silvia Bunge, PhD
Associate Professor
Department of Psychology & Helen Wills Neuroscience Institute
University of California at Berkeley



Reasoning and the Brain: Implications for Education

Reasoning, or the ability to think logically and solve novel problems, is a prerequisite for scholastic achievement. In this talk I will first review what we've learned about the brain mechanisms that support reasoning and its growth over childhood and adolescence – in particular, the neural changes that best predict future reasoning ability. I will then provide evidence that intensive practice of reasoning skills can alter brain structure, function, and behavior. Finally, I will argue that a deeper understanding of cognitive and brain development could help us to address the needs of individual children in the face of growing class sizes.



Francisco Xavier Castellanos, MD
NYU Child Study Center & Nathan Kline Institute

The Immediacy of Now: Towards a Mechanistic Understanding of ADHD

The goal of functional imaging is to identify the systems and processes that underlie typical and atypical neuronal functioning. Contrasting groups differing diagnostically can provide a test-bed for validating mechanistic models. Attention-Deficit/Hyperactivity Disorder (ADHD) provides an example of a condition characterized by suboptimal choices when weighing immediate vs. delayed gratification. Following Andrews-Hanna et al., 2010, we tested a prediction that default network subcomponents would be differentially involved in ADHD. We will report unpublished evidence of greater synchrony within the Now-oriented dorsomedial PFC default subnetwork than in the Future-oriented medial temporal lobe subnetwork in separate samples of adults and youth with ADHD vs. controls.

BJ Casey, PhD
Professor of Developmental Psychobiology
Director of Sackler Institute for Developmental Psychobiology
Weill Medical College of Cornell University

Development of Fear: Evidence from Mouse to Human

The study of fear learning and memory has garnered significant interest in recent years for its potential role in anxiety and stress related disorders. Regulating fear is a principle component of these disorders. By studying the development of fear learning and memories, insight can be gained into not only how these systems function normally across development, but also how they may go awry. This lecture will present developmental, environmental, and genetic evidence for changes in fear processes that may provide insights for better treatments and preventative measures for vulnerable populations.

Jason Chein, PhD
Associate Professor of Psychology
Brain Behavior and Cognition
Director of Neurocognition Lab
Temple University

On a joy ride with friends: Explorations of the effect of peers on adolescent decision making

One hallmark of adolescent risk taking is that it typically occurs when adolescents are with their friends. In a series of behavioral and neuroimaging (fMRI) studies with human adolescents and adults, we have explored how social context influences decision making. Results suggest that the presence of peers affects adolescent decision-making by priming a reward sensitive motivational state. To further explore this phenomenon, we have recently developed a rodent model of peer influences. A parallel between the human and rodent findings suggests that the peer effect on human adolescent risk-taking may reflect a hard-wired, evolutionarily conserved process through which the presence of age-mates increases individuals' sensitivity to potential rewards in their immediate environment.

Ron Dahl, MD
Professor, Community Health & Human Development and Joint Medical Program
University of California, Berkeley

Moving Forward: Some Reflections on the Past, Present, & Future of a Rapidly-Growing Field

This presentation will provide some brief reflections on this inaugural conference and some perspective taking on this rapidly growing young field of developmental cognitive neuroscience. The primary themes of this discussion will focus on: a) how to better integrate different aspects of the field (including social, affective, and behavioral dimensions of developmental cognitive neuroscience, as well as basic, clinical, and policy level research); b) considerations of structures (i.e. meetings, society, journals, data-sharing etc.) that can best promote positive development of the field. Audience discussion and suggestions will be welcomed to consider a broad perspective on these important issues to help shape the future of our field.

Adriana Di Martino, MD
Leon Levy Research Assistant Professor of Child and Adolescent Psychiatry
Associate Director, Phyllis Green and Randolph Cowen Institute for Pediatric Neuroscience

Advancing Autism Neuroscience Though Open Data Sharing: Initial Experience from the Autism Brain Imaging Data Exchange

The Autism Brain Imaging Data Exchange (ABIDE) is a grassroots initiative that aggregated and openly shared 1112 fMRI datasets of individuals with autism and controls across 17 international labs. ABIDE was created to demonstrate the feasibility and utility of open sharing Big Data to advance our understanding of the neuronal correlates of autism. The aggregating effort, results from initial data analyses, and challenges that need to be addressed in future efforts will be discussed.

Monique Ernst, MD, PhD
Head of Neurodevelopment of Reward Systems
Emotional Development and Affective Neuroscience Branch (EDAN)
Section on Neurobiology of Fear and Anxiety (NFA)
National Institute of Mental Health / NIH

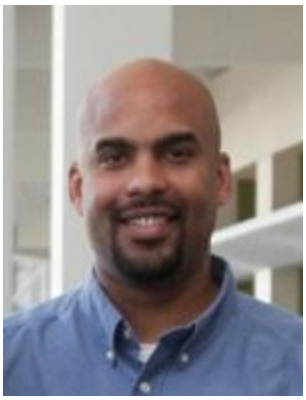
Striatal Functional Connectivity in adolescents and adults

This presentation will address commonalities and differences between adults and adolescents in how striatal structures are functionally connected with other key brain structures. Two types of data will be discussed, (1) the functional connectivity of core structures engaged in response to incentives using Dynamic Causal Modeling analysis during fMRI paired with a reward task, and (2) intrinsic connectivity during resting state using the striatum as seed. Findings show that the basic circuitry involved in reward processes is similar in adults and adolescents. However, the strength and pattern of connectivity differ as a function of age. Most notable findings are (1) the amplified role of the insula in adolescents relative to adults, and (2) the specific effect of age on the intrinsic connectivity of the striatum that affects mostly the ventral but not dorsal regions. These findings will be related to vulnerability for aberrant behavior and clinical implications.

Stefan Everling, PhD
Professor of Physiology and Pharmacology
Director, Laboratory of Neural Circuits and Cognitive Control
The University of Western Ontario London, Ontario, Canada

In vivo mapping of the saccadic eye movement network in macaques and humans using resting-state fMRI

I will present results from several studies in which we have successfully utilized resting-state fMRI to investigate the organization of the saccadic eye movement network in macaque monkeys. Our results show that functional connectivity measures based on the low-frequency fluctuations of the BOLD signal are largely determined by the underlying anatomical architecture, but also display dynamic fluctuations that have been previously ignored. I will show that the technique can be used for comparative mapping of human and macaque brain networks and for the identification of targets for further electrophysiological studies in macaque.



Damien Fair, PA-C, PhD
Oregon Health and Science University
Assistant Professor, Behavioral Neuroscience and Psychiatry
Assistant Scientist, Advanced Imaging Research Center

Using graph theory to inform heterogeneity in typical and atypically developing populations

Research and clinical investigations in psychiatry largely rely on the de facto assumption that the diagnostic categories identified in the DSM represent homogeneous syndromes. However, the mechanistic heterogeneity that potentially underlies the existing classification scheme might limit discovery of etiology for most developmental psychiatric syndromes. Another, perhaps less palpable, reality may also be interfering with progress – heterogeneity in typically developing populations. This talk will focus on the use of graph theory in combination with resting-state functional connectivity in clarifying behavioral and functional heterogeneity not only in children with mental disorders, but in typically developing children as well. I will argue that the illumination of such phenomena will likely be of significant practical importance for understanding the nature of typical development and to identifying the etiologic underpinnings of atypical developmental trajectories.

Adriana Galvan, PhD
Assistant Professor, Department of Psychology
UCLA

Ontogenetic Changes in the Neural Mechanisms Underlying Reward, Motivation and Learning: Insights from the Adolescent Brain

Adolescence is characterized by strong motivational drives and limited behavioral regulation. Converging evidence suggests that this developmental phenotype is governed by distinct neurodevelopmental trajectories in the cognitive and affective systems that underlie these behaviors. By probing these systems under an array of conditions in children, adolescents and adults, we have learned how ontogenetic differences in striatal sensitivity and prefrontal engagement render adolescents more prone to risk-taking, reward seeking and impulsive behavior. In this talk, I will present our work demonstrating heightened striatal sensitivity in adolescents to basic appetitive and aversive stimuli, discuss recent findings showing that the adolescent brain is uniquely sensitive to contextual changes in social, stressful and learning domains, and review these findings within the context of prevailing theories of adolescent behavior and neurodevelopment. In addition, I will explore how neurobiologically-supported increases in motivation and exploration during adolescence facilitate the attainment of autonomy as individuals transition into adulthood.

Jay N. Giedd, MD
Chief, Brain Imaging Section
Child Psychiatry Branch, NIMH

The Teen Brain: New Views from Neuroimaging

Dr. Giedd will summarize results from his 20 year longitudinal study using MRI, genetics, and cognitive/behavioral assessments to explore the path, mechanisms, and influences of child and adolescent brain development in health and illness. There will be an emphasis on the teen brain as a time of vulnerability but also of great opportunity.

Charles Geier, PhD
Assistant Professor of Human Development
Penn State University

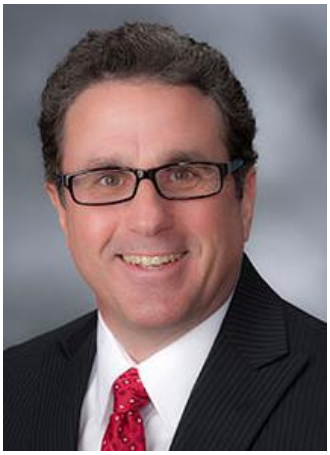
The Influence of Incentives on Inhibitory Control During Adolescence: A Developmental Cognitive Neuroscience Approach

Adolescents' risk taking may be viewed as stemming from one or more decisions, particularly those made in the context of salient incentives. Decision making, in turn, is supported by more basic cognitive and affective processes, of which incentive processing and inhibitory control are primary. Characterization of the normative interaction of incentive processing and inhibitory control across adolescence may provide critical insight on the basic mechanisms contributing to the complex behavioral phenomenon of risk taking. In this talk, I will present our on-going work examining the effects of incentives on cognitive control. This will include examination of developmental changes in reactivity in the ventral striatum as well as circuitry underlying cognitive control as a function of incentive context. Additionally, methods that enable assessment of different stages of reward processing as well as minimizing age-related differences in subjective reward valuation will be discussed. Overall, our results suggest that adolescents demonstrate persistent differences in the integration of incentives and inhibitory control, which may contribute to differential adolescent decision-making and risk taking.

Torkel Klingberg, MD, PhD
Professor in Cognitive Neuroscience
Karolinska Institutet
Stockholm, Sweden

Predicting Working Memory Development from Neuroimaging

In two analyses of longitudinal data we aimed at finding brain signals predicting future WM in children. BOLD signal, gray matter density and fractional anisotropy data was measured in children and adolescents aged 6-20. It found that in addition to information from behavioral testing, imaging data could provide unique information about future WM capacity. Moreover, while cross-sectional analyses related the WM capacity to fronto-parietal networks, future WM capacity was predicted from striatal activity and structure of fronto-parietal and fronto-striatal pathways. These studies show a novel aspect of the dynamics of neural development.

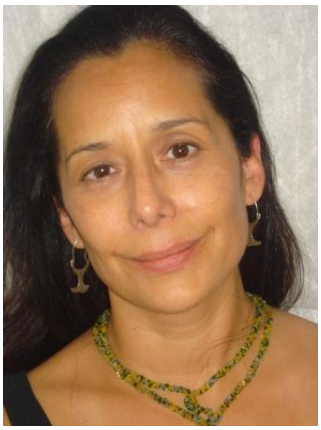


David A. Lewis, MD - ***KEYNOTE ADDRESS***
Chairman, Department of Psychiatry
UPMC Endowed Professor in Translational Neuroscience
Medical Director and Director of Research
Western Psychiatric Institute and Clinic
Director Translational Neuroscience Program
Director NIMH Conte Center for the Neuroscience of Mental Disorders
University of Pittsburgh

Developmental Trajectories in Cortical Circuits: Substrates for Health and Disease

In primates, both excitatory and inhibitory components of prefrontal cortical circuitry undergo marked developmental changes in molecular content, structural features and electrophysiological properties. Many of these changes are protracted, persisting through adolescence, but the rate and timing of the changes are distinctive to specific circuit components. This constellation of developmental trajectories likely provides the neural substrate for the maturation of cognitive abilities that are dependent on prefrontal circuitry, and also suggests the presence of multiple developmental epochs when circuit components may be particularly sensitive to adverse experiences. The implication of these circuit level findings in monkeys for interpreting imaging and behavioral studies of human postnatal brain development will be discussed.

Beatriz Luna, PhD
Laboratory of Neurocognitive Development
Western Psychiatric Institute and Clinic
University of Pittsburgh Medical Center



Maturation of Cognitive Control through Adolescence

The ability to flexibly and adaptively control behavior is present early in development but improves significantly into young adulthood. I will review studies where we have characterized developmental trajectories of brain systems underlying cognitive control of behavior from childhood through adolescence into young adulthood. Taken together, neuroimaging and behavioral results suggest that the core neural substrates of executive function are available by adolescence. However, there are continued changes and refinements in the system that support the ability to consistently and flexibly control behavior, which is still immature in adolescence. These key changes may define different stages of development such as the adolescent period when adult level cognitive control is accessible but not yet reliable.

Cheryl McCormick, PhD
Professor & Canada Research Chair in Neuroscience
Brock University

Differential susceptibility of adolescents and adults to the immediate lasting consequences of social instability stress on cognitive and social behaviour in a rodent model

I will review results with our lab model indicating that as adults, rats exposed to social instability stress in adolescence have heightened anxiety, impaired social behaviour, and cognitive differences compared to non-stressed control rats, whereas the same stressor procedures applied in adulthood do not have such lasting consequences. I also will describe our recent studies exploring the basis for the differential sensitivity of adolescents compared to adults, in which we consider questions such as a different "mind" versus an immature brain in adolescence, and differences in perception of stressors versus different experience of stress in adolescence.

Michael P. Milham, MD, PhD
Director, Center for the Developing Brain
Senior Research Scientist
Pediatric Psychopharmacologist
Child Mind Institute

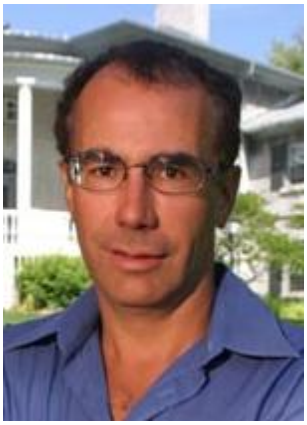
Emerging Models for Biomarker Identification in the Developing Brain

Central to the development of clinical tools for developmental neuropsychiatry is the discovery and validation of biomarkers. Resting state fMRI (R-fMRI) is emerging as a mainstream approach for imaging-based biomarker identification, detecting variations in the human connectome that can be attributed to developmental and clinical variables (e.g., diagnostic status). Despite growing enthusiasm, many challenges remain. I will discuss evidence of the readiness of R-fMRI based functional connectomics to lead to clinically meaningful biomarker identification in developing populations through the lens of the criteria used to evaluate clinical tests (i.e., validity, reliability, sensitivity, specificity, and applicability). Gaps and needs for R-fMRI-based biomarker identification will be identified, and the potential of emerging conceptual, analytical and cultural innovations (e.g., the Research Domain Criteria Project (RDoC), open science initiatives, and Big Data) to address them will be highlighted. The need to expand future efforts beyond identification of biomarkers for disease status alone will be discussed, with a particular emphasis on the importance of identifying clinical variables related to risk, expected treatment response and prognosis.

Bita Moghaddam
Department of Neuroscience
University of Pittsburgh

Reward processing in adolescent rodents

Adolescents often respond differently than adults to the same motivating contexts. Delineating the neural processing differences of adolescents is critical to understanding this phenomenon, as well as the bases of adolescent psychiatric vulnerabilities. We believe that age-related changes in the ways rewarding stimuli are processed in key brain regions could underlie the unique predilections and vulnerabilities of adolescence. I will present single-unit activity data from the VTA, orbital frontal cortex, nucleus accumbens, and dorsal striatum of adolescent and adult rats during a reward-motivated instrumental task. We observe striking age-related region-specific differences in the neural encoding of salient events during this task. These data provide insight on how rewards might shape adolescent behavior differently, and for their increased vulnerabilities to affective and addictive disorders.

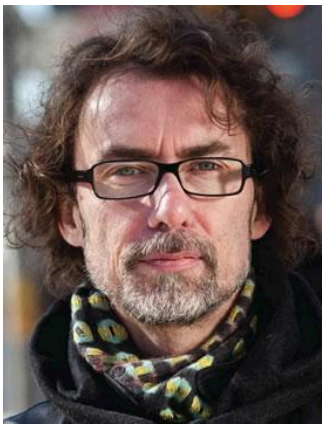


Doug Munoz, PhD
Professor of Physiology, Psychology and Medicine
Director, Queen's Centre for Neuroscience Studies
Canada Research Chair in Neuroscience
Queen's University

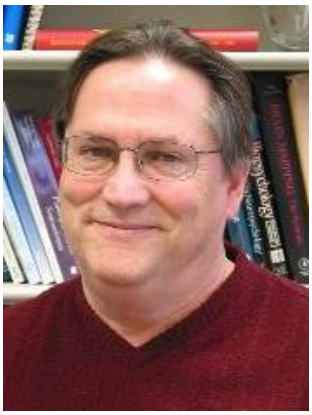
Using the anti-saccade task to characterize top-down control of behavior

The antisaccade task (look away from a visual stimulus) is a very useful tool to investigate child development and reveal deficits in sensory, motor and executive function. Monkeys can also be trained to perform the antisaccade task and their behaviour is qualitatively similar to human behaviour. Detailed neurophysiological studies have revealed how neurons in specific regions of the frontal cortex, basal ganglia, and superior colliculus must be regulated for correct performance of anti-saccades. These neurophysiological results can be used to develop models to understand suboptimal top-down executive control of behavior.

Tomáš Paus MD, PhD
Tanenbaum Chair in Population Neuroscience
Senior Scientist, The Rotman Research Institute
Professor of Psychology and Psychiatry
University of Toronto



Population Neuroscience of the Adolescent Brain



Steve Petersen, PhD
James S. McDonnell Professor of Cognitive Neuroscience
Director, McDonnell Center for Systems Neuroscience
Depts. of Neurology and Psychology
Washington University Medical School

What resting state network measures have done for us (and might do for you)

We use correlations of the BOLD signal at rest to study relationships among large collections of brain regions. This large-scale network shows separable systems of regions whose members often act together during tasks (e.g. sensorimotor and executive systems). The spatial layout of the systems on the brain has isolated locations where several systems closely articulate; regions surrounding these locations have high levels of cross-system correlation. The combination of spatial articulation and high interrelationship indicate that these locations might be particularly "vulnerable" to damage. Lesions at these points produce neuropsychological results consistent with this idea. Network-level understanding of the brain's functional organization can usefully inform other cognitive, developmental, and clinical neuroscience questions.

Russ Poldrack, PhD
Professor of Psychology and Neurobiology
Director of the Imaging Research Center
The University of Texas at Austin

Is "efficiency" a useless concept?

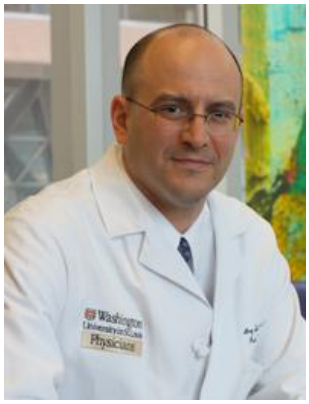
Changes in activation with development are often described in terms of changes in "efficiency" of brain function. I will argue that this is generally a redescription of the data rather than a useful explanation, and will ask how we might better understand such changes from a neural and computational standpoint.

Elizabeth Sowell, PhD
Professor of Pediatrics
Children's Hospital
University of Southern California

Structural brain development and the impact of pubertal hormones

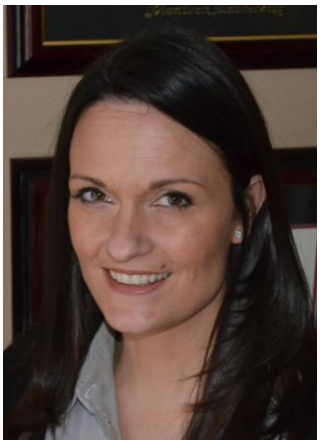
In this talk, I will discuss recent findings from our group on cross-sectional and longitudinal studies of adolescent structural brain development, and the role pubertal hormones. There will also be some discussion of individuals with fetal alcohol spectrum disorders, and how differential experience over time during development is likely important in shaping the mature brain.

Bradley L Schlaggar MD, PhD
A. Ernest and Jane G. Stein Professor of Developmental Neurology
Professor of Radiology, Pediatrics, and Anatomy & Neurobiology
Washington University School of Medicine & St. Louis Children's Hospital



The 'task B problem' and other considerations in developmental functional neuroimaging

In this brief talk, I will highlight a handful of conceptual and practical considerations relevant to developmental cognitive neuroscience, and group-wise comparisons *per se*.



Moriah E. Thomason, PhD
Assistant Professor of Pediatrics
Merrill Palmer Skillman Institute for Child and Family Development
Wayne State University School of Medicine

Fetal brain functional dynamics revealed by fcMRI

Many forms of psychopathology and neurological conditions are undergirded by disruptions in neural connectivity that may begin as early as in human fetal life. If altered dynamics can be identified before the emergence of clinical or preclinical symptoms and during the course of early functional specialization, such should advance understanding and facilitate earlier intervention. Advances in functional connectivity magnetic resonance imaging (fcMRI) have enabled a non-invasive means for examining neural dynamics at the beginning of life. We have applied fcMRI to > 50 human fetuses to learn about both typical and atypical fetal neural development.