S4SN 2017 Annual Meeting

WWW.S4SN.ORG

Washington, DC, November 10, 2017

S4SN 2017 Annual Meeting | Committees

Officers and Board of Directors

Rui F. Oliveira, ISPA – Instituto Universitário, Portugal (2017 President)
Alexa Veenema, Boston College, USA (Secretary-Treasurer)
Larry Young, Emory University, USA (Past-President)
Yue-Jia Luo, Beijing Normal University, China
Bruce McEwen, Rockefeller University, USA
Hidehiko Takahashi, National Institute of Radiological Sciences, Angawa, Japan
Ralph Adolphs, Humanities and Social Sciences (HSS), California Institute of Technology, USA
Essi Viding, University College London, UK
Alexa Veenema, Boston College, USA
Agustin Ibáñez, INECO- Institute of Cognitive Neurology, Argentina
Nim Tottenham, Columbia University, USA
Steve Phelps, The University of Texas at Austin, USA
Stephanie Cacioppo, University of Chicago, USA
James Curley, The University of Texas at Austin, USA
Takefumi Kikusui, Azabu University, Sagamihara, Japan

2017 Awards Committee

Rui F. Oliveira, ISPA – Instituto Universitário, Portugal
Larry Young, Emory University, USA – Human/Animal
Nim Tottenham, UCLA, USA – Human

2017 Program Committee

David Hsu, Stony Brook University, USA
Steve Chang, Yale University, USA
Ziv Williams, Harvard Medical School, USA
Elizabeth Redcay, University of Maryland, USA

Journal Affiliation

S4SN is happy to announce that our Society is now affiliated with the journal *Social Neuroscience*, published by Taylor and Francis. We believe that this affiliation will benefit our Society and encourage our members to submit manuscripts to Social Neuroscience.

Society for Social Neuroscience

8th Annual Meeting, November 10, 2017
Renaissance Washington, DC Downtown Hotel,
Washington, DC

2017 Annual Meeting Program

Contents

The Society for Social Neuroscience is an international interdisciplinary, non-profit, scientific society established to advance and foster scientific research, training, and applications.

www.s4sn.org

Schedule Overview

Friday, November 10, 2017

8:00 am – 6:30 pm	On-site Registration & Pre-Registration Check In, *Ballroom West A&B Foyer*
8:30 am – 7:00 pm	Exhibits Open, *Ballroom West A&B*
8:55 am – 9:00 am	**Welcome Remarks** by President **Rui Oliveira**, *Ballroom West A&B*
9:00 am – 10:00 am	Keynote Address, **The Functional Architecture of Social Vision**, Nancy Kanwisher, *McGovern Institute for Brain Research at the Massachusetts Institute of Technology*, *Ballroom West A&B*
10:00 am – 10:20 am	Break
10:20 am – 11:35 am	Symposium 1 **Neural Representations of Social Networks and Contexts,** Chair: James Curley, *Ballroom West A&B*
▶ 10:20 am – 10:35 am	Talk 1: Neural Encoding and Cognitive Consequences of Social Network Position in Humans, Carolyn Parkinson
▶ 10:35 am – 10:50 am	Talk 2: Neural Systems Tracking Popularity and Narcissism in Real World Social Networks, Kevin Ochsner
▶ 10:50 am – 11:05 am	Talk 3: Socially Driven Changes in the Social Decision-Making Network of Zebrafish, Magda Teles
▶ 11:05 am – 11:20 am	Talk 4: Temporal Dynamics of Social Behavior in Mouse Social Hierarchies, James Curley
▶ 11:20 am – 11:35 am	Talk 5: Q&A Period: The Speakers will take Questions from the Audience
11:35 am – 1:00 pm	Lunch Break *(On your own)*
1:00 pm– 2:00 pm	Poster Session A, *Ballroom West A&B*
2:00 pm – 3:15 pm	Symposium 2 **The Social Transmission of Pain and Threat: Implications for Understanding Social Communication, Social Behavior, and Social Relationships,** Chair, Abigail Marsh, Discussant, Lauren Atlas, *Ballroom West A&B*
▶ 2:00 pm – 2:15 pm	Talk 1: Mice are People too: Social Modulation of and by Pain in Laboratory Mice and Undergraduates, Jeffrey Mogil
▶ 2:15 pm – 2:30 pm	Talk 2: Social Transmission After Tone-Shock Conditioning: Fear Conditioning By-Proxy in Sisters and Strangers, Marie-H. Monfils
▶ 2:30 pm – 2:45 pm	Talk 3: Effects of Placebo Analgesia on the Multi-Voxel Representations of Directly Experienced Pain and Pain Empathy, Isabella Wagner
▶ 2:45 pm – 3:00 pm	Talk 4: Linking Empathic Simulation of Pain Experience and Anticipation to Extraordinary Acts of Altruism, Abigail Marsh
▶ 3:00 pm – 3:15 pm	Talk 5: Q&A Period: The Speakers will take Questions from the Audience
3:15 pm – 3:55 pm	**Novel Approaches and Methodologies,** *Ballroom West A&B*
▶ 3:15 pm – 3:35 pm	Animal Method: Comparing Human and Monkey Neural Circuits for Processing Social Scenes, Julia Sliwa
▶ 3:35 pm – 3:55 pm	Human Method: Learning and Connecting in the Real World: Conducting Neuroscience Research in High School Classrooms and Museums, Suzanne Dikker
3:55 pm – 4:15 pm	Break
4:15 pm – 5:30 pm	Symposium 3 **Anxiety and Responding to Threat: Neurobiological and Contextual Contributions to Development,** Chairs, Harma Meffert and Kalina Michalska, *Ballroom West A&B*
▶ 4:15 pm – 4:30 pm	Talk 1: Balancing Between Fear and Safety: A Distinct Ontogeny of Fear Learning and Social Buffering of Fear in the Anxious Phenotype, Jacek Debiec
▶ 4:30 pm – 4:45 pm	Talk 2: Childhood Shyness and Anxiety Influence Neural Responses to Fear Learning in Preadolescent youth, Kalina J. Michalska
▶ 4:45 pm – 5:00 pm	Talk 3: Neural Systems Underlying Extreme Early-Life Anxiety, Alexander Shackman
▶ 5:00 pm – 5:15 pm	Talk 4: Amygdala Response to Distress Cues and Callous-Unemotional Personality; Moderation by Trauma, Harma Meffert
▶ 5:15 pm – 5:30 pm	Talk 5: Q&A Period: The Speakers will take Questions from the Audience
5:30 pm – 6:00 pm	**Early Career Award Talks,** *Ballroom West A&B*
▶ 5:30 pm – 5:45 pm	Animal Method: “More than Meets the Eye: Neural Mechanisms of Stereotypic Vision”, Jonathan B. Freeman
▶ 5:45 pm – 6:00 pm	Human Method: “What is Personality, Where Does it Hide, and How to Find it?”, Oren Forkosh
6:00 – 7:00 pm	Poster Session B, *Ballroom West A&B*

Keynote

Nancy Kanwisher

Department of Brain & Cognitive Science, and McGovern Institute for Brain Research, MIT

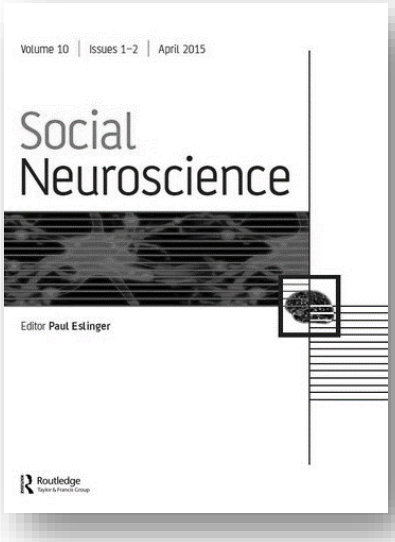
Taylor and Francis *Social Neuroscience* Keynote Address

Friday, November 10, 2017, 9:00 - 10:00 am, Ballroom West A&B

The Functional Architecture of Social Vision

Humans perceive their world in rich social detail, and cognitive neuroscience research has identified a large number of cortical regions that underlie this ability. I will first describe a study using electrical stimulation that supports the extreme causal specificity of one of these regions, the fusiform face area. However, the social world is populated not just by individual agents, but by groups of agents interacting with each other. I will then describe fMRI studies indicating that a particular region in the posterior superior temporal sulcus responds much more strongly to stimuli depicting social interactions between two agents, than to a) pairs of agents not interacting with each other, b) physical interactions between inanimate objects, and c) individual animate agents pursuing goals and interacting with inanimate objects. Further, this region contains information about the nature of the social interaction, specifically whether one agent is helping versus hindering the other. These results strengthen the evidence that social vision is mediated by a set of distinct cortical regions, each analyzing a different aspect of the social world, and suggest that one component of this system may be dedicated to perceiving interactions between multiple agents.

S4SN 2017 Annual Meeting sponsored by



EMORY UNIVERSITY

Silvio O. Conte Center for Oxytocin and Social Cognition

Symposium Sessions

#	Title	Date	Time	Location
1	**Neural Representations of Social Networks and Contexts**	**Friday, November 10**	**10:20 – 11:35 am**	**Ballroom West A&B**
2	**The Social Transmission of Pain and Threat: Implications for Understanding Social Communication, Social Behavior, and Social Relationships**	**Friday, November 10**	**2:00 - 3:15 pm**	**Ballroom West A&B**
3	**Anxiety and Responding to Threat: Neurobiological and Contextual Contributions to Development**	**Friday, November 10**	**4:15 - 5:30 pm**	**Ballroom West A&B**

Symposium Session 1

NEURAL REPRESENTATIONS OF SOCIAL NETWORKS AND CONTEXTS

Friday, November 10, 10:20 - 11:35 am, Ballroom West A&B

Chair: James Curley, University of Texas at Austin, Texas, USA

Speakers: Carolyn Parkinson, Kevin Ochsner, Magda Teles, James Curley

Overview: A critical feature of all socially living individuals is the ability to track over time both their own social relationships and the social relationships between other individuals living in their social group, particularly those involving the most central, popular or powerful group members. Individuals use this information to guide their own social behavior and to ensure that it is socially contextually appropriate. In this proposal, we bring together recent research in human imaging and animal models that has begun to elucidate the neural representation of such social networks.

TALK 1: NEURAL ENCODING AND COGNITIVE CONSEQUENCES OF SOCIAL NETWORK POSITION IN HUMANS

Carolyn Parkinson, Adam M. Kleinbaum & Thalia Wheatley, UCLA

Here, we present two studies that combine the analysis of real-world social networks with the characterization of social information processing within the minds of their members. In the first study, we characterized the social network of an academic cohort, a subset of whom completed a functional magnetic resonance imaging (fMRI) study in which they viewed videos of individuals who varied in terms of social distance from themselves ("degrees of separation"), the extent to which they are well-connected to well-connected others (eigenvector centrality), and the extent to which they connect otherwise unconnected individuals (brokerage). Understanding these aspects of others' social network positions requires individuals to track not only their own relationships, but also bonds between third parties, and the broader network topology. Pairing multi-voxel pattern analysis of fMRI data and social network analysis, we found that social network position information is both accurately perceived and spontaneously activated upon encountering familiar individuals. In the second study, we probed how knowledge of familiar individuals' social network positions, once retrieved, impacts social cognition and behavior. We found that social attention is modulated by eigenvector centrality, such that perceivers attend more to the apparent internal states of people who are particularly well-connected to well-connected others in their shared social network. These results build on the extant literature relating social status and social attention, and likely reflect the heightened behavioral relevance and social value of individuals with particular configurations of affiliative social ties. Taken together, the findings of these two studies demonstrate that people have strikingly accurate knowledge of where others sit in their social networks, retrieve this knowledge when encountering one another, and are influenced by this knowledge in their subsequent thoughts and behaviors.

TALK 2: NEURAL SYSTEMS TRACKING POPULARITY AND NARCISSISM IN REAL WORLD SOCIAL NETWORKS

Kevin Ochsner, Noam Zerubavel, Peter Bearman, Columbia University

Successfully navigating our complex social world requires understanding the relative status of members of our groups. Sociologists and social psychologists have historically emphasized two kinds of status that have important implications for behavior: power-based status, where individuals vary in their control over resources and outcomes, and affiliation-based status, where individuals vary in the extent to which they are liked by other group members. To date, the majority of neuroscience research has focused on power-based hierarchies rather than affiliation-based popularity. Here we present two imaging studies that leverage functional imaging to address questions about popularity. The first examined the neural systems tracking the popularity of members of real-world social networks. To do this, we combined social network analysis (SNA) of two friendship-based networks with fMRI analyses that identified brain regions whose activity scaled parametrically scaled with the popularity of target group members whose faces were viewed on on as series of trials. The second study flipped this method around to ask whether we could use fMRI to identify individuals high in narcissism, and whether those individuals would become less popular over time within their social network. We found that two kinds of brain regions tracked the popularity of others in your network – regions involved in affective evaluation (e.g. vmPFC, amygdala, ventral striatum) and social cognition (e.g. dorsal MPFC, TPJ) – whereas only the former tracked narcissism and predicted changes in popularity over time. These data have implications for models of affect, person perception and group behavior.

TALK 3: SOCIALLY DRIVEN CHANGES IN THE SOCIAL DECISION-MAKING NETWORK OF ZEBRAFISH

Magda Teles and Rui F. Oliveira, Instituto Gulbenkian de Ciência, Oeiras, Portugal.

The ability of an animal to express the appropriate behavioural response according to its social status in a group is a key adaptive feature in group-living species. Nevertheless, how social information is translated into behavioural changes and what are the specific cues that signal a change in social status are still unknown. In the last couple of years a neural network (aka social decision-making network- SDMN), composed by two forebrain and midbrain conserved neural circuits (the social behaviour network and the mesolimbic reward system) that are reciprocally connected, has been proposed as the neural substrate for the expression of flexible social behaviours. According to this hypothesis, the expression of social behaviour is best represented by the overall activation pattern of this network, rather than by the activity of each individual node. Therefore, the same neural circuitry may underlie the expression of different behaviours depending on social context. Here we present two studies in zebrafish that address socially driven behavioural shifts. In the first study we examined variations at the neurogenomic level in response to social status shifts and we found that whole brain transcriptome changes rely on the assessment of fight outcome. In the second study, we studied the expression of immediate early genes as markers of neuronal activity in the SDMN nuclei and found that social status driven behavioral transitions were best represented by the orchestrate activity of different nuclei across the brain. Our data highlight the impact of social information on the brain transcriptome and the relevance of a neural network focused approach when studying complex behaviours.

TALK 4: TEMPORAL DYNAMICS OF SOCIAL BEHAVIOR IN MOUSE SOCIAL HIERARCHIES

James Curley, Won Lee, Cait M Williamson, Department of Psychology, University of Texas at Austin, Texas, USA

Dominance hierarchies are a common form of social organization in group-living social species emerging when individuals must compete for access to resources such as food, territory or mates. We report that male and female laboratory outbred CD1 mice living in large ethologically-relevant vivarium housing consistently form extremely linear and stable dominance hierarchies in groups of up to 30 individuals. In larger groups we show that mice further self-organize themselves into dissociable sub-communities of individuals embedded in the larger social network. Within each hierarchy individual mice possess a unique social rank and show highly consistent aggressive and subordinate behavior to mice of relatively lower or higher social status. We also demonstrate that mice adjust their social dominance behaviors dependent upon their current social context. Sub-dominant mice attenuate their aggressive behavior towards other less dominant males in the presence of an alpha individual. Sub-dominant males also show a rapid social ascent up a hierarchy following removal of the alpha male from the social group. We report brain-region specific changes in immediately early gene activation and expression of brain plasticity related genes including BDNF, DNMT1, and DNMT3a in males undergoing this dynamic social ascent. These data provide a strong framework for investigating the neurobiological basis of flexible and dynamic changes in complex social behaviors that occur within group-living social species.

Q&A PERIOD

Q&A will begin after the session, speakers will take questions from the audience.

Symposium Session 2

THE SOCIAL TRANSMISSION OF PAIN AND THREAT: IMPLICATIONS FOR UNDERSTANDING SOCIAL COMMUNICATION, SOCIAL BEHAVIOR, AND SOCIAL RELATIONSHIPS

Friday, November 10, 2:00 – 3:15 pm, Ballroom West A&B

Chair: Abigail Marsh
Discussant: Lauren Atlas
Speakers: Jeffrey Mogil, Marie-H Monfils, Isabella Wagner, Abigail Marsh

Overview: Pain is a complex, centrally mediated phenomenon that is moderated by individual-level neurocognitive variables like emotion and expectation. Recent research has begun to explore inter-relationships between pain and social variables like familiarity, kinship, and prosocial behavior. For example, it has been found that socially communicated pain and distress elicit prosocial responses in mice and rats, but that sex, kinship, and familiarity moderate these responses. In humans, empathic neural responses to others' pain have been shown to reflect common representations in the mid-cingulate and anterior insular cortices—which are similarly responsive to the effects of opioid antagonists and placebos—and these common representations are linked to human prosociality as well, including extreme acts of altruism for strangers. Exploring neural processes that support the social transmission and moderation of pain may provide insight into key mechanisms involved in pain, empathy, and affiliation.

TALK 1: MICE ARE PEOPLE TOO: SOCIAL MODULATION OF AND BY PAIN IN LABORATORY MICE AND UNDERGRADUATES

Jeffrey Mogil, Department of Psychology, McGill University

Dr. Mogil will discuss the social modulation of pain in laboratory rodents and humans. Although it is a common assumption that empathy and prosocial behaviors are the sole province of humans, evolutionary antecedents of such phenomena are starting to be demonstrated in non-human animals, and even in rodents. Dr. Mogil will discuss his translational work on the interrelationships between pain and social behavior: both how pain is communicated socially, and how pain affects social interactions. He and his colleagues find that mice are capable of empathic pain contagion and apparent helping behavior (in female mice only), that pain status is communicated by facial expression, and that mouse-mouse and mouse-human interactions can affect laboratory studies of pain.

TALK 2: SOCIAL TRANSMISSION AFTER TONE-SHOCK CONDITIONING: FEAR CONDITIONING BY-PROXY IN SISTERS AND STRANGERS

Marie-H Monfils, Department of Psychology, University of Texas Austin

Dr. Monfil will discuss the role of kinship on the social transmission of fear conditioning by proxy in rats, with an emphasis on sex differences. Her work demonstrates that pairing a neutral conditioned stimulus with a painful unconditioned stimulus leads to associative learning such that the tone alone will elicit freezing in anticipation of pain. The association between the conditioned stimulus and the painful stimulus can also be transmitted by proxy, such as by observing the fear behavior of a conspecific who anticipates a painful stimulus. Dr. Monfils will discuss her recent research on the influence of kinship and familiarity on social transmission of fear in female rats. For example, social interactions between conditioned rats and rats conditioned by proxy contribute to the fear behaviors displayed by rats conditioned by proxy. Moreover rats who are kin demonstrate more prosocial behavior following threat, suggesting that familiarity and/or kinship influence how the anticipation of pain is transmitted between individuals.

TALK 3: EFFECTS OF PLACEBO ANALGESIA ON THE MULTI-VOXEL REPRESENTATIONS OF DIRECTLY EXPERIENCED PAIN AND PAIN EMPATHY

Isabella Wagner, University of Vienna

Empathy for pain engages similar brain regions as a direct painful experience. This suggests common representations for the two experiences that appear anchored in mid-cingulate and anterior insular cortices (MCC, AI). Definitive evidence for such common representations is, however, missing. Dr. Wagner will discuss recent findings demonstrating that placebo analgesia reduces both empathic and experienced pain. Dr. Wagner used multi-voxel pattern analysis to investigate the neuronal representations of experienced and empathic pain and how they are affected by placebo analgesia. Analyses focused on MCC and AI to test representations of self- and other-directed stimulation, and common or distinct representations between self- and other-directed stimulation, in participants who underwent fMRI while receiving painful and non-painful electrical stimulation, or while observing another person exposed to such stimulation. Results showed that MCC and AI representations of self-directed stimulation partly generalized to other-directed stimulation and vice versa. Self- and other-directed painful and non-painful stimulation were dissociable in the control group, but this was not possible for other-directed stimulation in the placebo group. Initial whole-brain searchlight results point towards altered prefrontal control processes following placebo analgesia. Results suggest that placebo analgesia changes neuronal representations that underlie direct pain and pain empathy.

TALK 4: LINKING EMPATHIC SIMULATION OF PAIN EXPERIENCE AND ANTICIPATION TO EXTRAORDINARY ACTS OF ALTRUISM

Abigail Marsh, Department of Psychology, Georgetown University

Empathic simulation is hypothesized to support the detection of pain and distress and subsequent costly altruism. But correspondence between ecologically assessed altruism and empathic mapping has not been directly tested. Dr. Marsh will discuss findings from a closely matched empathic pain paradigm in which individuals who have performed costly acts of real-world altruism to benefit a stranger exhibited increased self-other mapping in anterior insula (AI) when experiencing and watching a stranger experience pain or threat. Altruists exhibited greater self-other correspondence in pain-related activation in left AI both in terms of group-level overlap and individual-level prediction of empathic pain by first-hand pain (but not threat) experience. Altruists also exhibited enhanced functional coupling of left AI with left mid-insula during empathic pain and threat, and bilateral amygdala during empathic threat. Heightened empathic responding in altruists corresponds to their atypical representations of strangers relative to known others. Results highlight the role of empathic processes in altruism and limitations of self-reports.

Q&A PERIOD

Q&A will begin after the session, speakers will take questions from the audience.

Symposium Session 3

ANXIETY AND RESPONDING TO THREAT: NEUROBIOLOGICAL AND CONTEXTUAL CONTRIBUTIONS TO DEVELOPMENT

Friday, November 10, 4:15 – 5:30 pm, Ballroom West A&B

Chairs: Harma Meffert and Kalina Michalska

Speakers: Jacek Debiec, Kalina J. Michalska, Alexander Shackman, Harma Meffert

Overview: The capacity to correctly identify environmental threats and to adequately learn from them to modify future behavior is critical for survival. However, while fear and anxiety to such threats are adaptive responses, in excess, they are a significant risk factor for developing psychopathology. Marked individual differences in responsivity to fearful- and anxiety-provoking stimuli are observable in humans, as well as in rodents and monkeys.

However, there is also substantial variation in the extent to which developing organisms are exposed to environmental danger. In this symposium, we will explore the influence of individual differences in threat sensitivity and early experiences of threat on the development of anxiety and its behavioral consequences. By combining data from both normative and clinical human samples with animal models, we gain a more complete understanding of the contribution of different physiological and neural substrates to developmental trajectories of anxiety. Collectively, these papers connect individual traits to

threat responding across a variety of contexts, shedding light on different developmental pathways but also on the developmental systems in which the organism develops.

TALK 1: BALANCING BETWEEN FEAR AND SAFETY: A DISTINCT ONTOGENY OF FEAR LEARNING AND SOCIAL BUFFERING OF FEAR IN THE ANXIOUS PHENOTYPE

Jacek Debiec, Department of Psychiatry, University of Michigan

Studies in rodents show that fear conditioning is typically quiescent in newborn pups. This developmental dormancy of fear learning until around postnatal (PN) 10 is conditional upon diminished stress response and enables undisturbed attachment to the caretaker. However, maternal presence suppresses stress response and prevents fear conditioning in pups until around PN 15. In older pups, a mother can still attenuate stress responses but these effects are not sufficient to prevent fear conditioning. Using a rat model of a selectively-bred anxious phenotype developed by our collaborators, we found that rats that display spontaneous anxious behaviors in adulthood, may acquire fear conditioning as early as on PN 4, long before their sensory and motor development allows them to express learned fear. We also found that selectively-bred anxious infant rats are sensitive to maternal fear buffering effects. Interestingly, maternal presence was capable of disrupting fear conditioning in pups as late as on PN 28, a time when wild-type pups lose their developmentally unique sensitivity to maternal fear buffering. Our data suggest that selectively-bred anxious phenotype, compared to wild-type animals, is characterized by a precocious emergence of fear conditioning and a prolonged sensitivity to maternal buffering effects. Subsequent experiments revealed distinct endocrine and neural characteristics of fear learning in the anxious phenotype. We will discuss our data in relevance to interactions of hereditary and experiential social factors in the development of childhood anxiety disorders.

TALK 2: CHILDHOOD SHYNESS AND ANXIETY INFLUENCE NEURAL RESPONSES TO FEAR LEARNING IN PREADOLESCENT YOUTH

Kalina J. Michalska[1], Julia S. Feldman[2], Elizabeth Moroney, Laura Machlin, Nathan Fox, & Daniel S. Pine[2], [1]Department of Psychology, University of California, Riverside, CA, [2]National Institute of Mental Health, Bethesda, MD, [3]Department of Psychology, University of California Los Angeles, CA, [4]Department of Psychology, University of North Carolina Chapel Hill, Chapel Hill, NC

Central to etiological accounts of anxiety are abnormalities in fear conditioning, the associative learning process by which an initially benign conditioned stimulus (CS) assumes anxiety-eliciting properties by way of its co-occurrence with a naturally aversive unconditioned stimulus (US). Even though fear conditioning generally serves an adaptive function, it becomes a source of pathology when anxious responses persist to CSs that are no longer predictive of the aversive US. Of note, while the capacity for remembering and maintaining threat–safety discrimination improves with age, relatively little is known about how trait shyness and anxiety in childhood influence the development of brain processes related to the acquisition and subsequent recall of extinguished fears. The objective of the first of two studies was to examine whether early childhood shyness longitudinally influences autonomic and neural correlates of fear extinction recall in preadolescence. We obtained simultaneous neuroimaging and autonomic data in children (n=59) to test the hypothesis that high shy youth show greater autonomic modulation of fear circuitry to extinguished cues during extinction recall. Our results indicate that a set of brain areas is involved in somatic arousal during retrieval of extinguished fear in shy children and that brain responses to fear-related stimuli are modulated to a greater extent in these children. In a second study, we examined associations between eye-gaze and pediatric anxiety symptoms using a face-based version of the above fear conditioning task. Studies in adults suggest that avoidance of eyes may be an important feature of anxiety disorders. However, it remains unclear how the relationship between anxiety symptoms and eye-viewing patterns manifests in children. Youth (n = 82) participated in a fear conditioning and extinction paradigm. Eye movements were recorded in three different areas of interest. Conditioning influenced eye gaze patterns in that children looked longer and more frequently to the eye region of the CS+ than CS- face during fear acquisition, not at baseline or extinction. Further, anxiety symptoms were associated with eye-gaze avoidance, which mediated the effect of anxious traits on self-reported fear during acquisition. By delineating relations between childhood personality traits and indices of fear conditioning, these data may thus may inform theories of fear learning and development.

TALK 3: NEURAL SYSTEMS UNDERLYING EXTREME EARLY-LIFE ANXIETY

Alexander Shackman, Department of Psychology, University of Maryland College Park, College Park, MD.

Children with a behaviorally inhibited or anxious temperament (AT) are at risk for developing anxiety disorders, depression, and co-morbid substance abuse. These disorders are highly prevalent, often debilitating, and frequently treatment-resistant, underscoring the need to understand the neural systems that underlie the expression and regulation of the high-risk AT phenotype. Here, I will describe recent published and unpublished work combining multimodal brain imaging techniques with a well-validated primate model of AT. Monkeys are ideal for developing an understanding of the neurobiology of early-life anxiety; homologous genes and brains endow monkeys and children with a similar repertoire of defensive responses to novelty and potential threat, enabling similar procedures for quantifying trait-like individual differences in the anxious phenotype. Work using these methods has revealed compelling evidence that variation in AT—a multidimensional phenotype that incorporates threat-elicited alterations in behavioral inhibition and neuroendocrine activity—reflects a distributed network of brain regions that includes the central nucleus of the amygdala (Ce) and bed nucleus of the stria terminalis (BST). Both regions are involved during sustained exposure to acute intruder threat (n=592), whereas the BST specifically supports persistently elevated anxiety following threat encounters (n=109), ps< .05, corrected. AT is stable over time and heritable. Recent neurogenetic analyses reveal that the BST mediates the intergenerational transmission of genetic risk for the development of psychopathology, whereas the Ce mediates environmental risk (n=592). Furthermore, reduced functional connectivity between the Ce and prefrontal cortex was associated with heightened anxiety outside the scanner in monkeys (n=89) and pediatric anxiety patients (8–12 years; n=28). These findings provide new insights into the origins of temperament, a framework for understanding the neurobiological bases of early-life anxiety, and set the stage

for developing improved intervention strategies for stress-related psychopathology.

TALK 4: AMYGDALA RESPONSE TO DISTRESS CUES AND CALLOUS-UNEMOTIONAL PERSONALITY; MODERATION BY TRAUMA

Harma Meffert Ph.D., Patrick M. Tyler Ph.D., Mary L. Botkin, Anna K. Erway, Venkata Kolli MD, Stuart White Ph.D., Kayla Pope MD JD, R. James R. Blair Ph.D., Center for Neurobehavioral Research, Boys Town National Research Hospital, 14100 Crawford Street, Boys Town, NE 68010

Youth displaying disruptive behavior show amygdala hypo-responsiveness to fearful expressions as a function of a callous-unemotional (CU) traits (i.e., reduced guilt and empathy). However, some research suggests that trauma exposure may moderate this relationship. Specifically, work has identified two groups of disruptive youth with equivalent high levels of CU-traits, but differing levels of anxiety and trauma exposure. The objective of the first of two studies was therefore to examine whether trauma exposure influenced the neurobiology underlying fear expression processing in 72 youth with varying levels of disruptive behavior and trauma exposure. Participants performed a gender discrimination task while viewing morphed expressions (0%, 50%, 100%, 150% fear). A linear regression analysis on the BOLD data, using level of CU-traits and trauma exposure as covariates, showed a significant CU-traits-by-trauma exposure interaction within right amygdala; CU-traits were negatively associated with fear intensity modulated amygdala responses in low trauma participants but positively associated with fear intensity modulated amygdala responses in high trauma participants. The second study aimed at examining how the neurobiology underpinning fear expression processing predicted social behavior as a function of trauma exposure. Participants were invited back to complete a social goals task. Data suggest that stronger fear responsivity in the amygdala predicts prosocial behavior in low trauma youth (avoiding conflicts), whereas stronger fear responsivity predicts non-social behavior (revenge) in high trauma youth. These data suggest that there is not a unique pathophysiology associated with increased CU-traits. In youth with low trauma exposure, CU-traits relate to a reduced empathic response to distress cues. This is expressed at the neural level as a reduced amygdala response to these distress cues. However, in youth with high trauma exposure, an environmental insult known to increase threat sensitivity, CU-traits relate to a heightened response to fearful expression stimuli. Importantly, the current data strongly reinforce the importance of determining the pathophysiology underpinning a particular behavioral presentation; interventions need to be tailored to the individual's pathophysiology rather than their behavioral presentation alone.

Q&A PERIOD

Q&A will begin after the session, speakers will take questions from the audience.

Novel Approaches and Methodologies

Title	Date	Time	Location
Comparing Human and Monkey Neural Circuits for Processing Social Scenes	**Friday, November 10**	**3:15 – 3:35 pm**	**Ballroom West A&B**
Learning and Connecting in the Real World: Conducting Neuroscience Research in High School Classrooms and Museums	**Friday, November 10**	**3:35 – 3:55 pm**	**Ballroom West A&B**

Animal Method:

COMPARING HUMAN AND MONKEY NEURAL CIRCUITS FOR PROCESSING SOCIAL SCENES

Friday, November 10, 3:15 - 3:35 pm, Ballroom West A&B

Presenting author: Julia Sliwa, Rockefeller University. Co-authors: Sadie R. Marvel, Bard College and Winrich A. Freiwald , Rockefeller University

Recognizing agents, their actions, and their interactions is essential for understanding the world around us. In the monkey brain, these cognitive steps engage serially three distinct neural circuits: The face and body patches, the Mirror Neuron System (MNS) and finally the Exclusively Social Interaction Network, a putative precursor of the Theory of Mind (ToM) network in monkeys. It remains unknown however whether humans and monkeys employ same or different neural strategies to process social scenes. To answer we scanned human subjects with fMRI, while they were presented with the same videos as the ones presented to monkeys, and additionally with videos of social scenes involving human actors. We show that similarly to monkeys, humans 1) engage face and body areas in all social video conditions, and 2) engage the MNS in a generic manner for watching agent-object, agent-agent and object-object interactions. Yet contrary to monkeys, humans 1) spontaneously engage the ToM network also when watching non-acting agents, and 2) equally enhance the activity of the ToM network when watching agents performing goal-directed actions and social interactions. These results identify which neural strategies are shared and which ones adapted to the specific needs of the species.

Human Method:

LEARNING AND CONNECTING IN THE REAL WORLD: CONDUCTING NEUROSCIENCE RESEARCH IN HIGH SCHOOL CLASSROOMS AND MUSEUMS

Friday, November 10, 3:35 - 3:55 pm, Ballroom West A&B

Presenting author: Suzanne Dikker, New York University

Neuroscience research has produced tremendous insight into how the human brain supports learning and social dynamics. Still, laboratory-generated findings do not always straightforwardly generalize to real-world environments, such as schools. In an effort to bridge the neuroscience laboratory and naturalistic learning settings, we collaborated with New York City high schools to collect EEG data from students as they engaged in natural classroom interactions. Brain-to-brain coherence analyses showed that the EEG signal was more synchronized among students if they liked each other better, if they were more socially aware, and when they enjoyed a class activity better.The role of engagement in brain-to-brain synchrony is further supported by an art/science collaboration that enabled us to collect EEG data from 3,000 museum visitors during pairwise face-to-face interaction: in a subset of 614 participants, we found that pairs who reported higher social closeness and focus also exhibited stronger brain-to-brain synchrony. Taken together, we hope to demonstrate that an unconventional, 'crowdsourcing neuroscience' approach can provide valuable insights into the brain basis of dynamic real-world social interactions, complementing laboratory-based research on engagement and learning.

Early Career Award Talks

Congratulations to the 2017 Early Career Award Winners

Jonathan B. Freeman, New York University
Oren Forkosh, Max Planck Institute of Psychiatry

The Early Career Award special lectures take place on Friday, November 10, 2017, 5:30 – 6:00 pm, in Ballroom West A&B of the Renaissance Washington, DC Downtown Hotel.

The Society for Social Neuroscience has established this award to recognize Early Career Contributions to Social Neuroscience.

The purpose of the award is to recognize outstanding contributions by scientist early in their careers. Two awardees, one for human research and one for animal research, are named by the Awards Committee, and are honored at the S4SN 2017 Annual Meeting.

More than Meets the Eye: Neural Mechanisms of Stereotypic Vision

Friday, November 10, 2017, 5:30 –5:45 pm, Renaissance Ballroom West A&B

Jonathan B. Freeman

New York University

Visual perceptions of social categories are often thought to reflect direct 'read outs' of facial features. Recent computational models suggest, instead, that they emerge from a dynamic negotiation between the processing of facial features and top-down factors (e.g., stereotypes) harbored within perceivers. In such models, faces activate social categories, which in turn spontaneously activate stereotypes. Once triggered, stereotypes can create biases in how a face is perceived, leading its visual representation to become more consistent with stereotypes. We tested key predictions of such models across four fMRI studies, combining multi-voxel pattern analyses (MVPA) with a computer mouse-tracking technique that exploits hand movements as a measure of covert response activation. Study 1 provided evidence that faces simultaneously activate multiple social categories that manifest in patterns of the right fusiform gyrus (FG). In Study 2, multi-voxel representational patterns associated with stereotype traits were observed in the anterior temporal lobe (ATL), and these were automatically re-instantiated when exposed to a facial exemplar associated with the stereotype traits. In Study 3, we show that overlapping stereotypes (male and Black categories sharing stereotypes: 'aggressive') bias the visual perception of social categories and lead those categories to exhibit greater neural-pattern similarity in the FG and orbitofrontal cortex (OFC). Study 4 eplicated this effect but controlled for visual confounds and linked it to inter-individual variability in stereotypical associations. Together, the results suggest that social categories automatically activate stereotypes that in turn shape their own visual perception. The findings point to a network underlying stereotypic vision, in which faces activate stereotypical associations in the ATL, which are used by the OFC to form visual predictions that in turn modulate FG face representation.

What is personality, where does it hide, and how to find it?

Friday, November 10, 2017, 5:45 –6:00 pm, Renaissance Ballroom West A&B

Oren Forkosh [1,2]

[1] Max Planck Institute of Psychiatry, Munich, Germany, [2] Max Planck Institute for Ornithology, Konstanz, Germany,

Stable behavioral variabilities between individuals play a key role in natural selection by ensuring diverse responses to threats and challenges. These intra-individual differences, which are often referred to as personalities, are hidden traits since they cannot be measured directly. Instead, we generally rely on the way they are reflected in the behavioral repertoire of the animal. However, existing approaches to animal personality focus only on some particular behavioral quantities, resulting in a potentially biased, noisy, and anthropomorphic perspective. To address this, we developed a hypothesis-free computational approach to infer trait-like dimensions based on their stability and discriminatory power. Using the experimental setup that we constructed, we were able to phenotype 42 groups of four mice for a total of 168 animals, tracked continuously for four days or more. For each mouse and for each day, we produced a high-dimensional readout of 60 different behaviors, such as the number of chases, the number of approaches, time at the feeder, etc. Our mathematical model is conceptually similar to principal component analysis but instead seeks the directions in which behaviors are both unique and stable across time. We found four personality traits that remained stable even after we shuffled the mice into new groups where no two mice were familiar, as well as when we compared them as juveniles and as adults. Surprisingly, the personalities of mice spanned a structured space, triangularly shaped, which reflects the different behavioral strategies that mice use in order to survive. In our work, we suggest a new model to investigate personality, which focuses on stability as much as variability, and is just as applicable to humans as it is to mice and other animals.

Poster Schedule

Poster sessions are scheduled for Friday in Ballroom West A&B of the Renaissance Washington, DC Downtown Hotel in Washington, DC. All attendees must present their S4SN 2017 name badge to enter the Ballroom West A&B. Do not leave personal items in the poster room. The presenting author must be present during the assigned session. You may post your materials on the board assigned to you at any time listed below in the "Set-up Begins", but before the beginning of the assigned poster session. You must remove your poster promptly no later than the time listed below in "Take-down Complete." Any posters left up after the "Take-down Complete" will be removed and discarded.

Poster Session	Date	Set-up Begins	Session Begins	Session Ends	Take-Down Completed
A	**Friday, November 10**	**8:30 pm – 1:00 pm**	**1:00 pm**	**2:00 pm**	**2:30 pm**
B	**Friday, November 10**	**2:30 pm – 6:00 pm**	**6:00 pm**	**7:00 pm**	**7:15 pm**

***** Please note that only scheduled registered poster presenters may enter the exhibit hall during the half hour set-up time. **Note**: Please remove your poster promptly at take down complete time, so that the next presenter may set up their poster.

Posters Session A

Friday, November 10, 2017, 1:00 pm – 2:00 pm, Ballroom West A&B

A1 Deserted prairie vole mothers: unaltered maternal investment but increased emotionality due to heightened brain CRF system activity

Oliver J. Bosch[1], Tobias Pohl[1], Inga D. Neumann[1], Larry J. Young[2]; [1]Department of Behavioural and Molecular Neurobiology, University of Regensburg, Regensburg, Germany, [2]Center for Translational Social Neuroscience, Department of Psychiatry, Yerkes National Primate Research Center, Emory University, Atlanta, GA, USA.

When the father leaves the family, the prevalence of depression and anxiety disorders in mothers increases perhaps due to increased childcare responsibilities and reduced social support. Previous work in the biparental, socially monogamous prairie voles showed that separation of the bonded partner causes increased passive stress-coping, indicative of depressive-like behavior, and chronic stress in both females and males. However, the consequences of separation in lactating prairie voles are unknown. Here, after 18 days of cohousing, half of the prairie vole pairs were separated by removing the male. Following parturition, there were no group differences in maternal care. However, anxiety-related behavior as well as passive stress-coping behavior were significantly elevated in separated mothers. Furthermore, CRF mRNA expression in the PVN was increased after separation under basal conditions. In a second cohort of animals, females were acutely infused with vehicle or the nonspecific CRF receptor antagonist D-Phe 10 min prior to behavioral testing. The brief restraining during acute treatment infusion significantly decreased arched back nursing in both paired and separated vehicle-treated groups, whereas in the separated D-Phe-treated group the behavior was unchanged. Furthermore, in the separated females the increased anxiety-related behavior and passive stress-coping was back to normal levels (paired, vehicle-treated) after treatment with D-Phe. In conclusion, maternal investment is robust enough to withstand loss of the partner, whereas the mothers' emotionality is negatively impaired and potentially mediated by a CRF-dependent mechanism. This animal model has potential for mechanistic studies of the behavioural and physiological consequences of partner loss in single mothers.

Keywords: stress

A2 Mechanisms of social fear conditioning in zebrafish

Júlia Pinho[1], Pradeep Lal[2], Koichi Kawakami[2], Rui Oliveira[3] ; [1]Integrative Behavioural Biology Group, Instituto Gulbenkian da Ciência (IGC), Oeiras, Portugal and Eco-Ethology Research Unit, ISPA- Instituto Universitário, Lisboa, Portugal, [2]Division of Molecular and Developmental Biology, National Institute of Genetics, Japan, [3]Integrative Behavioural Biology Group, Instituto Gulbenkian da Ciência (IGC), Oeiras, Portugal; Eco-Ethology Research Unit, ISPA- Instituto Universitário, Lisboa, Portugal and Champalimaud Center for the Unknown, Lisboa, Portugal.

Group living animals can use public information when making decisions about the presence of threat in the environment. Social cues from conspecifics can be used not only to trigger a response but also as unconditioned stimulus (US) that can be paired with other cues in the environment (that will become conditioned stimuli, CS) in order to predict the presence of threat in the environment through associative learning (observational conditioning). The evolution of a specialized neural module to process social information has been the focus of much debated in comparative cognition literature. In this study we tested the occurrence of observational conditioning in zebrafish, and characterized its neuromolecular mechanisms. We found that chemical (alarm cue) but not visual (sight of conspecifics freezing) was effective as a US in the observational conditioning task. Next, we characterized the pattern of brain activation associated with olfactory observational conditioning using the expression of an immediate early gene (c-fos) as a marker of neuronal activity. Differential activation patterns were observed between learners and non-learners in olfactory bulb and dorsal medial telencephalon (Dm, teleost homologue of the basolateral amygdala in mammals). We created a transgenic zebrafish line that expressed the yeast Gal4 transcription factor in a specific neuronal population in Dm, and used it for the selective inactivation of Dm (by expressing a neurotoxin gene via the Gal4-UAS system). Then we tested the involvement of this brain region in observational learning (i.e. when a social US is used), and found that inactivation of the neuronal population impaired fear conditioning using the alarm cue as US. We showed that the same neuronal population is essential for fear conditioning using an electrical shock as US (Lal et al. submitted). Thus, our results support the existence of a common neuronal population that mediates both observational and non-social fear conditioning.

Keywords: Social Learning, Fear, Zebrafish

A3 Peripheral expression of oxytocin receptors: a cross-species comparison

Maria Greenwood[1], Elizabeth Hammock[1]; [1]Florida State University, Psychology Department, Program in Neuroscience.

Oxytocin (OXT) is an integral part of the neural regulation of social behavior across mammalian species, with a prominent role in maternal behaviors. Maternal OXT acts within the mother to transform her behavior and physiology to be able to deliver, nourish, and nurture her offspring. OXT is found in maternal peripheral fluids such as amniotic fluid, saliva, and breast milk. OXT receptors (OXTR) have been previously identified in regionally specific areas of the infant periphery in neonatal C57BL/6J mice (Mus musculus), and specificity was confirmed with a congenital OXTR knockout mouse model as well as competitive binding techniques. The aim of the current project was to assess peripheral sites of OXTR for cross-species comparisons in commonly used laboratory rodent models with well-characterized social behaviors. These species included Long-Evans rats (Rattus norvegicus), Sprague-Dawley rats (Rattus norvegicus), and Prairie voles (Microtus ochrogaster) Receptor autoradiography was performed on 20µm sagittal sections of whole neonatal (PD 0) males and females of each species using the 125iodinated-ornithine vasotocin ([125I]-OVTA) radioligand. A competition binding assay was used to assess the selectivity of [125I]-OVTA for peripheral OXTR. Radioactive ligand (0.05nM [125I]-OVTA) was competed against concentrations of 0nM and 1000nM excess unlabeled OXT. Autoradiographs demonstrated the high selectivity of the radioligand for neonate peripheral OXTR differentially across species. Previously identified regions of significant OXTR expression in the mouse were analyzed for comparison: oronasal cavity, ciliary bodies of the eye, whisker pads, adrenal gland, and anogenital region. Nonspecific binding that could not be fully competed away with unlabeled OXT was observed in areas with high lipid content such as the scapular brown adipose tissue and the liver. Collectively, these data confirm OXTR targets localized in the periphery across different mammalian rodent species and strains.

Keywords: Oxytocin, Neonatal, Autoradiography, Vole, Mouse, Rat

A4 Effect of relative social rank within a social hierarchy on neural activation in response to familiar or unfamiliar social signals

Won Lee[1], Hollie Dowd[2], Cyrus Nikain[1], Eilene Yang[1], James Curley[1]; [1]Psychology Department, Columbia University, [2]Barnard College, Columbia University.

Living in a social hierarchy shapes the physiology of individuals as well as their perception of social cues from others according to their own relative social status. We have previously shown that alpha males living in social hierarchies invest vast resources in scent-marking and the production of major urinary proteins (MUPs) and serve as an honest signal of the alpha status. Here, we identified brain regions involved in the perception of specific social cues in urine that are relevant to showing appropriate social behaviors in different social contexts. We housed adult outbred CD1 male mice (n=12) in a large vivarium constructed to resemble the wild habitat of the progenitors of laboratory mice. We reconfirm the previous finding that groups of 12 male mice living in these vivaria form stable linear dominance hierarchies in which each animal can be ranked individually. We show that animals living in the social hierarchy are able to flexibly change their social behaviors appropriate to different social contexts. We demonstrate brain-region specific activation throughout the social brain network of c-fos protein immunoreactivity throughout the social behavior brain network as mice are exposed to urine from familiar-alpha males, unfamiliar-alpha males, familiar-subordinate males or unfamiliar-subordinate males. Further, we demonstrate that animals vary in the degree of neural activation to the same social cue as they differ in their relative social ranks. Within brain regions we found significant differences across different social ranks or social cues, we performed double-label fluorescent immunohistochemistry to identify cellular types of the neurons that were activated in response to the social cues. This study emphasizes the importance of studying the neurobiological underpinnings of social dynamics within an ethologically relevant behavioral paradigm.

Keywords: social behavior, mouse, social dominance, social communication, olfactory system

A5 Immediate early gene activation throughout the social behavior network in response to dynamic changes in social status

Caitlin Williamson[1], Won Lee[1], Inbal Klein[1], James Curley[1]; [1]Columbia University.

Understanding the neural mechanisms of dynamic social behavior requires complex behavioral analysis as well as rigorous neurobiological techniques. Our lab investigates the social relationships of groups of adult outbred CD1 male mice (n=12) living in a large, complex vivarium. The aggressive and subordinate behaviors between mice are recorded during focal sampling observations (2-5 hours per day) that start daily at the onset of the dark light cycle. Previously, our lab has demonstrated that male CD1 mice living in these groups of 12 form linear dominance hierarchies and that social rank is associated with differential gene expression throughout the brain. Here, we show that removal of the alpha male from the group leads to behavioral changes in the remaining mice, with the beta male rapidly rising to alpha status and exerting high levels of aggression on all other individuals in the system. In this study, we examine c-fos immunoreactivity throughout the brain in order to determine which brain regions within the social decision making network are activated when an individual is recognizing this social change, integrating social information, and behaving in a contextually appropriate manner while undergoing social transition. We show that the infralimbic and prelimbic regions of the prefrontal cortex are differentially activated in response to this change in social status. Further, we present preliminary data demonstrating the behavioral consequences of selectively inhibiting this region of the prefrontal cortex using the DREADD system. This research provides insight into the neural mechanisms of social behavior in large, socially dynamic groups.

Keywords: social neurobiology, social context, prefrontal cortex

A6 Social affective behaviors activate insular cortex and require PKC

Morgan Rogers[1], Juan Varela[1], John Christianson[1], [1]Boston College.

Social animals can detect the affective state of others to organize appropriate social behaviors, a phenomenon termed social affect. Here we explore the mechanisms underlying social affect in a test in which an adult male rat is presented with a pair of unfamiliar male conspecifics, one of which is stressed via 2 footshocks and the other naïve to treatment. Test rats prefer to interact with a stressed juvenile (PN30) conspecific, but will avoid a stressed adult (PN50) conspecific. Fos immunoreactivity indicates that exposure to stressed PN30 versus PN50 conspecifics differentially activates the insular cortex (IC). IC is anatomically positioned to process social affective information and contains a dense distribution of oxytocin receptors (OTR). IC oxytocin (OT) augments intrinsic and synaptic plasticity and is critical to SAP behavior. Here we tested whether the effects of OT, a Gq11 coupled receptor, are mediated by PKC by applying the PKC antagonist Gö-6893 (200nM) in vivo and in vitro. Bilateral IC infusion of Gö-6893 abolished social affective behavior and OT failed to alter synaptic or intrinsic excitability in the presence of Gö-6893. These data suggest that OT, vial intracellular PKC signaling is a critical mediator of social affect in the IC.

Keywords: oxytocin, empathy, rat, insular cortex, PKC, intrinsic excitability, synaptic plasticity, Fos

A7 Oxytocin differentially couples the anterior cingulate cortex and amygdala for prosocial and antisocial decisions

Olga Dal Monte[1], Nicholas Fagan[1], Steve Chang[1] ; [1]Yale University.

In recent years, the neuropeptide oxytocin (OT) has become one of the most studied peptides of the human and animal neuroendocrine system. Research has shown widespread behavioral effects and potential therapeutic benefits. However, little is known about the mechanisms by which OT triggers these effects in the brain. Previous studies have focused on the amygdala as an important target of OT's effects, typically reporting a decrease in BOLD activation in response to emotional stimuli following systemic OT administrations. Furthermore, accumulating evidence suggests that OT plays a role in regulating communications among brain regions involved in social behavior. However, it remains unexplored how local OT signaling within a specific brain region modulates such interactions during social behaviors. Here, we focally infused OT in the basolateral amygdala (BLA) to examine its direct effects on the neuronal coordination between BLA and the reciprocally-connected anterior cingulate gyrus (ACCg), two regions previously investigated for their roles in social decision-making at the single-neuron level. We used a social reward allocation task in which an actor monkey chooses among delivering juice rewards to himself (Self), the other monkey (Other), both himself and the other monkey (Both) or a juice collection bottle (Neither). During this task, we recorded local field potential (LFP) activity simultaneously from ACCg and BLA to investigate changes in their coordination following either OT or vehicle (saline) infusions into BLA. The actors preferred to donate juice to the other monkey (Other) over a juice bottle (Neither), but also preferred Self over Both, providing the contexts for examining the ACCg-BLA interaction across prosocial (Other over Neither) and antisocial (Self over Both) decisions. OT infusions into BLA overall enhanced prosocial behaviors by increasing the number of Other and Both choices while increasing LFP power across multiple frequency bands in BLA following prosocial relative to antisocial choices. Notably, OT infusions into BLA resulted in distinct changes in the ACCg-BLA coherence for prosocial and antisocial decisions - OT increased the ACCg-BLA coherence in the gamma band for prosocial choices but in the beta band for antisocial choices. Our results suggest that enhancing local OT processing in the BLA distinctively modulates neuronal synchronization between ACCg and BLA to guide prosocial and antisocial decisions.

Keywords: Oxytocin, Basolateral amygdala (BLA), Anterior cingulate gyrus (ACCg)

A8 Serotonergic Efficiency Underlies Causal Effect of 5-HTP on Attention

Hannah Weinberg-Wolf[1], Nicholas Fagan[1], George Anderson[1], Olga Dal Monte[1], Steve Chang[1]; [1]Yale University.

Serotonergic transmission, measured via cerebrospinal fluid (CSF) concentrations of the serotonin metabolite 5-hydroxyindoleacetic Acid (5-HIAA), is linked to psychiatric disorders, particularly depression (Sharp and Cowen, 2011). Impaired serotonergic transmission is also linked to poor impulse control, impaired social functioning, extreme aggression, and even mortality in human and non-human primates (Higley & Linnoila, 1997; Westergaard, 1999). Diversity in serotonergic transmission is often independent from central concentrations of serotonergic compounds. In fact, when scientists modulate central serotonin to examine its effects on behaviors associated with depression, they often report inconsistent results. It is likely that this is in part due to individuals' diversity in central serotonergic transmission efficiency, a characteristic usually overlooked in these studies. Previously (Weinberg-Wolf et. al, 2016, SfN abstract), we reported that systemically administering the serotonin precursor l-5-hydroxytryptophan (5-HTP) results in robust bi-directional modulation of attention in rhesus macaques, whereby 5-HTP increased looking duration in animals with low baseline attention (Attend+ group) but decreased looking duration in animals with high baseline attention (Attend¬- group). Here, we elucidate the biochemical mechanisms underlying this causal effect of serotonin on attentional allocation by examining central serotonergic efficiency. While central concentrations of 5-HTP and serotonin at baseline positively predicted the direction in which, and magnitude by which, 5-HTP modulated attention, CSF analyses also confirmed that 5-HTP increased central concentrations of 5-HTP and serotonin in both groups. Previous literature indicates that the ratio of 5-HIAA to serotonin is the best representation of serotonergic efficiency (Roy and Linnoila, 1988). We found that the 5-HIAA to serotonin ratio indeed predicted both looking duration at baseline and also the percent change from baseline in looking duration following 5-HTP administrations. Attend+ animals exhibited lower baseline 5-HIAA to serotonin ratios, and thus poorer serotonergic efficiency, looked for shorter periods of time at baseline and exhibited more positive changes in looking duration due to 5-HTP than their Attend- counterparts. Our results suggest that differences in central serotonergic efficiency underlie diversity in how serotonergic manipulations causally influence attention. These findings may inform treatment plans for serotonergic interventions in disorders like depression and anxiety.

Keywords: Serotonin, attention

A9 Activity in the temporoparietal junction (TPJ) tracks dynamic changes in uncertainty when observing goal-directed action

Kayla R. Velnoskey[1], Steve W. C. Chang[1], Gregory McCarthy[1]; [1]Yale University.

The temporoparetal junction (TPJ) is a critical region for processing goal directed behavior (Allison, Puce, & McCarthy, 2000), yet the mechanism by which this occurs remains unknown. The TPJ may be organized in domain-specific social modules (i.e. Deen et al., 2015), or it may serve a domain general function (i.e. Lee & McCarthy, 2016) that is critical for modeling predictions about expected social behavior. We propose that the TPJ tracks changes in neural parameters for generating and updating predictions over time. We tested this hypothesis using a novel fMRI task in which participants (N=21) viewed a dot traversing a maze containing two possible goals. Participants continuously moved a slider to indicate their certainty about which goal the dot was trying to reach. Mazes were either barrier free (High Uncertainty) or included some barriers to constrain the dot (Low Uncertainty). Critically, the dot's path was matched in both conditions. We examined a whole-brain general linear model (GLM) including a regressor derived from participants' slider positions for estimating subjective changes in goal target uncertainty over time. The High Uncertainty v. Low Uncertainty contrast. revealed that only bilateral TPJ and insula were parametrically modulated by participants' own changes in subjective uncertainty over time. Connectivity analyses and computational modeling are being applied to further specify the relationship between STS/TPJ activity and goal observation with respect to uncertainty estimation. The current results suggest that STS/TPJ responses to goal directed behavior are in part explained by uncertainty in modeling the external world

Keywords: prediction

A10 Comparing human and monkey neural circuits for processing social scenes

Julia Sliwa[1], Sadie R Marvel[2], Winrich A Freiwald[1]; [1]The Rockefeller University, [2]Bard College.

Recognizing agents, their actions, and their interactions is essential for understanding the world around us. In the monkey brain, these cognitive steps engage serially three distinct neural circuits: The face and body patches, the Mirror Neuron System (MNS) and finally the Exclusively Social Interaction Network (ESIN), a putative precursor of the Theory of Mind (ToM) network in monkeys (Sliwa J and Freiwald WA, 2017). It remains unknown however whether

homologous brain regions are involved in humans, or whether humans and monkeys employ different neural strategies to process social scenes. To answer these questions we scanned twenty-six human subjects for fMRI acquisition in two sessions, while they were presented with the same videos as the ones presented to monkeys, and additionally with videos of social scenes involving human actors. Whole-brain activity for watching blocks of human or monkey individuals, their actions and their interactions was compared to the activity for watching control videos of objects' still, moving and interacting, using Random Effects (RFX) Generalized Linear Model (GLM) group analysis. We show that similarly to monkeys, humans 1) engage face and body areas (mapped independently using a classic localizer) in all social video conditions, and 2) engage the MNS (mapped independently using a classic localizer) in a generic manner for watching agent-object, agent-agent and object-object interactions. Yet contrary to monkeys, humans 1) spontaneously engage the ToM network (mapped independently using a classic localizer) even when watching non-acting agents, and 2) equally enhance the activity of the ToM network when watching agents performing goal-directed actions and social interactions. These preliminary results identify which neural strategies are shared and which ones adapted to the specific needs of the species, and specifically emphasize the uniquely human interest in understanding peers' goal-directed actions.

Sliwa J, Freiwald WA (2017) A dedicated network for social interaction processing in the primate brain. Science

Keywords: social interactions

A11 Role of macaque anterior cingulate cortex in value-based prosocial decision-making

K. M. Sharika[1], Michael Platt[1]; [1]University of Pennsylvania.

Previous studies on prosociality in rhesus macaques have shown that monkeys often choose to make positive decisions for a conspecific at no additional cost to self (Chang et al., 2011, Ballesta et al., 2015). While neurons in monkey anterior cingulate cortex (ACC) have been shown to code for other's receipt of positive rewards (Chang et al., 2011), human fMRI studies have implicated ACC in processing vicarious negative outcomes (for e.g. others in pain,Singer et al., 2004; Botvinick et al., 2005; Jackson et al., 2005; Saarela et al., 2007). To test if ACC neurons encode both positive and negative outcomes for others while making decisions for them, we trained rhesus macaques to perform a 'willingness to pay' task in which they chose between two differently colored targets (associated with varying magnitudes of juice across trials) while the juice on offer was cued to be either sweet-tasting or bitter-tasting for the actor monkey or a recipient monkey (sitting across the room and facing the actor monkey). Consistent with the literature on monkey prosociality, our preliminary results suggest that actor monkeys made decisions consistent with their preference for sweet-tasting over bitter-tasting juice, not only for themselves, but for the recipient monkey as well. To further tease out the underlying dynamics of this decision-making behavior with respect to different positive and negative payoffs for 'self' and 'other', we investigated the neuronal activity in ACC while monkeys performed this task.

Keywords: decision-making

A12 Social place cells in the bat hippocampus

David Omer[1], Shir Maimon[1], Liora Las[1], Nachum Ulanovsky[1]; [1]Weizmann Institute of Science Rehovot 76100, Israel.

Social animals need to know the spatial position of conspecifics, both because it is important for them to know the locations of socially-dominant animals, and for purposes of group navigation. However, nothing is known about how the location of other animals is represented in the brain. Here, we addressed this question by studying bats - highly-social mammals that excel in observational-learning and are also outstanding navigators. We designed an observational-learning task for Egyptian fruit bats (Rousettus aegyptiacus), where animals were trained in pairs: In each trial, one bat ('observer') had to observe and remember the flight-trajectory of the other bat ('demonstrator'). After a short delay, the observer had to imitate the demonstrator and fly along the same flight-trajectory to receive a reward - which required the observer to pay close attention to the demonstrator's position. We recorded neurons in hippocampal area CA1 of the observer bat during this task, using a tetrode-microdrive and a miniaturized wireless electrophysiology system that allowed recording of individual neurons in freely behaving bats. A total of ~350 neurons were recorded in 5 bats. To control for the known spatial properties of hippocampal place-cells, we did two things: first, the observer hung at a fixed position while it was observing ('space-clamp'); and second, we used a nine-axis motion sensor on the observer to exclude neural activity due to head-movements. We found CA1 neurons in the observer's hippocampus that represented the position of the demonstrator bat. About half of these cells represented the bat's own position (place cells) as well, but the other half did not. Further, the spatial representation of the demonstrator bat was unaffected by removal of spikes during sharp-wave-ripples - which have been linked to spatial 'preplay' and trajectory planning - and hence it cannot reflect spatial planning by the observer bat. Finally, we also found neurons in CA1 that represented the position of inanimate moving objects; this representation was different from the representation of the conspecific bat. Taken together, these data indicate a possible role for the hippocampus in social-spatial cognition.

Keywords: SOCIAL-SPATIAL COGNITION; OBSERVATIONAL-LEARNING; HIPPOCAMPUS; PLACE CELLS; BAT

A13 Vicarious Subjective Value Representation in the Human Brain: An fMRI Investigation

Matthew Piva[1], Kayla Velnoskey[2], Ruonan Jia[1], Ifat Levy[3], Steve Chang[4]; [1]Interdepartmental Neuroscience Program, Yale University, [2]Department of Psychology, Yale University, [3]Department of Comparative Medicine, Yale University School of Medicine, [4]Department of Psychology, Yale University.

When making economic decisions, people are biased to the present moment and thus discount future rewards in a time-inconsistent manner when making choices that impact their own well-being. Additionally exploring decision-making that impacts others is both relevant to everyday life and to further elucidating value representation in the brain. We designed a study in which participants were asked to make choices between an immediate monetary reward and various monetary rewards of greater values delivered following a delay. In half of trials, participants made decisions for themselves ("Self" trials), while in the other half of trials, participants made decisions for another participant ("Other" trials). We hypothesize that ventromedial prefrontal cortex, ventral striatum, and posterior cingulate cortex encode subjective value in Self trials, while an overlapping set of neural structures encodes vicarious subjective value in Other trials. Behavioral findings based on data from 22 participants indicate that Other choices, like Self choices, follow the expected hyperbolic rate of decay rather than exponential decay (Self: $Z = 3.82$, $P < 0.001$; Other: $Z = 3.11$, $P = 0.002$, Wilcoxon signed-rank test). Discounting rates for Self and Other choices were correlated ($r = 0.92$, $P < 0.001$, Spearman's correlation). However, we noted that participants on average displayed a higher rate of discounting in Self choices than in Other choices ($Z = 2.19$, $P = 0.028$, Wilcoxon signed-rank test). These behavioral results and upcoming univariate and multivariate analyses of BOLD signals can provide additional insight into the neural activity underlying decision-making for self and other.

Keywords: neuroeconomics

A14 Social Interaction Recruits Mentalizing and Reward Systems in Middle Childhood

Diana Alkire[1], Daniel Levitas[1], Katherine Warnell[2], Elizabeth Redcay[1]; [1]University of Maryland, College Park, [2]Texas State University.

Social cognition develops in the context of reciprocal social interaction. However, most neuroimaging studies of mentalizing have used non-interactive stimuli (e.g., descriptions of fictional characters) and may not reflect real-world mentalizing. Recent adult studies have shown that social-interactive context modulates activity in regions linked to social cognition, attention, and reward, but few interactive studies have been done with children. The current fMRI study examines middle childhood (ages 8-12, N=16), a period of increasingly complex peer interactions accompanied by social-cognitive advances. Using a novel paradigm in which children believe they are chatting online with a peer, we compared mental and non-mental reasoning about a live partner (Peer) versus a story character (Character), testing the effects of reasoning type and partner type in a 2 x 2 design. Consistent with prior research, mental versus non-mental reasoning engaged the mentalizing network, including the temporo-parietal junction and anterior temporal lobes. Furthermore, similar regions, plus anterior and posterior midline regions, were engaged more for Peer than Character, even when the task did not require mentalizing. Across reasoning type, Peer also more strongly engaged reward regions (ventral striatum and orbitofrontal cortex). Post-scan self-report questionnaires indicated that children liked reasoning about the peer more than reasoning about the character, supporting our interpretation that Peer conditions were more rewarding than Character conditions. Our results demonstrate that social interaction modulates both mentalizing and reward networks during middle childhood and contribute further evidence that social-interactive paradigms are needed to fully capture how the brain supports social processing.

Keywords: mentalizing

A15 Postnatal Oxytocin Production in Mice

Radhika Vaidyanathan[1], Elizabeth Hammock[1]; [1]Florida State University, Program in Neuroscience, Department of Psychology.

Oxytocin (OXT) via the oxytocin receptor (OXTR) facilitates species-typical social behavior and social recognition of a familiar conspecific. There are underlying sex-differences within species in OXT production and OXTR expression during development, with female mice showing earlier onset of OXT production and higher expression of Oxtr in the perinatal brain when compared to male mice. The effects of neonatal OXT manipulations may be influenced by underlying sex differences in Oxtr expression, and/or sex differences in OXT production and release. Because OXTR activation can promote OXT release, we hypothesized that it might also serve to enhance OXT production during development. In our experiments, we tested the hypothesis that congenital loss of Oxtr would impair the development of OXT production in neonatal C57BL/6J mice in a sex-specific manner. We have described earlier a sexually dimorphic effect of Oxtr deletion on Oxt expression. Our preliminary results showed that at postnatal day 8, male Oxtr knockout mice but not female knockout mice, show a 50% reduction in Oxt mRNA levels compared to WT animals determined by RT-qPCR. In this study, we further explore the developmental timeline of Oxt expression by RT-qPCR, and the effect of congenital loss of Oxtr, in the first postnatal week in mice. These data suggest that the development of OXT/OXTR signaling is sex-specific and suggests sex differences in the experience-dependent development of the OXT system.

Keywords: Oxytocin, mRNA, postnatal development

A16 Lateral septum microRNAs change in response to social fear conditioning in male mice

Anna Bludau[1], Rohit Menon[1], Melanie Royer[1], Gunter Meister[2], Inga Neumann[1]; [1]Department of Behavioural and Molecular Neurobiology, University of Regensburg, [2]Department of Biochemistry I, University of Regensburg.

Dysregulation of microRNAs has been implicated in various neurodegenerative and affective disorders. Generally, microRNAs are known to be crucial regulators of neuronal function and animal behaviour. For example, hippocampal miR-132 is up-regulated after contextual fear conditioning, whereas hippocampal overexpression of miR-134 decreases memory formation revealing a causal role of miRNAs in fear. Furthermore, miR-124 is known to regulate social behaviour in mice and humans. We recently demonstrated that the pro-social neuropeptide oxytocin (OXT) affects miRNA expression in the paraventricular nucleus of the hypothalamus of rats. Moreover, using the social fear conditioning (SFC) paradigm, a specific mouse model for social anxiety disorder, we showed that OXT infusion into the lateral septum (LS) reversed SFC-induced social fear. However, the influence of microRNAs triggered by OXT on regulation of social fear in mice has not been investigated so far. Therefore, we assessed miRNA changes in the LS of male social fear conditioned (SFC+) mice 90min after behavioural assessment and their potential influence on fear-alleviating properties of OXT. Acquisition of SFC showed significantly increased miR-132 and miR-124 level in the LS of SFC+ mice compared to unconditioned (SFC-) mice. Moreover, we observed a post-extinction increase in miR-132 (by trend) and miR-124 levels in SFC- animals whereas SFC+ mice revealed a significant increase of miR-124, but not miR-132 (vs. SFC- mice without extinction). Overall, our results suggest a possible functional involvement of miR-132 and miR-124 in social fear. Currently, we are evaluating the fear-alleviating properties of OXT via microRNAs on social fear related behaviour.

Keywords: microRNA

A17 Social learning is differentially affected by muscarinic acetylcholine receptor blockade in gonadally intact and ovariectomized female mice

Kelsy Ervin[1], Cecil Dana Main[1], Wansu Qiu[2], Elena Choleris[1]; [1]Department of Psychology and Neuroscience Collaborative Program, University of Guelph, [2]Department of Neuroscience/Psychology, University of British Columbia.

Through social learning, animals acquire information from conspecifics rather than trial-and-error. Rodents can learn about novel foods via social transmission of food preferences (STFP), in which observers learn to prefer a food previously smelled on the breath of a demonstrator. In male rats, acquisition depends on muscarinic acetylcholine receptor (mAChR) signaling (Boix-Trelis etal,2007,Neurobiol Learn Mem,87:659; Carballo-Márquez etal,2009,Hippocampus,19:446; Carballo-Márquez etal,2009,Neurobiol Learn Mem,91:98). Female mice in proestrus perform better than mice in diestrus (Ervin etal,2015,Horm Behav,74:53) and estrogens improve social learning and promote ACh signaling (Hammond etal,2011,Psychoneuroendocrinology,36:182; Mitsushima etal,2009,J Neuroendocrinol,21:400); thus gonadal hormones may interact with ACh to influence social learning. We tested effects of mAChR antagonist scopolamine on gonadally intact and ovariectomized (OVX) mice on social learning in the STFP. In the first experiment, observer mice received 1, 2, or 3mg/kg scopolamine or saline 30min before social interaction with a demonstrator and were tested immediately for a food preference. Intact mice were impaired at a lower dose of scopolamine (2mg/kg) than OVX mice (3mg/kg), suggesting they were more sensitive to scopolamine. However, scopolamine also inhibited feeding behavior. To avoid this potentially confounding effect, we tested

observers for food preference 48h after acquisition and treatment with 0.1, 1, or 2mg/kg scopolamine or saline. Initial results show that intact mice were impaired at 1 and 2mg/kg scopolamine. Preliminary results suggest OVX mice are also impaired at 2mg/kg and possibly 1mg/kg scopolamine. Social learning is common in animals and humans, and it is important understand its mechanisms in males and females. Funded by NSERC.

Keywords: learning and memory

A18 The effects of PI3K inhibition on the rapid facilitation of social recognition by estrogens or estrogen receptor agonists in the dorsal hippocampi of female mice

Paul A S Sheppard[1], Alanna Lumsden[1], Iain A Watson[2], Katherine J Sellers[2], Deepak P Srivastava[2], Elena Choleris[1]; [1]University of Guelph, [2]King's College London.

In addition to their delayed/long-lasting effects on gene transcription, rapid effects of estrogens on learning and memory have been repeatedly shown. Facilitation of social recognition (SR) occurs within 40 minutes of systemic administration of 17β-estradiol (E2), as well as estrogen receptor α (ERα) and G-protein coupled estrogen receptor (GPER) selective agonists (PPT and G-1 respectively), but not an estrogen receptor β (ERβ) agonist (DPN) in female mice. Intra-dorsal hippocampal administration of E2, PPT, or G-1 facilitates SR. In addition, systemic administration of E2, PPT, or G-1 increases dendritic spine density in the dorsal hippocampus. The mechanisms of action of these rapid effects are not well understood. A role for estrogenic actions on cell signaling cascades underlying synaptic plasticity and dendritic spine dynamics is likely. Inhibitors of the phosphoinositide-3 kinase (PI3K)/Akt pathway block rapid actions of E2 on object memory consolidation and modulate dendritic spine density, size, and complexity. Furthermore, PI3K signaling is involved in hippocampus-dependent learning tasks and downstream activation of mTOR. Whether the PI3K pathway is also involved in rapid estrogenic facilitation of SR in the hippocampus is unknown. We infused into the dorsal hippocampus LY294002 at 5ng/side - a dose that does not affect SR by itself - to investigate only the PI3K-dependent effects of E2, PPT, or G-1 at doses shown to rapidly facilitate SR in a difficult version of the SR paradigm which is completed within 40 minutes of estrogen/ER agonist/vehicle administration, thus assessing rapid effects of estrogens. Preliminary results show that PI3K inhibition blocks E2-facilitated SR.

Keywords: neuroendocrinology of social behaviour

A19 The rapid effects of hippocampally-synthesized estrogens on recognition learning in ovariectomized mice

Theresa Martin[1], Emma Harman[2], Elena Choleris[3]; [1]Graduate student in charge of the research project., [2]Undergraduate student helping on the research project, [3]Primary Investigator and supervisor of the research project.[5].

It is known that the hippocampus synthesizes its own estrogens from testosterone via the enzyme aromatase, and is implicated in both social and object recognition. Studies have demonstrated that infusion of exogenous estrogen into the hippocampus before and shortly after a learning event rapidly leads to enhanced short and long-term recognition memory. A role for locally-synthesized endogenous estrogens on these rapid enhancing effects on memory, is emerging. Dorsal hippocampal inhibition of the estrogen synthetizing enzyme aromatase shortly after learning led to impaired long-term object recognition memory. The role of hippocampally-synthesized estrogens in the initial, short-term memory/learning of recognition tasks, however, is still unclear. Here we infused the aromatase inhibitor Letrozole at one of three doses; 0.005, 0.025, and 0.5 µg/hemisphere, or 2% dimethyl sulfoxide (DMSO) vehicle bilaterally into the dorsal hippocampus of 2-month old ovariectomized CD1 mice 15 minutes before either a social or an object recognition paradigm. Two stimuli (either conspecifics or objects, respectively) were repeatedly introduced into the home cage of experimental mice for 3 habituation periods, followed by a test period, where a novel stimulus was presented in place of one of the repeated stimuli. Testing was completed within 40 minutes of treatment, targeting the rapid effects of estrogens on short-term memory. We hypothesized that subjects treated with Letrozole would demonstrate impaired recognition learning. The results of this study will contribute to a better understanding of the rapid role of Hippocampally-synthesized estrogens in discrimination learning.

Keywords: Neuroscience

A20 Interaction between oxytocin receptor genotype and social environment on zebrafish social behavior

Rui Oliveira[1], Diogo Ribeiro[2], Rita Nunes[2], Magda Teles[2], Savani Anbalagan[3]; [1]ISPA - Instituto Universitário & Instituto Gulbenkian de Ciência, [2]Instituto Gulbenkian de Ciência, [3]Weizmann Institute of Science.

Oxytocin-like peptides have been implicated in the regulation of social behavior across taxa, affecting a diversity of behaviors across functional contexts. However, in a number of the studies that have investigated the effects of oxytocin on social behavior the relative contributions of the genotype and of the environment have not been disentangled. In this study we have used the Zebrafish (Danio rerio), a highly social fish species, to study the genotype-environment interaction in the effects of the oxytocin receptor gene in different aspects of social behavior, namely: sociality (i.e. social approach); social habituation; social recognition; and shoaling behavior. For this purpose we have raised zebrafish of different genotypes (WT, OXTR-/-) in different social environments (WT groups, OXTR-/- groups). There was a main effect of genotype on social recognition, with OXTR-/- individuals not being able to discriminate between conspecifics. In contrast there was no effect of genotype on sociality. A genotype-environment interaction was found both for social habituation and for shoaling behavior, such that OXTR-/- individuals raised in OXTR-/- groups exhibited deficits that were rescued in OXTR-/- individuals raised in WT groups. Thus, it is demonstrated that the social environment interacts with genotype in the development of social behavior and it can revert phenotypes associated with specific genes. Our results suggest that more caution is needed in the interpretation of studies using transgenic or mutant individuals that are raised in cohorts of the same genotype.

Keywords: Social Behavior

A21 Peripheral methylation of macaque OXT and OXTR genes, oxytocin levels in cerebrospinal fluid, and social behavior

Desiree De Leon[1], Shota Nishitani[1], Hasse Walum[1], Kai M. McCormack[2], Jeffrey Rogers[3]; [1]Emory University, [2]Spelman, [3]Baylor College of Medicine

Oxytocin (OXT) and its receptor (OXTR) are encoded by OXT and OXTR, respectively. Methylation of these genes is variable in humans, and peripheral measures of their methylation have been linked to variability in social behaviors and neuroendophenotypes. Because OXTR on hypothalamic OXT neurons can regulate OXT release, we examine whether OXTR or OXT methylation in blood predicts concentrations of OXT in cerebrospinal fluid (CSF) and social behavior in rhesus macaques. We report a similarity between human and rhesus CpG sites for OXT promoter and OXTR MT2 regions. We did not detect a statistically significant association between methylation of these CpG sites and CSF OXT concentration that survived corrections for multiple comparisons. Before corrections, methylation of one OXTR CpG site (-717bp from transcription start site) explained less than 1.69% of the variance in OXT CSF levels (p=0.013) and was associated with increased proximity to other animals and decreased anxiety.

Because no associations survived statistical corrections, if there is any relationship between methylation of these genes in blood and OXT CSF or social behavior, the effect size is too small to be detected reliably with this sample size and would need to be replicated in additional studies. These results do not support the hypothesis that blood methylation of OXT or OXTR is associated with CSF OXT concentration or social behavior in rhesus macaques. It is possible, though, that methylation of these loci in the hypothalamus or in cheek epithelia may be associated with central OXT release and behavior.

Keywords: Oxytocin

A22 Childhood Emotional Invalidation and Right Hemispheric Involvement During a Pain Empathy Task: An EEG Study

Laura Jelsone-Swain[1], Kirsten Arnett[1], Alexandra Roach[1], Meredith Elzy[1], Jessica Morrison[1]; [1]University of South Carolina Aiken.

Empathy is the ability to understand and feel another person's emotions, and plays a critical role in social behavior and interactions. Impairment in empathic processing is linked to severely hindered social relationships, as seen in autism spectrum disorder and psychopathy. Despite recent interest in this topic, our understanding of the developmental and neural involvement for empathic processing is not well understood. Recent evidence suggests the Mirror Neuron System (MNS) may be involved. Therefore, this study aimed to examine the MNS using electroencephalogram (EEG) during a pictorial action-based pain empathy task (e.g. images of someone stepping on a nail). A further goal was to measure how perceived emotional invalidation (EI) during childhood may influence MNS involvement during pain empathy processing. Mu rhythm suppression over the sensorimotor regions of the brain, a commonly used indicator of MNS activity, was measured using EEG during the pain empathy task. Surveys gathered information about empathy levels and perceived childhood EI. Our results showed that perceived EI during childhood negatively related to empathy. Importantly, EI had a significant impact on MNS activity during observation of painful images compared to non-painful images, which appeared strongest over the right hemisphere. The present findings suggest that perceived childhood EI may decrease empathizing abilities and influence neural responses to the painful experiences of others. Implications from this study could involve clinical intervention targeted at childhood emotional invalidation to facilitate the healthy development of empathy.

Keywords: pain empathy, mirror neuron system, emotional invalidation, mu rhythm suppression, EEG

A23 Social Recognition is Mediated by the Interaction Between Rapid Effects of Estrogens and Oxytocin

Pietro Paletta[1], Sarah Howard[1], Kirstyn Ali[1], Elena Choleris[1]; [1]University of Guelph.

The ability to recognize an individual that has been encountered before is known as social recognition (SR). Both estrogens and oxytocin (OT) have been implicated in mediating SR. When ERa, OT, or the oxytocin receptor (OTR) are knocked out, SR is blocked suggesting that both estrogens and OT are needed for proper SR functioning, with there likely being an interaction between them. This would occur by estrogens binding to ERb/GPER in the paraventricular nucleus (PVN), which would facilitate the production/release of OT. OT will then bind to OTR in the medial amygdala and facilitate SR. To test this, we first needed to determine whether 17b-estradiol (E2) infused into the PVN can facilitate SR in mice. My current results show that E2 in the PVN can rapidly facilitate SR at 25 and 50nM. Next, to determine if this occurs through an interaction with OT, an OTR antagonist will be infused into the medial amygdala while E2 is infused into the PVN. The mice will be run through a SR paradigm where two stimulus mice are presented in two habituation phases. In the test phase, one stimulus mouse is replaced by a novel mouse. If the novel mouse is investigated more, it would suggest that the other mouse is familiar to them and that SR occurred. If the antagonist blocks the facilitative effect that E2 in the PVN has on social recognition, it would show support for the idea that estrogens and OT interact to facilitate social recognition. Funded by NSERC.

Keywords: Social Recognition

A24 Nucleus accumbens dopamine D1-type receptors mediate social learning but not food intake in male and female mice

Richard Matta[1], Madison J. Russell[1], Danielle J. Tessier[1], Noah Bass[1], Elena Choleris[1]; [1]Department of Psychology and Neuroscience Program, University of Guelph, Guelph, ON, Canada, N1G2W1.

The neurobiological mechanisms underlying social learning are not well understood. With systemic treatments using dopamine (DA) receptor antagonists, our lab has shown that D1-type receptors regulate social learning, whereas D2-type receptors regulate feeding behavior in the social transmission of food preferences (STFP) in mice. The brain areas underlying. these effects are slowly being investigated. Limbic regions including the hippocampus and nucleus accumbens (NAc) receive dopaminergic projections from the ventral tegmental area. With dorsal hippocampal infusions we showed that D1-type receptors mediate social learning in both male and female mice, whereas D2-type receptors are only necessary in female STFP. The NAc is implicated in both social behavior and individually acquired food preferences in rodents. Hence, in this study we investigated the involvement of NAc D1-type receptors in the STFP. We infused the D1-type receptor antagonist SCH23390 (1, 2, & 4 µg/µL) into the NAc shell of adult male and female CD-1 mice. Infusions were 15 min before a 30 min social interaction where observers had the opportunity to learn a food preference from a same-sex demonstrator. Results show that SCH23390 at 1 µg/µL blocked social learning in males, and SCH23390 at 4 µg/µL blocked social learning in females. The effects on social learning could not be explained by changes in feeding behavior, since SCH23390 did not affect total food intake in either sex. Hence, the NAc may be another site of action underlying the STFP. We are also highlighting sex differences and possible effects of the estrous cycle. Supported by NSERC

Keywords: social learning, dopamine, nucleus accumbens

A25 The Processing Of Social Information During Motor Resonance

Brandon Hager[1], Albert C Yang[2], Jennifer Gutsell[1]; [1]Brandeis University, [2]Beth Israel Deaconess Medical Center.

Social environments require flexible information processing. Motor resonance (MR), broad activation of large cell populations in the sensorimotor areas, is an important factor contributing to social cognition and processing. Suppression of electroencephalography (EEG) mu oscillations provides an index of MR, which seems to change with changing social environments. The goal of this study was to use multiscale entropy (MSE) to determine whether MR is dependent on the flow of information (complexity) contained in the mu signal, and whether complexity is related to the flexibility of MR in response to various social targets. A total of 48 healthy controls were recruited and MR assessed using EEG while viewing the actions of people characterized by varying combinations of warmth and competence dimensions of the stereotype content model. MSE was calculated on the mu (8-13 Hz) frequency band at the C3 and C4 electrodes, corresponding to the sensorimotor area, during resting state (baseline) and task conditions. A statistically significant difference between baseline and task complexity was found $t(46)$ -4.77, $p<0.001$. Additionally, higher baseline complexity in the sensorimotor area was statistically significantly predictive of

reduced MR F(1, 46)=14.57, p<0.001. A significant difference was found between high warmth/competence (HWHC) and low warmth/competence (LWLC), with HWHC showing higher complexity t(46) 3.45, p<0.01. The complexity of the mu wave may provide an additional means to understand how the brain flexibly processes social stimuli. This new approach may provide targets for the understanding and treatment of the social-behavioral deficits seen in disorders like autism spectrum disorder.

Keywords: Resonance

A26 The Relationship between Experienced Guilt, Moral attitudes, and Psychopathic Traits

Judith Chou[1], Yawei Cheng[1]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan.

A number of recent fMRI studies have implicated the prefrontal cortex, anterior cingulate cortex and the anterior insula as the neural correlates of guilt. The role of guilt in prosocial interactions has been identified in individuals with psychopathic traits. Individuals with psychopathic traits exhibit abnormal responses of emotional guilt along with impaired moral judgement. However, little is known about the possible relationship between moral attitudes, psychopathic traits and experienced guilt. Thus, the current study aims to test the hypothesis that individual differences in implicit moral attitudes can predict individual differences in amount of experienced guilt. To measure guilt, we designed a moral action task, wherein 35 neurotypical subjects aged between 18 and 30 viewed morally-laden scenarios and imagined themselves as the agents who did either helping, harming, or neutral social actions. To measure implicit moral attitudes, the Implicit Association Task (IAT) was adapted from Greenwald et. al (1998) and redesigned with the categorization of "immoral" and "moral" action clips. Using this morality IAT, we divided subjects into two moral attitude groups of either flexible or relatively obdurate, and anticipate more task-induced neuro-hemodynamic activity associated with guilt in subjects of the latter group. Participants were also asked to complete the Justice Sensitivity Index, Interpersonal Reactivity Index, and the Psychopathic Personality Inventory (revised). The results of this study may provide better understanding of individual differences in moral attitudes and experiencing guilt in relation to psychopathic traits.

Keywords: moral attitudes; experienced guilt; fMRI

A27 Socioeconomic status and minority status effects on brain structure and cognitive function: A multivariate analysis of the PING study dataset

Carlos Cardenas-Iniguez[1], Marc G. Berman[1]; [1]Pediatric Imaging, Neurocognition, Genetics Study, The University of Chicago.

Childhood low socioeconomic status (SES), widely associated with increased psychosocial and environmental stress, has been previously associated with differences in brain morphometry, cognitive function and social behavior. The current study investigates this finding further using multivariate analysis approaches, Partial Least Squares (PLS) and Canonical Correlations, to explore the relationship between cortical surface area and conditions associated with SES, such as household income and parental education, in addition to racial/ethnic minority status, also previously associated with increased psychosocial and environmental stress. Drawing from the Pediatric Imaging, Neurocognition and Genetics dataset (PING), a dataset of 1108 diverse participants ages 3-20 (570 male, 538 female), we analyzed cortical area data parcellated into lobular regions (total of 8 regions) using a data-driven, fuzzy clustering technique highlighting genetic similarities in cortical areas using Freesurfer. Consistent with previous investigations in the literature, PLS analyses revealed that even after controlling for age and gender, all cortical lobe areas (bilateral parietal, occipital, temporal, and frontal) showed a reliable and significant positive relationship with household income and parental education, such that lower SES was associated with smaller surface area. Canonical Correlation analyses on cortical surface area and demographic variables revealed a latent variable showing a strong positive relationship with being White, having high SES and being male, but a strong negative relationship with being Black or Hispanic. Our results are consistent with previous reports indicating childhood SES has a differential impact on brain development, while also showing evidence to support that minority status may also a significant impact.

Keywords: development

A28 Cross-brain signal coherence: A novel indicator of two-brain social interaction

Joy Hirsch[1], Xian Zhang[1], Adam Noah[1], Swetha Dravida[1]; [1]Yale School of Medicine; University College London.

Although spontaneous and natural human-to-human communication is an essential social behavior, dynamic neural mechanisms for interactive processes are not fully understood. In this investigation, we advance an evidence-based theoretical framework for two-person social interaction. Functional near-infrared spectroscopy (fNIRS) is a non-invasive spectral absorbance technique that detects changes in cortical blood oxygen levels with surface-mounted optical sensors. Functional NIRS is tolerant of limited head motion, enabling simultaneous hemodynamic signal acquisitions from interacting dyads. We used an 84-channel NIRS system (Shimadzu LABNIRS) with 42 channels covering both hemispheres of each participant to acquire deoxyhemoglobin signals during live two-person interactions. The paradigm was motivated by the Interactive Brain Hypothesis, which proposes that interpersonal interaction evokes specialized and dynamic neural mechanisms. Interacting dyads (58 participants) alternated between 15 s talking and listening epochs under two conditions: dialogue (interactive) and monologue (non-interactive). Left inferior frontal and temporoparietal (Wernicke's) regions were associated with talking and listening tasks, and served as functionally-defined regions-of-interest. We tested two hypotheses: 1) talking and listening mechanisms are upregulated and extended during interaction; and 2) interaction increases cross-brain signal coherence. Signals acquired during listening epochs increased within Wernicke's regions during dialogue ($p<0.05$); however, speech processes were not similarly modulated. Cross-brain signal coherence increased between Wernicke's regions and the subcentral area during dialogue relative to monologue ($p<0.01$). Two fundamental components of an Interactive Brain Model emerge from these results: 1) left temporoparietal regions include specializations responsive to two-brain verbal interactions, and 2) cross-brain signal coherence is a novel indicator of these dynamic mechanisms.

Keywords: Two-person neuroscience, Interactive Brain Hypothesis

A29 Deep brain stimulation of the medial prefrontal cortex modifies social bias in mice

Raymundo Báez-Mendoza[1], Firas Bounni[1], Ziv M. Williams[1]; [1]Department of Neurosurgery, Massachusetts General Hospital & Harvard-MIT Health Sciences and Technology, Harvard Medical School, Boston, MA, USA.

Group behavior plays a core role in animal and human behavior. Although group behavior has been explored widely within psychology, ecology, and sociology, the neural mechanisms of this phenomenon remain largely unexplored. Here, we investigated how altering the neuronal activity of the rodent medial prefrontal

cortex (mPFC) using deep-brain stimulation (DBS) modifies social biases introduced by a group's collective decisions. Small groups of wild-type mice foraged together in a T-maze. A pair of mice were trained to consistently explore either the right or left arm of the T-maze, which, in combination with varying the reward location, resulted in positive or negative social biases for the untrained focal mouse. To investigate the neuronal substrates of group decisions as the animals foraged together for food, we recorded from neurons in the mPFC, an area that plays a role in decision-making and social encoding. We applied DBS to the mPFC to investigate the causal role that this area plays during group decision making. We found that when the mice foraged together, the behavior of individual animals was significantly influenced by that of the entire group. Importantly, the animals learned to ignore negative social bias. Furthermore, there was no social bias while foraging in an unpredictable environment nor while foraging with inanimate totems. Social influence was reflected by the activity of a specific subset of neurons in the mPFC. Taken together, these neurons encoded the groups' choices in combination with the presence or absence of reward on each arm. Importantly, these neurons reflected little information about the animals' own decisions or reward prediction errors. Applying DBS to the mPFC amplified social bias, particularly negative social bias, suggesting a possible target for DBS placement for treatment of deficits in social interactions. Together, these observations reveal that (1) individual choices in mice can be influenced by group decisions (2) these group decisions are reflected in the activity of specific neurons in mPFC, and (3) the mPFC plays a causal role in decision-making during social interactions.

Keywords: Social behavior, medial prefrontal cortex, DBS, mice

A30 Theta oscillations increase during live two-person eye-to-eye contact relative to eye-to-picture gaze

J. Adam Noah[1], Yumie Ono[2], Xian Zhang[1], Swethasri Dravida[1], Joy Hirsch[1]; [1]Yale School of Medicine, New Haven, CT , [2]Meiji University, Kawasaki, Japan.

Human eye-to-eye contact is a primary source of social cues. Functional neuroimaging studies have suggested that brain responses to viewing live, dynamic faces compared to pictured faces are dependent on eye gaze. We tested the hypothesis that live eye-to-eye contact alters specific electroencephalography (EEG) frequency bands. Twenty-six adults (13 dyads) participated in a paradigm that cued partners to make eye-to-eye contact in a block design with 3 s of eye-to-eye contact interleaved with 3 s of crosshair fixation. Dyads participated in an identical paradigm in which both individuals concurrently looked at the eyes in a pictured face. EEG recordings were obtained from electrode positions F3, F4, F7, F8, C3, C6, PO7, and PO8 according to the 10-20 layout. Gaze data were obtained using a two-person eye-tracking system. EEG signals were averaged and smoothed using a median filter with a 0.10 s window, effectively a 7 Hz low-pass filter. Gaze data confirmed equivalent eye movements between the eye-to-eye and eye-to-picture conditions. Point-by-point t-tests of event-related potentials (ERPs) indicated altered frontal activity 2 s after onset of active eye-to-eye contact relative to eye-to-picture gaze. In comparison, there was no difference between the two waveforms during resting baseline ERPs. Wavelet decomposition analysis showed ERP results specific to theta band for eye-to-eye contact versus eye-to-picture conditions ($p=0.01$). Other frequency bands were not differentiated by this condition. Findings extend models of eye-to-eye contact in live social situations to include theta-specific oscillations.

Keywords: Eye-to-eye effects

A31 Diazepam reverses anxiety-like behavior, social anhedonia and dopamine deficit following acute amphetamine withdrawal

Millie Rincón-Cortés[1], Anthony Grace[1]; [1]University of Pittsburgh.

Psychostimulants, including amphetamine (AMPH), increase dopamine (DA) release from ventral tegmental area (VTA) neurons, which is associated with their acute reinforcing actions. This positive state is followed by a negative affective state each time the drug is taken (opponent process theory). AMPH-withdrawal is accompanied by symptoms of anxiety and depression, which are associated with DA system dysfunction in humans and animal models. Most studies have focused on the negative affective state after withdrawal from chronic drug administration; yet, this negative state appears even after a drug is taken for the first time in both humans and rodents. In rats, acute AMPH-. withdrawal increases FST immobility and decreases the number of spontaneously active VTA DA neurons up to 48-hours post-withdrawal. We assessed social anhedonia in the three-chambered social approach test and anxiety-like behavior in the elevated plus maze following acute AMPH withdrawal within this period. Acute AMPH withdrawal reduced sniff time, increased anxiety-like behavior and attenuated VTA population activity ($p<0.05$, n=6-9). Since benzodiazepines are commonly used to treat post-acute AMPH withdrawal syndrome in humans, we tested the effects of diazepam on anxiety-like and social behaviors and VTA population activity. An acute (5mg/kg) dose of diazepam circumvents the neurobehavioral effects resulting from acute AMPH-withdrawal, as demonstrated by decreased anxiety-like behavior, normal social behavior and VTA DA activity comparable to controls ($p<0.05$, n=6-8). These data suggest that diazepam prevents the negative affective state resulting from AMPH-withdrawal and highlight a window of time during which treatment may prevent neurobehavioral changes promoting transition into chronic use

Keywords: amphetamine, withdrawal, social behavior, dopamine, in vivo electrophysiology

A32 A neural substrate for social interactions between dyads with disparate socioeconomic backgrounds

Olivia Descorbeth[1], Xian Zhang[1], J. Adam Noah[1], Swethasri Dravida[1], Joy Hirsch[1]; [1]Yale University, New Haven, CT.

Neural mechanisms that mediate live, online social cognition are poorly understood. Recent developments in functional near-infrared spectroscopy (fNIRS) enable simultaneous neuroimaging (hyperscanning) of dyads during natural social interactions. Prior behavioral findings suggest that socioeconomic disparities signal "in" and "out" group memberships, although neural encoding of such disparities during dynamic interpersonal interactions is not understood. We hypothesize that executive planning and speech production mechanisms are more engaged during verbal interactions between individuals from disparate socioeconomic groups. In this study, 19 high and 23 low disparity dyads were scanned during natural dialogue using an 84-channel fNIRS system (Shimadzu, LABNIRS) with 42 channels covering both hemispheres of each participant. A post-scan self-report survey indicated that high disparity dyads felt more anxious than low disparity dyads; however, acoustic analysis of spoken narratives revealed no evidence for differences in total spoken words. Increased neural activity based on deoxyhemoglobin signals was observed in left dorsolateral prefrontal cortex (DLPFC) of high disparity dyads relative to low disparity dyads ($p<0.05$). Consistent with contrast findings, increased cross-brain signal coherence was found between DLPFC and premotor cortex for high disparity dyads. For low disparity dyads, cross-brain coherence increased between fusiform gyrus, the subcentral area, and somatosensory cortex, potentially reflecting reciprocal signaling of face information. This is the first demonstration of a neural basis for altered dynamic interactions during social communication between pairs of individuals from highly disparate socioeconomic backgrounds, and advances a theoretical framework for such interactions by suggesting an extended role for executive planning mechanisms in real-life conversations.

Keywords: Social disparity

A33 Neural signals for communication of social intentions: Beta wave oscillations distinguish between initiating and terminating eye-to-eye contact

Xian Zhang[1], J. Adam Noah[1], Swethasri Dravida[1], Yumie Ono[2], Joy Hirsch[1]; [1]Yale School of Medicine, New Haven, CT, [2]Meiji University, Kawasaki, Japan.

Eye-to-eye contact is a universal social cue signaling intent to initiate or terminate communication based on whether one person's eye-gaze is directed toward or away from an observer. We hypothesized that neural activity reflected in electroencephalography (EEG) signals during dyadic interactions would differentiate between initiation and termination of eye-to-eye contact. We recorded EEG signals from 13 participant dyads (n=26) for two types of eye-gaze interactions: 1) "toward" -- one participant ("partner") makes eye-to-eye contact with an observing participant ("observer"), or 2) "away" -- partner diverts eye-gaze away from the observer. Dyads were positioned 140 cm apart from each other. Each participant alternated between observer and partner trials. In each trial, the observer's gaze was directed straight ahead. The partner's gaze alternated either toward or away (10°) from eye-to-eye contact with the observer. Trial durations alternated between 1.5 and 2.5 s. Electrodes were positioned at F3, F4, F7, F8, C5, C6, PO7, and PO8 according to a standard 10-20 layout. EEG signals were decomposed into gamma (40-100 Hz), beta (12-40 Hz), alpha (8-12 Hz), theta (4-8 Hz), and delta (0-4 Hz) frequency bands. "Toward" and "away" events were compared for each band. Between 735-785 ms, beta wave oscillations in right dorsolateral prefrontal cortex (F8, $p<0.013$) differed between "toward" and "away" conditions, and suggests that opposing intentions to communicate, signaled by eye-to-eye contact or eye-gaze directed away from an observer, are represented by a beta wave neural signature. Models of communication intentions in real social conditions are advanced by this finding.

Keywords: Cross-brain communication

A34 Crowd Perception: Crowd Emotional Valence and Consistency Affect Behavioral Responses and Late ERPs

Sara Driskell[1], Aina Puce[1]; [1]Indiana University.

Many people watch brief news clips of events such as protests and make judgments about crowds, including how justified their actions are. Here we studied how crowds of differing emotional valence (happy, angry) in varying amounts (no, medium, and high consistency) were perceived using behavior and EEG in 26 subjects. We edited and arranged faces from the Chicago Face Database into crowds of 36 faces (total horizontal visual angle was 13.2 degrees; faces were 1.6 degrees each). Participants focused on a central fixation cross and pressed one of two buttons to indicate the crowd's predominant emotion. For response time and accuracy, we found that people were faster, $F(2,48) = 829.58$, $p < .001$, $\eta p2 = .97$, and more accurate, $F(2,48) = 51.23$, $p < .001$, $\eta p2 = .68$, for crowds with more compared to less emotional consistency. For EEG data, we found no effects of valence or consistency in early visual ERP peaks. In contrast, there were main effects of both valence and consistency for LPP latency, $F(1,24) = 8.29$, $p = .008$, $\eta p2 = .26$ and $F(2,48) = 3.22$, $p = .049$, $\eta p2 = .12$, respectively. LPP latencies were later for angry crowds and consistent crowds. There was also an effect of valence for SPW amplitude, $F(1,24) = 4.69$, $p = .041$, $\eta p2 = .16$, such that the SPW was larger for happy versus angry crowds. Our data indicate that emotion and especially its consistency can impact our perceptions of crowds, both in behavioral data and later ERPs.

Keywords: Visual perception, ERPs, emotion, crowds

A35 Interhemispheric paired associative stimulation of the prefrontal cortex jointly modulates frontal asymmetry and emotional reactivity

Samuel Zibman[1], Edan Daniel[1], Uri Alyagon[1], Abraham Zangen[1]; [1]Ben Gurion University of the Negev.

A major challenge in determining the role of frontal asymmetry in emotion is that while the correlation between deficits in lateralization and in cognitive functions has been established, a causal relationship has not been fully demonstrated. One technique that can be used to alter connectivity and establish causality in the brain is paired associative stimulation (PAS) which, through the coordinated stimulation of two regions by two TMS coils, targets the intervening connectivity. 27 healthy subjects were recruited for a three session, sham-controlled crossover study, receiving left to right PAS (LR-PAS), right to left PAS (RL-PAS) and sham during different weeks. The protocol consisted of 210 pulse pairs with an ISI of 8ms. Subjects performed the emotional Stroop task, assessed by measuring attentional bias, and brain activity was recording with EEG prior to and following the stimulation period. Our results reveal that LR PAS increases attentional bias while increasing right frontal asymmetry whereas RL PAS decreased the attentional bias while decreasing right frontal asymmetry ($F(2,24) = 3.266$, $P=0.05$ and $F(2,27) = 5.936$, $P=0.005$ for attentional bias and frontal asymmetry respectively). These results confirm a relationship between frontal alpha asymmetry and attentional bias. This is the first demonstration of PAS's effectiveness in inducing cognitive changes by targeting interhemispheric PFC connectivity in a directional manner. Furthermore, by combining TMS with EEG, we provide a toolbox for evaluating effectiveness of PAS protocols that may facilitate development of novel therapies.

Keywords: Frontal Asymmetry

A36 Sex Differences in Oxytocin Modulation of Social Reward and Social Motivation in Syrian Hamsters

Johnathan Borland[1], Kymberly Grantham[1], Asia Johnson[1], Kyle Frantz[1], Elliott Albers[1]; [1]Georgia State University.

The rewarding properties of social interaction are critical for the expression of adaptive social behaviors and the development and maintenance of social relationships. Dysfunctions in social reward also play a major role in various psychiatric disorders. As a result, differences in the mechanisms mediating social reward may contribute to sex differences in psychiatric disorders. A critical gap in current knowledge surrounds basic potential sex differences in the neural mechanisms underlying social reward. Recent data from our lab indicate that activation of oxytocin (OT) receptors in the ventral tegmental area (VTA) are essential for social reward in male Syrian hamsters. Because the mesolimbic dopamine system and the oxytocin system are sexually differentiated, we hypothesized that OT in the VTA has sex specific effects, and tested this hypothesis using two behavioral assays. With the Pavlovian Conditioned Place Preference (CPP) test and a novel Operant Social Preference (OSP) task we recently validated, we investigated the role of OT receptors in the VTA on the rewarding and motivating properties of social interactions in male and female hamsters. In the first study, both males and females were injected with either OT (9uM) or saline into the VTA just prior to social interaction opportunities in their non-preferred chambers. After three 10-minute training sessions, hamsters were tested to measure the amount of time spent in the chamber paired with social interactions. Social interaction increased the time spent in the non-preferred chamber for both males and females. OT injected in the VTA further increased time spent in the social interaction associated chamber for males, but decreased the time spent in the social interaction associated chamber among females compared to saline treated subjects. In the second experiment, hamsters were

injected with the highly selective OT receptor agonist (9uM), OT receptor antagonist (90uM) or saline into the VTA. In summary, OT receptor agonist injected in the VTA had no effect on social reward in males, but decreased social reward in females. OT receptor antagonist injected in the VTA decreased social reward in both males and females. Collectively, these data demonstrate that OT in the VTA decreases the rewarding properties of social interactions among females, while increasing the rewarding properties of social interactions among males.

Keywords: Social Motivation

A37 Neural and behavioral response to oral oxytocin in pre-weaning mice.

Manal Tabbaa[1], Elizabeth Hammock[1]; [1]Florida State University.

The neuropeptide oxytocin (OXT) may play an integral role in shaping experience-dependent development. Our lab has characterized oxytocin receptor (OXTR) binding in the oronasal cavity of developing mice. To test the hypothesis that OXT acts through oronasal OXTR to affect the developing brain and emerging behavior, we tested the response to orally applied OXT in pre-weaning mice. OXT or vehicle was administered orally to EGFP:OXTR reporter mice on either postnatal day 14 (P14) or 21 (P21). The c-Fos response was investigated in brain regions receiving oronasal OXTR information. Orally applied OXT decreased variability in c-Fos activity in the trigeminal spinal and motor nuclei of P14 females, but not males. Additionally, OXT decreased variability in c-Fos activity in the trigeminal sensory, spinal, and motor nuclei of P21 males, but not females. Furthermore, c-Fos activity was correlated among trigeminal nuclei in OXT treated P21 males, but not females. In a second study, behavioral responses to oral administration of OXT vs saline with unilateral whisker stimulation were recorded. Preliminary data indicate OXT increased oromotor behavior in P14 males and increased locomotor activity in P21 males. We are currently investigating c-Fos activity in the trigeminal nuclei of whisker stimulated subjects and in regions receiving input from the trigeminal nuclei. These data will help determine if oral OXTR modulates orosensory input, the suckling central pattern generator, and the development of peri-weaning behavior.

Keywords: Oxytocin Sensory Development Trigeminal Motor Output Postnatal peri-weaning experience

A38 Predicting Strategic Behavior in a Competitive Two-player Game from Gaze Patterns and Neuronal Activity in the Superior Temporal Sulcus (STS)

Yaoguang Jiang[1], Michael M Platt[1]; [1]University of Pennsylvania.

Most social interactions are dynamic and open-ended. Yet most neurobiological studies of social interactions reduce these complex behaviors to a very restricted, often binary action space (e.g. prisoner's dilemma), within which the choices of two participating parties often quickly stabilize. The neural processes mediating dynamic social interactions remain largely unknown. To address this gap, we examined the behavior of both humans and rhesus macaques playing a zero-sum competitive soccer game. In this game, one player (the "shooter") uses a joystick to move a "ball" across the screen to reach the "finish line", while the other player (the "goalie") uses a joystick to block the ball. Whichever player succeeds wins a point (humans) or a squirt of juice (monkeys). This task thus provides an environment with an infinite array of possible interactions motivated by competition. Both monkeys and humans developed highly complex, dynamic interactions in this task. Both human and monkey shooters demonstrated great variability in terms of the angle, speed, and end point of ball, as well as significant cross-trial variability in their reaction time and number of directional changes made per trial. Both human and monkey goalies minimized the moment-to-moment distance between the vertical position of the ball and the goalie bar, and predicted ball position based. on movements made by the shooter in previous trails. Both human and monkey shooters made gaze shifts to the eventual position on the finish line where they would shoot the ball, providing evidence of long-range planning. Pupil diameters measured before trials in both shooters and goalies predicted who would win, suggesting pupil-linked variation in attention or arousal may contribute to performance. In monkeys we also recorded the firing rates of single neurons in the mid superior temporal sulcus (mSTS), a region hypothesized to be homologous to human temporo-parietal junction (TPJ). Surprisingly, a large proportion of mSTS neurons responded to both the expectation and delivery of reward. Some mSTS neurons signaled other facets of this dynamic task including the distinction between a sure win/loss and a close win/loss, a prediction error in regard to the opponent's movement, and changes in strategy both within a trial (e.g. feints) and across trials (e.g. shooter aiming above or below the goalie). Finally, a subset of mSTS neurons showed elevated activity when monkeys competed against a live opponent compared with competing against a computer or a replay of previously recorded monkey behavior, a signal that may reflect detection or attribution of agency

Keywords: social competition

A39 A novel, simple, and affordable system for tracking the dynamics of social preference in small rodents

Shlomo Wagner[1], Shani Haskal[1], Chen Megelnik[1], Shai Netser[1], Shlomo Wagner[1]; [1]Department of Neurobiology, University of Haifa, Haifa, Israel.

Deciphering the biological mechanisms underlying social behavior in animal models requires standard behavioral paradigms that can be unbiasedly employed in an observer- and laboratory-independent manner. During the past decade, the three-chamber test has become such a standard paradigm, used to evaluate social preference (sociability) and social novelty preference in mice. This test suffers from several caveats, including its reliance on spatial navigation skills and negligence of behavioral dynamics. Here we present a novel experimental apparatus and an automated analysis system which offer an alternative to the three-chamber test while solving the aforementioned caveats. The custom-made apparatus is simple for production, and the analysis system is publically available as open-source software, enabling its free use. Using this system we found that male C57BL/6J mice keep their preference towards social stimuli for longer periods than females. We then defined several new parameters of social behavioral dynamics in mice and revealed that social preference behavior is segregated into two distinct phases. An early exploration phase, characterized by high rate of transitions between stimuli and short bouts of stimulus investigation, is followed by an interaction phase with low transitions rate and prolonged interactions, mainly with the preferred stimulus. Finally, we found that BTBR mice, known for their atypical social behavior, show a specific deficit in transition from exploration to the interaction phase, suggesting a reduced tendency towards social interactions. Thus, the system presented here facilitates a more thorough and detailed analysis of social behavior in mice, enabling a better comparison between strains and treatments.

Keywords: Social preference; social memory; social investigation; three-chamber test

A40 Atypical Mismatch Negativity to Threatening Voices in Generalized Anxiety Disorder

Yu Huang[1], Yawei Cheng[1]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan.

Previous research has shown that mismatch negativity (MMN) can be a reliable index for preattentive detection of emotional salience of voices. Emotional MMN was coupled with amygdala reactivity to threatening faces (Cheng et al., 2017). Emotional MMN was reduced in accordance with symptom severities in

individuals with autism and schizophrenia (Fan & Cheng, 2014; Chen et al., 2016). Given emotional MMN as a neural signature to detect anxiety, we hypothesized that emotional MMN should become atypical in patients with generalized anxiety disorder (GAD). 40 patients with GAD and 40 controls will be recruited in this study. We used a passive oddball paradigm, angrily and fearfully spoken deviant syllables dada, randomly presented within a train of emotionally neutral standard syllables, to measure their mismatch negativity (MMN). The Beck Anxiety Inventory (BAI) and State-Trait Anxiety Inventory (STAI) will be used to assess their anxiety level. We anticipate that MMN response to threatening (angry and fearful) voices, rather than corresponding non-vocal sounds, will be significantly decreased in patients with GAD. The amplitudes of MMN will be associated with their anxiety symptom severities, as shown by the scores on the BAI and the STAI.

Keywords: mismatch negativity (MMN); anxiety disorder; emotional voices; neurologic signature

A41 Emotional empathy imbalance of autism: amygdala reactivity to conscious and nonconscious emotional processing

Yu-Chun Chen[1], Yawei Cheng[1]; [1]Institute of Neuroscience, National Yang-Ming University, Taipei, Taiwan.

Empathy imbalance hypothesis (Smith, 2009) suggests that individuals with autism Spectrum Disorder (ASD) should have a deficit of cognitive empathy and a surfeit of emotional empathy. Considering that inconsistent amygdala reactivity to emotional faces might be ascribed to aberrant attention in ASD, we hypothesized to investigate if there would be an imbalance between conscious and nonconscious emotional processing. This fMRI study recruited 25 young adults with autism spectrum disorder and 25 matched controls, and measured their amygdala reactivity and functional connectivity in response to conscious and nonconscious (backward masked) perception of threatening faces. The results showed that individuals with ASD relative to the controls would show significantly reduced amygdala reactivity to conscious emotional processing but heightened amygdala reactivity to nonconscious emotional processing. Such imbalance would be associated with their social deficits. The findings might shed light on empathy imbalance hypothesis of autism and provide some support to facilitate their treatment strategy.

Keywords: Autism Spectrum Disorder; amygdala reactivity; emotional processing; fMRI

A42 The role of reproductive viability and hormone production in deception detection in a human female population

Tarrio Olivia[1], Juliana De Vito[1], Briana Goncalves[1], Shakera Walker[1], Julian Keenan[1]; [1]Cognitive Neuroimaging Laboratory, Montclair State University.

Across sexually reproducing organisms, deception is a tactic that males and females often utilize during mating and these strategies extend to humans (Benz et al. 2005; Decker et al., In Press). Sexual selection has predicted and confirmed counter-strategies in terms of mating tactics, including the detection of deception by females (Keenan, 2001). The present study examines first the abilities of females to accurately detect deception as a function of her reproductive viability. Second, as estradiol and progesterone receptors have been found to be correlated in areas of the brain that are associated with both fective and cognitive function (Gruber et al., 2002; Brinton et al., 2008), free-flowing hormonal activity (LH, Progesterone, Estrodial) are predicted to correlate with a change in deception detection abilities. Both confidence and accuracy were measured during a deception detection video task. Preliminary data indicate a correlation between deception detection and menstrual cycle such that the closer an individual is to ovulation the greater the deception detection. These data may help to determine not only the role of deception detection in a social neuroscience context, but how concealed ovulation may have evolved rather uniquely in Homo sapiens

Keywords: Deception

A43 Peer pressure, deception, and the Medial Prefrontal Cortex: A transcranial magnetic stimulation study

Briana Goncalves[1], Julia Oakes[1], Vivek Kanpa[1], Mehdi El Filali[1], Julian Keenan[1]; [1]Cognitive Neuroimaging Laboratory, Montclair State University.

It is well documented that people tend to claim more knowledge than they truly know. Overclaiming, which is the inclination to claim more information than is possible (Paulhus, 1991) has previously been found to be involved with the medial prefrontal cortex (MPFC). In this method, brain regions were disrupted with transcranial magnetic stimulation (TMS) during the task by means of single-pulse TMS. Overclaiming was observed in the MPFC, Supplementary Motor Area (SMA), Central Zed (SHAM), and the Precuneus (Pz) while applying a level of social pressure. Employing high social is suspected to increase deception, while low social pressure should cause an individual to overclaim less often. Overclaiming was measured by presenting a list of words containing both real words and false words. Participants were asked if they 'know' the words presented. One that purports to know false words is guilty of overclaiming, which is thus used as an indicator of deception. It was found that social pressure increases deception. Furthermore, disruption of the MPFC influenced deception more during high social pressure conditions. These data indicate a complicated relationship between social pressure and deception in the MPFC.

Keywords: Deception

A44 Gray Matter Volume of rIFG Correlates with Impulsivity Transdiagnostically

Megha Chawla[1], Zu Wei Zhai[1], Jintao Zhang[2], Sarah Yip[1]; [1]Yale University, [2]Beijing Normal University.

Internet Gaming Disorder (IGD) is a candidate behavioral addiction included in the DSM-5 as a “Condition for Further Study”. While prior neuroimaging studies exist, the brain-basis of IGD remains poorly characterized. In particular, findings from gray matter volumetric studies comparing IGD and control groups have found conflicting results, used variable diagnostic criteria to define IGD, have not corrected neuroimaging data for multiple comparisons, or have not accounted for potential confounding variables. Here, we compared regional gray matter volumes between young adults with DSM-5 IGD (n=28) and age-matched controls (n=31) using optimized voxel-based morphometry (VBM), as implemented in FSL. Based on prior work, the amygdala, insula, right inferior frontal gyrus (rIFG) and left ventral striatum were selected as a priori ROIs. Contrary to previous findings, there were no significant differences in brain structure in the IGD group compared to healthy controls. Correlational analyses indicated associations between trait impulsivity and rIFG volumes across all participants, even when controlling for group (r_s = .407, p = .002). These results implicate the rIFG in individual differences in trait impulsivity and demonstrate the utility of dimensional approaches in characterizing brain-behavior relationships.

Keywords: Internet Gaming Disorder

A45 Vasopressin In The Lateral Septum Modulates Sex-Specific Neurotransmission: Implications For Sex-Specific Regulation Of Social Play

Remco Bredewold[1], Jennifer Schiavo[2], Alexa Veenema[1]; [1]Neurobiology of Social Behavior Laboratory, Department of Psychology and neuroscience program, Michigan State University, East Lansing, MI, USA, [2]Neurobiology of Social Behavior Laboratory, Department of Psychology, Boston College, Chestnut Hill, MA, USA.

Social play is an affiliative and rewarding behavior displayed by nearly all mammals and peaks during the juvenile period. We recently showed that arginine vasopressin (AVP) acting via the V1a receptor (V1aR) in the lateral septum (LS) regulates social play in opposite directions in male and female juvenile rats. The LS is often conceptualized as a relay station that receives input from many brain regions and is a core hub in the social decision-making network. Therefore, we sought to determine whether and how the LS-AVP system interacts with the release of a wide array of neurotransmitters (NTs) including GABA, glutamate (Glu), dopamine (DA), noradrenaline (NE), acetylcholine (ACh) and glycine and whether this occurs in sex-specific ways. We used microdialysis with and without retrodialysis to quantify extracellular NT release in the LS in awake and freely moving juvenile rats, while 1) AVP was applied into the LS, 2) rats were exposed to social play or 3) a V1aR antagonist was administered into the LS. We observed a variety of dynamic release patterns of NTs that were sex-, and condition-specific. In detail, application of AVP into the LS caused an increase in the extracellular Glu and DA release in the LS of females, while no change was seen in males. Other NTs did not change in sex-specific ways in response to AVP. Furthermore, exposure to social play was associated with an increase in the release of all NTs in females, while in males, DA and NE remained unchanged. Finally, application of a V1aR antagonist in the LS caused sex differences in the extracellular release of Glu, NE and ACh, with higher release in females. Interestingly, the observed sex differences in extracellular Glu and DA release in the LS after AVP administration and during social play were eliminated with V1aR antagonist administration. These findings suggest a differential involvement of NTs in the LS of male and female juvenile rats exposed to social play, with potential roles of Glu and DA in the sex-specific regulation of social play by the LS-AVP system.

Keywords: microdialysis, reward, sex difference, GABA, glutamate, dopamine, Lateral Septum, social play

Posters Session B

Friday, November 10, 2017, 6:00 pm – 7:00 pm, Ballroom West A&B

B1 Biological mechanisms of pro-social behavior in rats

Inbal Ben-Ami Bartal1, Kim Long1, Justin Kenney2, Anne Wheeler2, Paul Frankland2, Carrie Shyliansly3, Karl Deisseroth3, Dacher Keltner4, Daniela Kaufer1 ; 1 Integrative Biology Dept, University of California Berkeley. 2Institute of Medical Science, University of Toronto, Toronto, 3Howard Hughes Medical Institute, Stanford University, Stanford,4Department of Psychology, University of California, Berkeley

Empathy, the ability to recognize and share other's distress, is a major building block of life in societal groups. The tendency to resonate with others is sometimes coupled with a motivation to improve their wellbeing. In humans, empathy is often a major motivating factor for pro-social behavior, acts that improve another's welfare, like helping. A simple form of empathy, termed emotional contagion, exist in many different species, including rodents. Rodents can be a useful model for investigating the neural mechanisms that give rise to an animal's affective response to the social cue of distress, as well as how that cue can lead to approach motivated by a pro-social drive. We are addressing this question with a rodent model of helping behavior in which rats get the opportunity to help other rats by releasing them from a trap. Helping a conspecific in distress is a complex behavior that results from a response to cues of distress from an animal in need. What happens in the brain from the moment these cues are perceived that lead up to a behavioral decision to approach? Rats were tested in different conditions (e.g. in-group/out-group). C-fos immunohistochemistry across the whole brain was used to construct a functional connectome of helping behavior. Fiber photometry recordings give further insight into the activity of animals in-vivo. Results indicate that a specific network is important for helping behavior, which includes both cortical and sub-cortical areas. Activity levels and network analysis pointed to the importance of areas implicated in human empathy, and regions in the reward pathway, for rats tested in the helping behavior paradigm.

B2 Specifying the direction and time-course of frontal alpha asymmetry during a power-priming task

Carl Michael Galang[1], Sukhvinder Obhi[1]; [1]McMaster University.

Power refers to the ability to control other's access to resources without interference. Past social neuroscience research has shown that priming participants to a state of high power increases activity in the left-frontal region of the brain, as indexed by stronger suppression of oscillations in the alpha band (8-12Hz). This type of frontal alpha asymmetry has been shown to be associated with approach-related motivation. The current study extends this research by specifying the direction and time-course of this effect. We measured EEG activity while participants engaged in a ten minutes writing task priming either high, low, or neutral power. Results show that participants in the high power condition exhibit greater alpha suppression in the left-frontal region of the brain compared to those in the low power condition. However, we found no differences between the neutral and high power groups, suggesting that it is the low power group that is driving this effect. Furthermore, by splitting our analysis between three time points - start, middle, and end of the essay writing task - we identified the general stability of the frontal alpha asymmetry in the high power condition and the eventual disappearance of this effect in the neutral power condition. This suggests that, while the low power group is driving the effect at the start and middle of the essay, it is the high power group that is driving the effect by the end.

Keywords: EEG

B3 The effect of a virtual reality intervention on resting-state networks

Maarten Vaessen[1], Sofia Seinfeld[2], Minye Zhan[1], Marta Poyo Solanas[1], Beatrice de Gelder[1]; [1]Maastricht University, [2]Barcelona University.

Most people effortlessly recognize emotions whether in the face only, in the whole body or in the voice. An important theoretical and translational question concerns the plasticity of emotion recognition and whether recognition can be influenced, and thus improve behavior of people with e.g. psychopathic traits. This study aims to understanding the neural mechanisms through which virtual embodiment can impact emotional recognition. Evidence suggests that body ownership illusions, induced by substituting a person's body in immersive virtual reality with a co-located virtual one, can enhance emotion recognition possibly due to the enhancement of simulation mechanisms in the somatosensory cortex. We studied the effect of a brief exposure to VR including embodiment as a victim of aggression in a population that scored low on recognition of fear. Participants had a 6 min. resting-state (RS) fMRI scan followed by a short intervention with VR after which another 6 min. resting-state scan was acquired. Pre- and post-VR differences in RS functional connectivity was assessed. We found a reduction in

post-VR connectivity in regions including the somatosensory cortex, the extrastriate body area, inferior temporal cortex and fusiform face and body regions. These regions form a network that is more generally associated with the action observation or mirror neuron systems. It is striking that these regions are affected by the VR intervention even when there is no task being performed. We conclude that VR might be a valuable tool for influencing emotion recognition in vulnerable groups and has a measurable neural effect.

Keywords: fMRI

B4 Similarity of brain activation between observer and instructor when learning to fold origami

Kathrin Kostorz[1], Virginia L. Flanagin[1], Stefan Glasauer[2]; [1]German Center for Vertigo and Balance Disorders; Graduate School for Systemic Neurosciences, LMU Munich, [2]Center for Sensorimotor Research and Department of Neurology; German Center for Vertigo and Balance Disorders; Graduate School for Systemic Neurosciences, LMU Munich.

In today's web-based society, platforms like YouTube offer great opportunities: Everyone can upload self-made instructive videos, which anyone interested can watch and thus learn by observing and imitating the seen content. Here we investigated this facet of human learning using functional magnetic resonance imaging (MRI): we created an instructive origami video by videotaping a highly trained instructor who folded an origami inside the MRI scanner without vision i.e. being blindfolded. As a control, the instructor folded similar but partly repetitive folds. For the preliminary results reported here, 19 subjects viewed the instructive video three times inside the MRI with the task to memorize the steps leading to the final origami. Right after each video, they had to reproduce the origami as far as they could. While watching the control video of the repetitive folds, subjects had to count the number of folds being made to ensure cognitive load and attentiveness. We assessed similarity using the intersubject-correlation method (Hasson et al. 2004). We found similar activity between the instructor and the mean observer in the action observation network in all conditions. Thus performing a complex naturalistic task and observing it activates a range of brain regions common to both participants even in the absence of visual feedback for the blindfolded instructor. Intersubject similarity in the action observation network was higher for the 'watch to learn' conditions than the 'count folds' conditions, which. highlights a new facet of involvement of the action observation system in learning

Keywords: observational learning

B5 Oxytocin and arginine-vasopressin innervation of cerebral cortex in human and chimpanzee brains

Christina Rogers[1], Amy Ross[2], Shweta Sahu[1], Ethan Siegel[1], Jeromy Dooyema[3] Mary Ann Cree[3], Edward Stopa[4], James Rilling[1], H. Elliott Albers[2], Todd Preuss[1]; [1]Emory University, [2]Georgia State University, [3]Yerkes National Primate Research Center, [4]Browning University.

Oxytocin (OT) and arginine-vasopressin (AVP) are involved in the regulation of complex social behaviors across a wide range of taxa. OT is associated with social recognition, pairbonding, and maternal bonding in rodents. In humans, OT is implicated in the promotion of trust, cooperation, and in-group altruism. AVP is associated with aggressive and territorial behaviors, but also pair-bonding, paternal behavior, and mate-guarding in males. OT and AVP exert these effects via release in the central nervous system, and their effects are mediated by the distribution of receptors across brain regions. OT and AVP v1a receptors are found in regions far from the nuclei of the hypothalamus where they are produced. This raises the question of how these peptides reach their remote receptors. Optogenetic evidence from rats suggests that projections from hypothalamic OT and AVP neurons can release peptide from axon terminals into synapses. Moreover, neuroimaging evidence shows that intranasal administration of OT and/or AVP in humans can modulate neural activity in the cortex. To determine whether OT and AVP projections actually innervate the cortex in primates, we performed immunohistochemistry for fibers containing OT and AVP in humans (n=3), chimpanzees (n=3), and rhesus macaques (n=5). We found AVP fibers in various subregions of the insular cortex in humans, including frontoinsular cortex and agranular insula. Chimpanzees exhibited lower AVP innervation of the insula, limited to the agranular insula and piriform cortex. OT fibers were found in the straight gyrus of human brains and the anterior cingulate cortex in chimpanzee brains. Our results contrast with previous reports of OT and AVP immunohistochemistry in human brains, which did not report the presence of fibers in the cortex. Interestingly, nonapeptide innervation was present in regions known to contain von Economo neurons (AVP in frontoinsular cortex in humans and OT in cingulate cortex in chimpanzees), suggesting that they may play a role in modulating the activity of this class of neurons. Overall, our results help to address the issue of how OT and AVP exert effects on brain regions far from the hypothalamus, particularly in primates, and provide evidence of species differences in OT and AVP neuroanatomy.

Keywords: nonapeptides

B6 How fairness dispositions impact spatial temporal neural dynamics in a three-party distribution game

Keith Yoder[1], Jean Decety[1]; [1]University of Chicago.

Humans are social creatures who must balance self-interest and fairness concerns. Moreover, people differ in their sensitivity to injustices directed at themselves or others. The current study used a neuroeconomics paradigm to investigate whether individual differences in justice motivation were associated with changes in how individuals processed fair and unfair monetary distributions. Participants were asked to accept or reject monetary distributions while undergoing electroencephalography (EEG). In a modified version of the ultimatum game, trials were varied to independently manipulate Self-Fairness and Other-Fairness. Response decisions were analyzed using a generalized multi-level model. Participants were most likely to accept mutually fair distributions and least likely to accept mutually unfair distributions. Event-related potentials (ERPs) were extracted for each trial type and subjected to a repeated measures ANOVA. Distributions which were SelfFair elicited greater deflections for the early posterior negativity (EPN), P3, and late positive potential (LPP) over posterior sites. Dispositional self-oriented justice sensitivity, but not other-oriented justice sensitivity, was correlated with the Self-by-Other interaction for event-related potentials (ERPs) linked to both saliency processing (medial frontal negativity; MFN), attention allocation (P3), and deliberation (LPP). Overall, these findings demonstrate that people do take into account how their decisions affect others, but that self-interest plays a greater role in early stages of information processing during social decision-making.

Keywords: neuroeconomics

B7 Behavioral and neural correlates of social learning in the monkey amygdala

Philip Putnam[1], Prisca Zimmerman[1], Kennya Garcia[1], Jeno Szep[1], Haley Moore[1], Angela Tulk[1], Katalin M. Gothard[1]; [1]University of Arizona, College of Medicine

Social stimuli carry intrinsic valence/value. For example, natural fitness indicators (youth, beauty) or culturally acquired features (social status) trigger social interest and engage partners in social interactions. The intrinsic value becomes reinforced

(or not) through social interactions when each individual is associated with positive or negative outcomes. Previous studies from our and other laboratories have shown that neurons in the amygdala respond to social stimuli presumably reporting their intrinsic value. Neurons in the amygdala also respond to value acquired through classical conditioning (e.g., pairing arbitrary stimuli, with positive and negative outcomes). We have designed a task that allowed us to monitor looking behaviour, operant choices, and neural activity in the amygdala in monkeys as they learn to associate conspecifics with different amounts of reward. The subjects were presented with 3 previously unfamiliar monkeys in pairs of simultaneously playing videos and learned, by trial and error, 3 outcomes associated with each individual. Videos of moving objects, associated with the same three levels of reward were used as controls. Here were report the relationship between learning, looking behaviour, and neural responses to multiple task variables the amygdala. Neurons in the amygdala respond to the content of the videos, to the reward associated with each stimulus, and to task parameters (e.g., the operant response). We compare the extent to which neurons in the amygdala respond to the intrinsic and/or learned value of social stimuli and report that oxytocin (administered intranasally into the amygdala) enhances the selectivity of neurons for individuals.

Keywords: monkey amygdala

B8 Non-medical prescription opioid use and its impact on emotional and cognitive empathy.

Sara Liane Kroll[1], Boris B. Quednow[1]; [1]Experimental and Clinical Pharmacopsychology, Department of Psychiatry, Psychotherapy and Psychosomatics, Psychiatric Hospital of the University of Zurich, Lenggstrasse 31, CH-8032 Zurich, Switzerland.

In the last two decades, non-medical prescription opioid use (NMPOU) has become an increased public health concern, especially in the United States. Although misuse of opioid analgesics (e.g., morphine, hydromorphone, oxycodone, and fentanyl) has reached epidemic dimensions, little is known. about its sequelae on social cognition. Studies with heroin users and opioid-substituted patients have shown deficits in emotion perception. However, in this population, it is difficult to attribute postulated findings only to neuropharmacological effects because of confounding factors such as comorbid physical and psychiatric diseases. Therefore, we compared 21 individuals with NMPOU with 28 matched healthy and drug-naïve controls. Participants conducted the Comprehensive Affect Test System, investigating emotional perception, and the Multifaceted Empathy Test, measuring cognitive (CE) and emotional empathy (EE). Trait empathy was assessed using the interpersonal reactivity index (IRI). This is the first study investigating social cognition in individuals with NMPOU. Emotion perception and CE were significantly reduced in opioid users compared to controls. Pearson's correlations revealed dose-dependent deficits in affect recognition and CE. In contrast, the IRI showed no significant differences in trait empathy between both groups. Thus, contrary to cocaine and alcohol users displaying deficits mainly in EE, individuals with NMPOU show selective impairments in CE, indicating that the opioid system might be involved in CE processing. Similar CE deficits were also found in autistic patients supporting Panksepps neurochemical theory of autism. Therefore, future interventions of opioid dependence could target CE deficits in order to improve social interaction and consequently enhance therapy outcome and prevent relapse

Keywords: social cognition

B9 Attenuated Rates of Reward-Representation Optimization as a Transdiagnostic Biomarker of High Trait Aggression in Children

Derek Groskreutz[1], Emilie Bertschinger[1], Denis Sukhodolsky[1], Brent Vander Wyk[1]; [1]Yale University.

Aggression is considered a behavioral manifestation of the RDoC's negative valence domain of Frustrative-Nonreward, defined as the lack of receipt of an expected reward. Many studies investigating aggression or its dimensional component have done so from an emotion regulatory standpoint, in which dysfunction in the regulatory response to not receiving an expected reward is implicated in a failure to suppress affect-driven arousal. Here, we consider the formation of reward expectation itself, and the rate at which reward representations are modified as a function of experience, as potential contributors to heightened states of frustration often observed in aggressive children. We compare ventral striatal (VS) activation patterns and behavioral data (response time and accuracy) in a Go/No-Go fMRI paradigm between a transdiagonstic cohort of children with high trait aggression (n=118) and healthy controls (n=24). Despite controlling for reward value and frequency, Patients exhibited statistically significant differences in levels of VS activation throughout the repetition of different conditions with varying reward probabilities ($t=2.59$, $p=0.0105$). Moreover, parametric analyses revealed that Patients' VS activation remained consistent within conditions despite their repetition, while Controls exhibited attenuations in conditions with high reward probability and increases in activation within conditions of low reward probability ($t=2.95$, $p=0.0050$). These results suggest that children with high-trait aggression may be insensitive to changing reward contingencies. They further suggest that a failure to optimize reward representations in conjunction with environmental reward probabilities may be a mechanistic contributor to heightened levels of frustration observed in aggressive subjects. Grant support by the NIMH.

Keywords: aggression

B10 Recruitment of the ventral tegmental area and its afferent pathways during socially rewarding behavior in juvenile male and female rats

Christina Reppucci[1], Cassandra Gergely[2], Nara Nascimento[2], Grace Ro[2], Remco Bredewold[1], Alexa Veenema[1]; [1]Michigan State University, [2]Boston College.

The ventral tegmental area (VTA) is an essential component of the mesocorticolimbic dopamine reward system and an important node of the Social Decision-Making Network (O'Connell & Hofmann, 2011). As such, the VTA is interconnected with brain regions implicated in the expression of social play, a highly rewarding behavior predominately displayed by juveniles, and expressed by nearly all mammalian species. In the current study, we investigated the recruitment of the VTA (Experiment 1) and its afferents (Experiment 2) during social play behavior in juvenile male and female rats. Single-housed juveniles were exposed, in their home cage, to an age- and sex-matched unfamiliar juvenile for 10 min ("Play" condition) or received similar handling but no partner ("No Play" condition). In Experiment 1, Fos and tyrosine hydroxylase (TH) immunohistochemistry was used to determine activation of the VTA and its dopaminergic neurons in response to social play. Preliminary data showed that females in the play condition had more Fos in the rostral VTA than females in the no play condition, and the opposite pattern was observed in males. No sex difference or effect of social play was found for Fos expression within TH-positive VTA neurons, which may have been due to the very low number of double-labeled neurons observed. In Experiment 2, we combined retrograde tract tracing using cholera toxin B subunit (CTB) with Fos immunohistochemistry to determine activation of afferent projections to the VTA in response to social play. Preliminary data showed that exposure to social play was associated with increased Fos induction in the medial prefrontal cortex (mPFC) and lateral septum (LS) for both sexes. Social play also induced Fos expression in CTB-positive neurons within these brain regions, but the occurrence of double-labeled neurons was very low. Together, these data suggest that social play is associated with weak VTA dopaminergic activation, as well as weak recruitment of mPFC and LS pathways

to the VTA. However, the sex-specific activation of VTA non-dopaminergic neurons, and activation of the mPFC and LS in both sexes may serve as important clues for further investigation of the neural circuitry underlying social play behavior in juvenile males and females.

Keywords: reward, motivation, juveniles, ventral tegmental area, Fos, tract tracing, sex differences

B11 Interactions between behavior and autonomic cardiac functioning: Change over time in preschool program targeting children exposed to early-life stress

Karen E Smith[1], Greg J Norman[1]; [1]University of Chicago.

Children exposed to early-life stress are at risk for a wide range of social and emotional behavioral difficulties. However, there is considerable variation in these outcomes. Understanding what contributes to this variation will aid the development of more effective interventions for children exposed to early-life stress. As the parasympathetic nervous system is an important bidirectional pathway of communication between the brain and periphery, and parasympathetic cardiac functioning has been linked to brain activity in areas including the medial prefrontal cortex and amygdala during emotional and self-regulatory processes, autonomic cardiac regulation, specifically parasympathetic regulation, is a likely predictor of individual differences in children's outcomes. Indeed, there is strong evidence that high resting parasympathetic functioning buffers some of the negative effects of early-life. stress. However, little work has examined how parasympathetic functioning changes in children exposed to early-life stress, whether it can be influenced through intervention, and if these changes relate to children's behavior. This tudy examined how children's self-regulatory behaviors and parasympathetic functioning changed over the course of a preschool program targeting children exposed to early-life stress, and if changes in parasympathetic functioning over time predicted alterations in behavior. We found that children's self-regulatory behaviors improved over the course of the preschool program, and this was accompanied by increases in parasympathetic functioning over time. Additionally, increases in parasympathetic functioning predicted enhanced self-regulatory behaviors. These findings suggest that autonomic cardiac functioning is malleable in young children, and may be a potential marker of improvement in self-regulatory processes in at-risk children during intervention

Keywords: Psychophysiology

B12 A behavioral and neural study of motivations for deception

Anastasia Shuster[1], Dino Levy[1]; [1]Tel Aviv University.

Deception plays a big part in social interactions. While from a utilitarian stand-point, people should lie whenever they benefit from it, in reality this is not the case. Studies showed that people incorporate into their decision process the consequences of their lie on others. Here, our objective is to identify the internal motivations that drive a decision to deceive, and outline the neural correlates of dishonest behavior. Thirty-three participants completed a task called The Message Game, in which a subject (Sender) sends out either a profitable yet deceptive message or a truthful but not-as-profitable message to another participant (Receiver). Payoffs varied across trials, in order to assess individual sensitivity to different motivations for deception. Subjects' neural activity was recorded using an fMRI scanner. We found that overall deception occurrence varied dramatically between subjects, as well as underlying motivations, both in which motivations drive the behavior and to what extent. Several brain regions were implicated in the decision to deceive, including the superior temporal sulcus and the temporoparietal junction (TPJ). Interestingly, we identified motivation-specific regions of activations, modulated by how they affect individuals' behavior. We found utilitarian considerations to correlate with activity in the lateral prefrontal cortex, while other-oriented motivations involved the TPJ, dorsal prefrontal cortex and anterior cingulate cortex. Finally, we show that connectivity between these regions is associated with subjects' behavior as well. Our results suggest that different people have different motivations to act honestly and these differences may be traced to specific neural substrates and connections.

Keywords: Decision-making

B13 The role of ventral striatum in reward-based attentional bias

Joseph Leshin[1], Harma Meffert[2], Michelle Vantieghem[3], Isaiah Sypher[4], James Blair[2]; [1]University of North Carolina at Chapel Hill, [2]Boys Town National Research Hospital, [3]Columbia University, [4]University of Michigan.

People are typically well attuned to social factors. Indeed, models of attention suggest that salient social information easily biases attention. However, recent data also suggests that prior experiences can bias attention involuntarily. Specifically, implicit knowledge of previous reward associations can shape a person's overall selection biases in later, similar, contingencies. We used the additional-singleton task to determine the neural underpinnings that biases perceptual processing as a function of reward history. Participants underwent fMRI while they searched for a unique shape amongst an array of differently shaped objects. All shapes, including the target shape, were of similar color except one distractor shape. From trial to trial, target colors could stay the same or swap with the distractor color (i.e., non-swap vs. swap trials, respectively). Participants randomly received a low or high reward after correct trials. Individual differences in reward sensitivity (RS) were examined. Relative to individuals low in RS, individuals high in RS responded significantly faster following high versus low rewards; this same group showed significant bilateral activation in the ventral striatum during high rewards than low rewards compared to those low in RS. We also found significant positive connectivity between the ventral striatum, visual cortex, and ventral medial prefrontal cortex during high reward non-swap trials than high reward swap-trials among those high in RS than in those low in RS, suggesting that reward modulated attention may be implemented by a network comprised of these brain areas. This study demonstrates an individual difference mechanism that underlies reward-based attentional bias.

Keywords: attention

B14 The Effect of Ostracism and the Influence of Childhood Emotional Invalidation on Impulsivity: An EEG Study

Matthew Tyra[1], Brigette Cuonzo[1], Jonathan Burton[1], Ty'Keyana Mickless[1], Laura Swain[1]; [1]University of South Carolina Aiken.

Impulsivity is a multi-faceted construct that underlies many forms of maladaptive behavior. There are multiple influences that precede impulsive behavior, and one of these influences may be negative social interaction patters; more specifically, in this study we examine the influences of ostracism and childhood emotional invalidation. This study integrates a multidisciplinary approach in order to better understand impulsivity, parent and peer relationship influences, and the neural activity related to this behavior as measured by electroencephalogram (EEG). Using EEG, the lateralized readiness potential (LRP) component was measured as a neural index of selective motor activation. Impulsivity measurements included both behavioral and survey data. An experimental design was implemented to test the effects of ostracism on impulsivity and the LRP waveform. The influence of perceived childhood emotional invalidation was also examined. Several notable findings were found in this study: (1) individuals that experienced ostracism had increased performance on the Flanker Task and some patterns of the LRP waveform that are indicative of changes in impulsivity, (2) perceived childhood emotional invalidation was related to facets of impulsivity, and (3) self-

reported impulsivity trait scores were not related to Flanker Task performance or LRP waveform data. These findings highlight the impact of social interactions on impulsivity levels in its different forms. Lastly, the third finding of this study emphasizes the multifaceted nature of impulsivity and the need for future clarification of what facets are captured by different impulsivity measures.

Keywords: Social/Personality, Impulsivity, Ostracisim, Emotional Invalidation, EEG

B15 Effects of Oxytocin and Vasopressin on Behavior and Brain Responses Related to Activities Expressing In-group and Out-group Concerns: An fMRI Study

Adam Teed[1], Jelena Rakic[1], Daniel Mark[3], Daniel Krawczyk[1]; [1]University of Texas at Dallas, [2]University of North Texas.

Oxytocin (OT) and vasopressin (AVP) have been seen to influence behavior in a variety of social contexts, and recent studies have shown OT to promote concern for the well-being of in-group rather than out-group members. The distinction between in-group and out-group concerns is captured, respectfully, by Benevolence and Universalism, two core values conceptualized by the Basic Human Values Theory (BHVT). To better understand the scope of the hormones' potential effects on social behaviors and brain regions elicited by these concerns in real-world contexts, participants in this study responded to novel stimuli categorized according to four BHVT values, including Benevolence and Universalism, during fMRI scanning. Specifically, 20 male participants rated single sentence descriptions of values-related activities based on how worthwhile they were and how likely they were to participate in them. Each person performed this task during three separate fMRI scanning sessions in which they received nasal sprays of either OT, AVP or a placebo solution according to a pseudo-randomized, double-blinded, within-subjects procedure. Oxytocin did not influence activity ratings, but vasopressin increased worthiness ratings of Universalism activities when compared to placebo. fMRI results during ratings of Benevolence activities show OT enhancing and AVP attenuating similar cortical networks stretching from the posterior temporal lobe, through the insula, up to the inferior frontal gyrus. This study is the first to show vasopressin promoting out-group concern. Evidence of divergent effects in wide-spread cortical networks between OT and AVP as elicited by a variety of real-world contexts is also provided

Keywords: Psychoneuropharmacology

B16 I will choose freewill: A TMS extension of Libet's experiment and its implications for social neuroscience

Briana Goncalves[1], Juliana De Vito[1], Saeed Yasin[1], Heather Soder[1], Julian Keenan[1]; [1]Cognitive Neuroimaging Laboratory, Montclair State University.

The work of Libet over 30 years ago introduced the notion that intention of motoric tasks originate in the sub-cortical motor areas and that the frontal cortex only engages after intentionality has been established. These findings have been employed as a basis for arguing that intentionality begins in sub-cortical motor regions and that higher cortical regions remain agnostic until far into the 'decision' making process. Here we use a cognitive task demonstrating that 1) Free will can be manipulated. Inhibitory TMS was delivered to right and left Motor Cortex (MC) during a simple forced-choice picture preference task. Following right MC TMS, participants were more likely to prefer right sided images, and vice-versa following left MC TMS. 2) Questioning during the task revealed that participants were willing to provide reasons for the choices with confidence. These data suggest, though only preliminarily, that notions of Libet's theory can be applied to higher-order, non-motor tasks. We argue that a large part of the self is equally constructed in this manner and that the ease at which we manipulate each other is contingent on the illusion of freewill.

Keywords: Self-awareness

B17 Non-invasive eye tracking for the study of social cognition in monogamous titi monkeys

Sara Freeman[1], Louise Loyant[2], Michelle Palumbo[1], Takeshi Murai[1], Melissa Bauman[1]; [1]University of California-Davis, USA, [2]National Veterinary School of Toulouse, France.

Primates acquire social information primarily through the visual system. Measuring patterns of eye movement gives researchers insight into the cognitive processes that allow individuals to visually navigate their social world. Eye-tracking technology has been used in social neuroscience research with humans and nonhuman primates to determine what individuals pay attention to and what they ignore. To investigate the biology of social attachment, we study the monogamous coppery titi monkey (Callicebus cupreus). Like humans, titi monkeys form enduring adult social attachments. We used non-invasive eye tracking (Tobii Pro TX300) to quantify their looking behavior. We tested 19 animals (8 juveniles; 11 adults) with photos and videos of other titi monkeys. The viewing task was voluntary: each monkey was presented with visual stimuli while sitting in a familiar transport box that was modified to include a small window at face height. Fourteen animals (74%) participated and spent an average of 26% of the session looking at the stimuli. Juveniles spent significantly more time looking at the stimuli than adults ($p<0.03$), and all monkeys spent significantly more time looking at videos compared to photos ($p<0.02$). We found no effect of sex on looking time. We are now using this technology to determine whether pair-bonded mates show preferential looking at the face of their pair-mate compared to unfamiliar faces. Future studies can include manipulations of the oxytocin and vasopressin systems, which are known to influence social attachment and primate visual attention. This work was supported by P51 OD011107 and the Good Nature Institute.

Keywords: cognition

B18 Rats hunt stag. How social competence and tolerance drive cooperation in a rodent social dilemma task.

Scott Rennie[1], Eric Dewit[1], Alexandra Silva[1], Marta Moita[1]; [1]Champalimaud Neuroscience Programme.

Social animals navigate an ambiguous world defined by their own choices and those of the conspecifics they interact with. Competent social decision making requires interacting conspecifics to evaluate ongoing social information and integrate it with that of prior interactions and outcomes. To explore how pairs of rats integrate these forms of information we developed a double T-maze assay for testing 2x2 social dilemma games and established a social choice task that corresponds to a high risk Stag Hunt (SH) game, where each animal can see the other. In the SH game there are two Nash Equilbira: mutual cooperation, yielding the highest reward at the greatest risk (reward depends on reciprocation by the other) and mutual defection, which provides a constant (independent of the other) intermediate reward. We then examined the behaviour of rat dyads, where each rat has the option to choose first and defect or risk cooperating, or choose second and coordinate or anti-coordinate. In this standard SH game rats displayed a robust tendency to alternate (70%) and capacity to coordinate (70%) from the first session with a stable and significantly greater than chance coordinated cooperation emerging by the sixth session. This high level of coordinated cooperation was supported by an increasing tendency to tolerate prior unreciprocated cooperation. Previously cooperating dyads ceased to do so when social information was removed by separating the each T-maze, isolating the animals. We then provided naive pairs with a fixed likelihood of reward for cooperation from the most cooperative sessions, regardless of the others choice.

Animals in this condition did not develop a preference for cooperation. Together this indicates that rats are capable of coordinated cooperation in a risky SH game, and that this depends not only the presence of conspecific but upon the ability to coordinate their choices and outcomes trial by trial.

Keywords: Cooperation, social behaviour

B19 Common and Distinct Neural Substrates of Monetary and Social Reward processing in Major Depressive Disorder.

Anjali Sankar[1], Ashley Yttredahl[1], Elizabeth Fourcade[1], Benjamin Sanford[2], Erin McRobert[2], Benjamin Sheler[3], Brain Mickey[2,4], Tifanny Love[2,4], Scott Langenecker[5], David Hsu[1,2]; [1]State University of New York, Stony Brook, [2]University of Michigan, Ann Arbor, [3]Florida International University, [4]The University of Utah, [5]University of Illinois at Chicago.

Abnormalities in reward processing are evident in major depressive disorder (MDD), yet the specific nature of these abnormalities is still somewhat unclear. For instance, the role of the reward system in processing losses in MDD is not properly understood. In addition, most neuroimaging studies in MDD use monetary stimuli to examine reward processing with little focus on social stimuli, which may be the most salient in MDD. A better understanding of reward processing in MDD with a focus on delineating the nature and clinical implications of reward-related abnormalities is essential for developing new treatment targets and improving therapeutic outcomes. In the present study, we examined neural responses to social and monetary gains and losses in MDD patients and healthy controls. Functional MRI data were acquired from 19 patients with MDD and 19 healthy controls while they responded to social gains and losses (social acceptance and rejection; Social Feedback Task; SFT) and monetary gains and losses (Monetary Incentive Delay Task; MID). Due to a priori hypothesis, small volume correction (SVC) was applied to an anatomically defined regions-of-interest mask comprising the bilateral anterior insula and the nucleus accumbens. Within-group analyses for the SFT task showed a trend for significance in the right insula during acceptance (pfweSVC=0.051) as well as significant activation in the same region during rejection (pfweSVC<0.001) in patients with MDD, but not in healthy controls. Within group analysis for the MID task showed significant activations in the right insula during monetary wins (pfweSVC=0.027) as well as losses (pfweSVC<0.001) in healthy controls, but not in patients with MDD. In conclusion, the results suggest dissociable salience related responses towards rewarding stimuli in healthy volunteers and patients with MDD. MDD patients may be associated with enhanced salience particularly towards positive and negative social cues. Monetary cues, on the other hand, may elicit enhanced salience related responses in healthy controls.

Keywords: reward

B20 Moral Decision-Making in the Criminal Justice System: The Influence of Gruesome Descriptions

Michel Patiño-Sáenz[1], Martín Haissiner[2], Jorge Martínez-Cotrina[3], Daniel Pastor[4], Sandra Baez[1], Maria-Alejandra Tangarife[1], Agustin Ibáñez[5]; [1]University of los Andes, Bogotá-Colombia, [2]INECO foundation, Buenos Aires- Argentina, [3]Universidad Externado de Colombia, Bogotá-Colombia, [4]Universidad de Buenos Aires, Buenos Aires- Argentina, [5]Favaloro University, Buenos Aires, Argentina.

It has been shown that gruesome descriptions of harm can increase the punishment given to a transgressor, a biasing effect mediated by negative emotions. However, there is a lack of studies inquiring the influence of such descriptions on moral decision-making in people involved in the criminal justice system. The objective of this study was to explore the influence of gruesome written descriptions on moral decision-making in this group of people. To that end, we recruited attorneys, judges and public prosecutors (Criminal justice group, CJ, n=30) whose field of specialty is criminal law. In addition, we included a control group of people who did not have a formal education in law (n=30), but who were paired in age and years of education with the CJ group. All participants completed an online, Spanish-adapted version of a moral decision-making task. A series of text-based stories describing two characters, one inflicting harm on the other, were presented to participants. Transgressor's intentionality (accidental vs. intentional harm) and language used to describe harm (gruesome vs. plain) were manipulated in the stories. Results showed that control subjects punished more the transgressor when harm was described using gruesome language. However, that was not the case of people in the CJ group, who assigned the same amount of punishment in both conditions. In consequence, these results shed light on how moral decision-making is organized in the brain. Particularly, it demonstrates that affective signals can be modulated by the expertise a person has in dealing with emotionally charged moral scenarios.

Keywords: Moral Decision-Making

B21 The impact of the early life family environment on behavior, nonapeptides, and the epigenome of offspring

Aubrey Kelly[1], Alexander Ophir[1]; [1]Cornell University.

The nonapeptides (vasopressin and oxytocin) are important modulators of behavior, including aggression, anxiety, and social behavior. Early life experiences are known to alter behavior and gene expression by genomic and epigenomic means. However, most of what is known about the relationship between early life experience and the neural and genetic mechanisms regulating adult social behavior comes from uni-parental species. Few studies have examined the impact of paternal influence on offspring development or the extent to which paternal care influences the development and epigenetic modification of nonapeptide systems. In the present study, we used prairie voles (a socially monogamous and biparental rodent) to determine how variation in parental care affects the development of the social brain and behavior. We utilized a 2x2 design and raised offspring in the presence or absence of a father, and also raised pups in families where parents were forced to make a tradeoff between feeding and staying in contact with offspring ("working" for food vs. "not working" for food). Variation in parental care resulted in several behavioral differences once subjects reached adulthood. Males raised in working families exhibited impaired social behavior, while males and females raised in single mother families exhibited less exploratory behavior and impaired performance in a spatial learning and memory task. We also examined the impact of the early life environment on nonapeptide gene expression and methylation status. This study contributes basic knowledge about the social and developmental consequences on nonapeptide-mediated mental health disorders characterized by social deficits, anxiety, and aggressive tendencies.

Keywords: social behavior, vasopressin, oxytocin, development

B22 The effect of omega-3 on executive functions and event-related potentials: A randomized, controlled trial

Bess Yin- Hung Lam[1], Adrian Raine[2], Yu Gao[3], Annis Lai- Chu Fung[4], Wei Zhang[6], Sin-Man Ng[5], Tatia Mei- Chun Lee[5]; [1]Gratia Christian College, [2]University of Pennsylvania, [3]City University of New York, [4]City University of Hong Kong, [5]The University of Hong Kong, [6]Qeens College of the City of New York.

Background: Poor nutrition is a risk factor for brain. Prior findings suggest that nutritional intervention specifically omega-3 supplementation may help enhance brain structure and function. However, what is less known is by what brain and behavioural mechanisms for omega- 3 supplementation producing the neuropsychological improvement specifically the executive function. The present

study aims to (1) investigate whether a nutritional intervention to adolescents can enhance their executive function; and (2) identify the neural correlate by which omega-3 supplementation enhances executive function in children and adolescents. Method: This study consisted of a double-blind, placebo-controlled, randomized controlled trial of 193 children recruited from the primary and secondary schools in Hong Kong. Adolescents aged between 8 and 18 years old, residing in Hong Kong. Exclusion criteria consisted of: (1) allergy to fish or fish products, (2) use of fish oil supplementation in the past six months, (3) intellectual disability. Children and adolescents were randomly assigned to 3 groups: (1) child receiving omega-3 drinks (treatment group), (2) child receiving placebo drinks (placebo group), and (3) child receiving no drinks at all (control group). Assessments took place at 3 time-points: prior treatment, the end of treatment and post-treatment. Tower of London (ToL) and ERP adopting the Oddball paradigm was administered to children at all three time points. Written informed consent was obtained from the parents while assent will be obtained from adolescents. Results: Both ERP and behavioral results showed that the executive function of those in the treatment group had the best enhancement. Specifically, the initiation time measured by ToL and the right P3 novel/target correlates measured by ERP were enhanced in the treatment group. Conclusion: By taking bimodal methods to study the effect of omega- 3 supplementation on the executive function in children and adolescents, the findings of the present study suggest that the brain function of children and adolescents can be enhanced by adopting the nutritional supplementation of omega-3 at the community level. The present study therefore has clinical implications

Keywords: Executive function

B23 The Influence of Anxiety on Performance: An EEG Study

Brigette Cuonzo[1], Ty'Keyana Mickles[1], Laura Swain[1]; [1]University of South Carolina, Aiken.

Negative social interactions and experiences can be triggered by anxiety-provoking situations, which is attributed to changes in behavior and brain activity. One way social dysfunction may manifest is through changes in attention and impulsivity, which can interfere with social behaviors and relationships. However, it is not known whether internal or external anxiety-provoking situations are more influential in producing these changes. Therefore, the purpose of this study was to compare changes in attention and brain activity between an internal (giving a speech) and external (social exclusion) anxiety-provoking manipulation. Electroencephalography (EEG) was used to measure brain activity during a flanker task post manipulation. We hypothesized we would see a stronger effect through a longer latency and more errors in the anxiety-provoked group. All participants were non-clinical, and data were collected to examine levels of trait and state anxiety, affect, and sensitivity of appetitive and aversive systems. Results from the social-exclusion manipulation showed longer latency and increased accuracy. Results from the speech manipulation showed that individuals reported only slight changes in their levels of state anxiety and had decreased accuracy. Collectively, these results suggest that individuals may interpret external cues as more threatening and therefore their pre-motor cortex is primed to act, which results in higher accuracy. Implications from this study suggest that there may be differences in how threats are perceived. Future studies should look at differences between introverts and extroverts to identify any differences in how threats are interpreted within these groups.

Keywords: Anxiety, Behavioral Inhibition, Ostracism, EEG

B24 Emotionally charged thoughts: Transcranial direct current stimulation over the prefrontal cortex reduces rumination about romantic rejection.

Ashley Yttredahl[1], Anjali Sankar[1], Alexandra Byrne[1], David Hsu[1]; [1]Stony Brook University.

Neuroimaging studies suggest that the right ventrolateral prefrontal cortex (vlPFC) plays an important role in down-regulating negative emotional responses to social rejection. Applying transcranial direct current stimulation (tDCS), a form of neuromodulation, over the right vlPFC has been shown to reduce aggression and hurt feelings following social exclusion. Here, we examined the effects of vlPFC tDCS on additional cognitive and motivational states including state rumination, desire for social interaction, and self-esteem during romantic rejection. Ten healthy, romantically-single participants (5 women) between ages 18-25 received 1 session each of active and sham anodal tDCS (1.5mA, 20min) over the right vlPFC (double-blinded active vs. sham stimulation were administered at least 7 days apart, counterbalanced across subjects). Following tDCS, participants received feedback that they were not liked by self-selected, highly desired romantic partners and rated their emotional responses on a 0 - 10 scale. Low and high levels of rejection were presented. Results showed that level-dependent increases in state rumination following rejection ($F(2,37) = 5.89$, $P = .006$) were attenuated by the active stimulation ($F(1,37) = 4.52$, $P = .04$). These findings suggest that right vlPFC tDCS specifically reduced rumination but did not affect the desire for social interaction or self-esteem following romantic rejection. We will combine our approach with fMRI to localize downstream pathways by which the vlPFC regulates rumination following rejection. This will further our understanding of emotion regulation during rejection and guide future research on tDCS treatments for disorders characterized by rejection sensitivity and high rumination such as major depressive and borderline personality disorder.

Keywords: Neurostimulation

B25 Negative Social Emotions in Parents of Newborns

Ana-María Gómez-Carvajal[1], Michel Patiño-Sáenz[1], Hernando Santamaría-García[2], Mateo Bernal[1], Sandra Baez[1], Mario Valderrama[1], Daniela Lizarazo[1], Juliana Restrepo[1], José Santamaría-García[1], Diana Matallana[3], Jaime Silva[4], Angélica Parra[4], Paula Torres[4], Maria Fernanda Barreta[4] ; [1]University of los Andes, Bogotá-Colombia, [2]Pontificia Universidad Javeriana, Bogotá-Colombia, [3]Pontificia Universidad Javeriana, Bogotá-Colombia, [4]Departamento de Ginecologia y Obstetricia Hospital San Ignacio, Bogotá- Colombia .

High levels of oxytocin are associated with better performance in social cognition tasks. However, high levels of oxytocin have also been associated with increased levels of envy and schadenfreude -pleasure at others' misfortunes-. This study aims at characterizing negative social emotions (envy and schadenfreude) and other components of social cognition (ToM and empathy) in subjects presenting high levels of oxytocin (women in the puerperal period and their respective partners). The control group consisted of men and women without children or partners. Control women were in the luteal phase of the menstrual cycle or taking oral contraceptives. Both study groups were matched in age, sex, and years of education. Twenty-two parents of newborns (11 women, 11 men) and 15 controls (8 women, 7 men) completed an experimental task designed to trigger schadenfreude and envy. Moreover, participants were assessed with ToM and empathy tests. Potential confounding variables such as general cognitive functioning, stress levels, hours of sleep and depression symptoms were also measured. Results showed that parents of newborns have increased levels of envy and schadenfreude. These effects are not explained by any confounding factor. Moreover, no significant differences were found in ToM or empathy tests. Our findings offer unprecedented evidence on specific differences in envy and schadenfreude levels in parents of newborns. This is consistent with previous studies showing a positive relationship between oxytocin levels and negative social emotions. Therefore, oxytocin is probably modulating brain circuits underpinning negative social emotions in parents of newborns, promoting the expression of such emotions.

Keywords: Negative social emotions

B26 Incentive and Punishment Processing in Youth with High Levels of Externalizing Behavior

Yonglin Huang[1], Yu Gao[1] ; [1]Brooklyn College City University of New York.

Youth with externalizing problems and psychopathic traits exhibit extreme and chronic patterns of antisocial behavior. Individuals who display these characteristics and tendencies are responsible for a disproportionate amount of crime. In spite of involvement with the criminal justice system, many continue to reoffend. It is believed that individuals with elevated levels of externalizing behavior and psychopathic traits may have disruptions in reward or punishment processing, giving rise to problematic behaviors. Our study tests the hypothesis that higher level of externalizing behavior in adolescents would be associated with higher sensitivity to environmental incentives and reduced sensitivity to aversive stimuli. Functional brain imaging data is acquired during a conditioning paradigm (modified Monetary Incentive Delay task), in which participants learn to associate cues to monetary rewards or punishments. Caregivers report of adolescents' aggression, delinquency, and psychopathic traits is collected. We examine neutral activity in the brain regions underlying the anticipation and receipt of reward/punishment in relation to problematic behaviors.

Keywords: fMRI, externalizing behavior, psychopathy, adolescence

B27 An exploration of time perception in early-stage romantic relationships

Jean Liu[1], Nicole Kuek[1]; [1]Yale-NUS College.

The early stage of romantic love is characterized by passion, with high levels of physiological arousal and dopaminergic activity. In turn, these characteristics have been found to influence time perception, such that individuals who experience arousal-inducing events or who have received dopamine agonists overestimate time durations. Bringing these findings together, we hypothesized that an individual in a romantic relationship would experience the dilation of time in the presence of their romantic partner. We recruited 80 healthy young adults who entered a heterosexual romantic relationship in the 3 months prior to study enrolment. In the temporal reproduction task, participants viewed photographs of their partner, an attractive stranger, or an average stranger (in counter-balanced order). These were shown for 2-6s, with participants reproducing the duration of photograph presentation using a keypress. In a second reproduction task, participants used their non-dominant hand to hold either their partner's hand or a stress ball (in counter-balanced order across participants). They were exposed to 300Hz auditory tones that were presented for 2-6s, and were asked to reproduce these durations using a keypress. Across both tasks, early stage romantic couples were found to overestimate time intervals in the presence of their partner, as compared to attractive and average controls or a neutral stress ball. These findings suggest that the old adage of time 'standing still' (or slowing down) is true of romantic love, a pattern consistent with prior time estimation research relating to physiological arousal and dopamine.

Keywords: Romantic love

B28 Neural mechanisms for converting social value into self-oriented decision value

Haruaki Fukuda[1], Ning Ma[1], Shinsuke Suzuki[2], Norihiro Harasawa[1], Kenichi Ueno1, Justin L Gardner[3], Noritaka Ichinohe[4], Masahiko Haruno[5], Kang Cheng[1], Hiroyuki Nakahara[1] ; [1]RIKEN, [2]Tohoku University, [3]Stanford University, [4]National Center of Neurology and Psychiatry, [5]National Institute of Information and Communication Technology.

The neural signals of internal reward valuation process comprise a self-oriented decision-making. In social setting, decision-making is influenced by social factors and related concerns of others' reward. However, the underlying mechanism of converting social values into self-oriented decision-making process is still poorly understood. In this study, we demonstrated social value conversion mechanism, using a novel paradigm in human fMRI with computational modeling. We conducted a behavioral choice task involving bonus reward to self and others to isolate three computational and neural stages for social value conversion into self-oriented value-based decisions: offer value, the effective value that links between offer and decision, and final decision value. For behavior, we modeled the choice behavior by logistic regression and observed a significant modification by the other-bonus, although the extent of the modification is weaker by other-bonus than self-bonus given the same face amount. For BOLD signal, offered other-bonus value was observed in right temporoparietal junction (rTPJ) and left dorsolateral prefrontal cortex (ldlPFC). These signals modulated effective other-bonus value encoded in the right anterior insula (rAI), which is then routed into decision valuation in ventromedial PFC (vmPFC) to complete the conversion process. Moreover, conversion showed individual variation with different socio-behavioral isotypes; rAI and ldlPFC coupling to vmPFC responses differed between selfish and prosocial subjects, respectively. These findings provide a computational framework for understanding the neural integration and conversion of various social signals in value-based decision-making.

Keywords: social decision-making

B29 Autism-associated changes in the representation of social information in prefrontal circuits

Dana Rubi Levy[1], Tal Tamir[1], Maya Kaufman[1], Aharon Weissbrod[1], Elad Schneidman[1], Ofer Yizhar[1]; [1]Weizmann Institute of Science, Israel.

Deficits in social behavior are among the primary symptoms of autism spectrum disorder (ASD). Although little is known regarding the circuit alterations that might give rise to this complex phenotype, evidence from both human patients and animal models suggests that dysfunctions of the prefrontal cortex (PFC) might play a dominant role in ASD pathophysiology. However, a major gap still exists in understanding how the PFC encodes social information, and how changes in these representations might correlate with impaired behavioral response. To address these questions, we utilized a custom-built behavioral apparatus and recorded unit activity in the ventromedial PFC of behaving male mice presented with precisely-timed social and non-¬social odor cues. We found distinct representation for social stimuli in the vmPFC, such that a large proportion of recorded units responded exclusively to male or female odors over a repertoire of non-social cues. Cue-responsive units also showed greater response magnitude to social odors than to non-social stimuli. Population-level analyses revealed that while male and female odors evoke similar activity patterns in the vmPFC, these representations are notably distinct from those of non-social cues, regardless of odor valence. In Caspr2 knockout mice, a well¬ established genetic model of autism, these patterns were significantly altered, such that vmPFC units c. showed decreased specificity to social odors as well as blunted stimulus¬-evoked response dynamics. Taken together, our results identify specific representations for salient social stimuli in the mouse vmPFC and indicate altered processing of social information in a genetic model of autism.

Keywords: autism, prefrontal, electrophysiology

B30 Posttraumatic stress disorder (PTSD), but not childhood abuse, modulates pupil dilation to emotional stimuli

Lauren Murphy[1], Negar Fani[2], Bekh Bradley[2], Erin Tone[3], Seth Norrholm[2], Tanja Jovanovic[2], Abigail Powers[2] ; [1]Department of Psychology, Emory University, [2]Department of Psychiatry and Behavioral Sciences, University School of

Medicine, [3]Stanford University School of Medicine.

Mechanistic changes in attention towards threatening stimuli may increase vulnerability to posttraumatic stress disorder (PTSD) following trauma exposure (Pine et al., 2005; Fani et al., 2011). Recent research distinguishes unique patterns of attention toward negative faces in individuals with PTSD and toward positive faces in individuals with childhood abuse exposure (Powers et al., submitted). To further understand the mechanisms supporting this attentional modulation, we compared pupil dilation to emotional faces across groups with PTSD or childhood abuse. Subjects included 55 African American women (ages: 18-65) recruited from an urban hospital setting who met criteria for at least one DSM-IV-TR criterion A traumatic event. Subjects were screened using the Clinician Administered PTSD scale (CAPS) and the Childhood Trauma Questionnaire (CTQ) to measure PTSD diagnosis within the past month and childhood abuse, respectively. Then, subjects were eye-tracked (ASL Model R6) during an emotionally-salient dot probe attention task which included viewing unknown faces configured side-by-side in one of three pairs: angry/neutral, happy/neutral, or neutral/neutral. Pupil diameter was measured and averaged during the initial stimulus presentation (0-2s). Individuals with a current diagnosis of PTSD showed significantly greater pupil dilation to angry faces than those without a PTSD diagnosis ($F1,55=4.52$, $p=0.04$), but no difference for neutral or happy faces ($p's>0.10$). Childhood abuse did not impact pupil dilation during any condition (all $p's>0.10$). These findings suggest that individuals with PTSD may experience increased arousal to negative stimuli, but that differences in arousal levels may not underscore differences in emotional attention in individuals with childhood trauma.

Keywords: PTSD; early life stress; emotion regulation; pupil dilation

B31 The neuroimaging of human fear conditioning: quantitative seed-based and linguistic meta-analyses

Daniel Stjepanović[1], Kevin S. LaBar[1]; [1]Center for Cognitive Neuroscience, Duke University.

The application of fear conditioning across organisms and techniques has begun to detail the neurobiological mechanisms through which fears are acquired and extinguished. Key in advancing our understanding of fear conditioning is the ability to synergise results across studies to test the consistency of findings. The amygdala has repeatedly been demonstrated to be critical to fear learning and a key node in a network of cortical and subcortical regions that together form a fear-learning network. However, the amygdala has not consistently emerged in quantitative meta-analytic reviews. One explanation for this discrepancy may be the reliance on whole-brain analyses. Additionally, work to date has not explored how individual factors may determine the regions recruited and thereby contribute to greater variability. The aim of the present work, therefore, was to attempt to resolve these discrepancies by conducting a survey of the human neuroimaging literature. Utilising seed-based d mapping (SDM) of peak coordinates from 32 studies using whole-brain analyses, we identified a network of regions including the inferior frontal gyrus, cingulate cortex, superior temporal gyrus, insula, and thalamus. Importantly, when we examined 33 studies that specifically interrogated the amygdala, we additionally observed consistent activation within right amygdala. We expand upon these results by examining what influence study factors have upon the observed activation networks, examining both low-level perceptual and individual factors such as gender. Our survey illustrates the challenges inherent in aligning results across imaging studies and supports the corpus of data that reveal a key role for the amygdala in fear learning.

Keywords: emotion

B32 Warmth and Competence Predict Motor Resonance and Helping Behavior

Nadya Styczynski[1], Jeremy Simon[1], Jennifer Gutsell[1]; [1]Brandeis University.

Research has shown a connection between the extent to which an observer will mentally simulate a target individual's movements (motor resonance), and the target's social categorization. In order to test not only how the presence of social categorization but the content of that categorization affects motor resonance, we directly manipulated the perception of target individuals, varying their warmth and competence, the dimensions of the Stereotype Content Model (SCM). Motor resonance was operationalized as the suppression of the mu wave while observing a target individual, and measured using electroencephalography. When these targets were in the medium warmth category, high competence targets elicited the most motor resonance; similarly, when targets were high in competence, warm and cold targets elicited more resonance then medium warmth targets. This fits with literature indicating increased resonance for motivationally relevant targets, as intentions (indexed by warmth) are relevant only when the target is capable (indexed by competence) of carrying them out. In addition, we successfully replicated behavioral findings showing that competence predicts passive behaviors and warmth predicts active behaviors. Lastly, active helping behaviors inversely predicted resonance, while passive helping behaviors directly predicted resonance, providing the first evidence that resonance directly predicts certain behaviors.

Keywords: Social Neuroscience

B33 Ecologically-relevant paradigm for assessing social olfaction in marmosets

Stephanie Womack[1], Jeffrey French[1]; [1]University of Nebraska Omaha.

Navigation of the social world depends largely on recognition of, and responses to, sensory stimuli, and in mammals, odors and olfaction are prominent signals used to navigate a host of social interactions. Marmosets (Callithrix) utilize odors that are a combination of urine, feces, and sebaceous secretions from specialized perigenital scent glands in social communication. In this study, we designed a paradigm that incorporated an ecologically-relevant foraging task where baited tubes were presented in a 'tree-like' apparatus that takes advantage of marmosets' natural, gummivorous sap-feeding behavior. We measured olfactory performance by testing discrimination learning between urine-cued reward (simple syrup; n=8 feeding sites) and distilled-water cued sites with aversive stimuli (quinine/ascorbic acid solution; n=8). Assessment was based on percentage correct (urine) choices made within one minute ([A correct choices/total choices] * 100). Animals interacted with the apparatus and were able to discriminate between social and non-social stimuli regardless of age or sex; initial training indicated there was no correlation between latency to approach the apparatus and overall performance. Marmosets exhibited proficiency (≥80% correct choices) in as few as sixteen trials, and reached criteria (80% correct choices on five consecutive days) through repeated exposure in as few as fifty trials. These results indicate that the protocol is successful in assessing olfactory performance: marmosets were able to perform well above chance and maintain proficiency through subsequent trials. This paradigm will allow for experimental evaluation of sensory thresholds, social discrimination/recognition, and the impact of neuropeptides on these processes. Supported by NIH (HD089147).

Keywords: social olfaction

B34 Neural and behavioral signature of human social perception

Ana Saitovitch[1], Hervé Lemaitre[1], Elza Rechtman[1], Raphael Calmon[1], David Grévent[1], Volodia Dangouloff-Ros[1], Francis Brunelle[1], Nathalie Boddaert[1], Monica Zibovicius[1] ; [1]INSERM U1000, Department of Pediatric Radiology, Hôpital Necker Enfants Malades, AP-HP, University René Descartes, PRES Sorbonne Paris Cité, UMR 1163, Institut Imagine, Paris, France.

Social behavior is greatly variable across individuals, outside the scoop of pathology. Being a basic key mechanism of social behavior, eye gaze may reflect this variability. In this study, we used eye-tracking to objectively measure inter-individual variability of gaze behavior in healthy young volunteers and to investigate its correlates with brain functioning at rest, measured with MRI. Results showed that number of fixations to the eyes during passive visualization of social scenes varies within a wide range among individuals and that individual patterns remain stable across time, suggesting an individual signature in social behavior. Moreover, whole brain correlation with rest cerebral blood flow (CBF) showed that inter-individual variability in gaze behavior has its own neural signature: individuals who look more to the eyes are those with higher rest CBF values within the right superior temporal regions. Taking a step further into the understanding of the neural basis of social behavior, our results indicate the existence of a neural signature associated with the inter-individual variability in social perception.

Keywords: Social perception, Inter-individual variability, eye-tracking, rest CBF, ASL-MRI

B35 Older Adults' Neural Activation in the Reward Circuit is Sensitive to Face Trustworthiness

Leslie Zebrowitz[1], Noreen Ward[2], Jasmine Boshyan[2], Angela Gutchess[1], Nouchine Hadjikhank[2]; [1]Department of Psychology, Brandeis Uniiversity, Waltham, MA, [2]2Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Charlestown, MA.

We aimed to determine whether: 1) older adults (OA) also show neural sensitivity to face trustworthiness in reward circuit regions previously found to respond to face trustworthiness in younger adults (YA); and 2) greater OA positivity observed behaviorally in trustworthy ratings was mediated by age differences in neural activation in reward regions. fMRI analyses examined brain activation to mixed older and younger faces presented in blocks of high, medium, and low trustworthiness. OA neural response to variations in face trustworthiness replicated previous research investigating YA. Whereas previous research investigating OA failed to find differential OA amygdala and insula activation to high vs. low trustworthy faces, we found that low and high trustworthy faces elicited stronger OA right amygdala activation than medium trustworthy faces, and high trustworthy faces elicited stronger left insula activation than medium ones. In addition, OA showed greater activation to high than medium and/or low trustworthy faces in dorsal anterior cingulate, bilateral caudate, medial orbito-frontal cortex, nucleus accumbens, and ventral medial prefrontal cortex. As predicted, OA rated the faces as more trustworthy than did YA. However, this effect was not mediated by age differences in neural activation in reward regions. Surprisingly, YA showed no significant neural sensitivity to high trustworthiness in any of the reward regions, and only a weak sensitivity to low trustworthiness. In conclusion, neural responses to face trustworthiness in reward regions are preserved in OA, and the well-documented responses in YA did not generalize to stimuli that included older as well as younger faces.

Keywords: Aging

B36 Stop the clock: Optogenetic activation of the GABAergic nigrotectal pathway resets interval timing.

Koji Toda[1], Nicholas A. Lusk[1], Glenn D. Watson[1], Dongye Lu[1], Henry H. Yin[1]; [1]Duke University.

Interval timing in the seconds to minutes range has been observed across many species. Considerable evidence implicates the basal ganglia circuits in interval timing behavior, yet the underlying mechanisms remain unknown. Using a new behavioral task with head-fixed mice, we examined the role of the basal ganglia output in interval timing. The variance in the timing of the licking behavior is proportional to the interval between rewards, i.e. scalar property. Single-trial analysis reveals that bouts of licking behavior could be described well with discrete stepping dynamics with variable onset times, which are strongly modulated by motivational state. On sporadic peak probe trials with reward omission, the duration of the lick bout is determined by motivational state, but centered around the expected time of reward delivery. We optogenetically manipulated the GABAergic basal ganglia output projections from the SNr to the intermediate/deep layers of the superior colliculus (SC). Photo-stimulation of axon terminals in the SC not only stopped the ongoing licking movement, but also reset the initiation of anticipatory licking for the next interval. Our findings suggest that the nigrotectal basal ganglia output pathway not only sends a top down motor command signal but also contribute to the internal clock of the brain.

Keywords: Interval timing, basal ganglia, substantia nigra pars reticulata, superior colliculus, optogenetics, licking, orofacial movement

B37 Elevated resting heart rate as a predictor of altruistic behavior

Stephanie Dimitroff[1], Ethan Harrod[1], Kelly Faig[1], Karen Smith[1], Greg Norman[1]; [1]University of Chicago.

Can resting autonomic nervous system activity predict whether someone will behave in an altruistic manner? In the current experiment, we had participants (n=83) interact with two fictitious partners, whom they were introduced to via video. In the experimental condition, participants observed one partner socially reject the other. Following this manipulation, participants played a social memory game with both partners and were told to administer a sound blast when their partner produced an error; participants had control of the volume dial. Participants with an elevated baseline heart rate (HR) were more likely to administer louder sound blasts to the partner who had socially rejected the other, representing a propensity towards altruistic punishment. Participants also rated their partners on likability, knowing these ratings would be seen by said partner. Participants with elevated resting HR were more likely to rate their partners as likable, and thus were more socially accepting towards their partners. Afterwards participants completed a two-recipient dictator game, and individuals with elevated baseline HR were more likely to give away a larger sum of their money. Overall, these results suggest that individuals with higher resting HR are more likely to engage in positive social behaviors. Future research should explore the mechanisms by which elevated HR may predispose an individual to act more altruistically.

Keywords: altruism, psychophysiology

B38 Autonomic nervous system activity and disgust sensitivity predict social evaluation of speech

Kelly E. Faig[1], Elizabeth A. Necka[1], Stephanie J. Dimitroff[1], Karen E. Smith[1], Frederica M. Rockwood[1]; [1]University of Chicago.

The behavioral immune system utilizes psychological and physiological mechanisms to protect individuals from infection by promoting avoidance of pathogenic entities including conspecifics. One such mechanism is the emotion disgust. The current experiment sought to elaborate on recent research investigating the relationship between disgust sensitivity and negative attitudes toward outgroup members. Participants listened to a set of 36 different voices from a variety of backgrounds (both English speaking countries and elsewhere) and rated them according to how pleasant they perceived the speaker to be. Measures of autonomic nervous system cardiac regulation (high-frequency heart rate variability and pre-ejection period) were collected during a 5-minute baseline period as well as while participants listened to and rated the speakers. Participants also completed several questionnaires assessing individual differences in sexual, moral, and pathogen disgust. Results indicate that self-reported disgust sensitivity predicts perceived pleasantness of the speakers such that increased disgust was associated with decreased pleasantness ratings. High-frequency heart rate variability also related to participants' perceptions of speakers' pleasantness. These findings implicate behavioral immune activation in the processing of social stimuli through emotional and autonomic mechanisms.

Keywords: Psychophysiology, the Behavioral Immune System

B39 Emotion recognition and autistic traits in normal young adults: an exploratory study of eyetracking and psychophysiological responses

Helio Cuve[1], Yu Gao[1], Shawn Fagan[1], Akiko Fuse[1] ; [1]Brooklyn College CUNY.

Effective emotion processing is associated with better levels of health and social performance while deficits in this ability have been linked with the development and maintenance of difficulties in social adjustment in autism. Whether the deficits in emotion recognition in ASD generalize to non-clinical samples based on their levels of autistic traits is currently unknown. Furthermore, the mechanisms underlying these deficits are not yet well understood. The present study aimed to test two main hypotheses for emotion recognition deficits in autism, namely, the eye avoidance hypothesis and the hypoactivation hypothesis using a non-clinical sample of undergraduate students. Although no full support was obtained for any of the two hypotheses cited in the literature, in general, global and subscale scores of autistic traits were negatively associated with SCR, suggesting an hypoarousal. However, no behavioral differences in accuracy or eye-tracking patterns were observed. The present results suggest that the currently available hypothesis cannot fully explain emotion recognition deficits and furthermore, the relations between arousal, accuracy, and fixations vary according to different emotions, independent of autistic traits. It is possible that autistic traits are not a good predictor of emotion recognition performance in non-clinical samples or simply, arousal and behavioral performance might be independent processes. Nonetheless, the present results might also suggest that our manipulations were not sensitive enough to capture subtle differences in non-clinical samples. Future studies should aim for more sensitive approaches and include potential competing variables that can affect emotion recognition performance.

Keywords: autism, trait, emotion, facial, eye tracking, arousal. emotion

B40 Post-weaning social isolation affects motor and social behavior in Wistar rats

Lorena Andreoli[1], Edgard Morya[1] ; [1]Edmond and Lily Safra International Institute of Neuroscience.

Distress in early years is considered a risk factor for neurodevelopmental diseases. This hypothesis is the foundation of a largely used animal model of post-weaning isolation (PWI) for these disorders. This model presents several neural correlates similar to humans with schizophrenia (i.e., reduced prefrontal cortex volume and dendritic spine density; increased spontaneous ventral tegmental area dopaminergic neurons activity). Our work aims to assess the neural correlates of social impairment and motor behavior in a PWI model of schizophrenia. Twelve Wistar rats (six PWI, six controls) underwent stereotaxic surgery for microelectrode implantation in areas of mesocorticolimbic pathway. Animals were acclimated in a black wooden box (60x60x40 cm) for two days for motor behavior assessment (locomotion distance) and, in the third day, we paired dyads of animals for social interaction evaluation. Behavior was video tracked (60Hz, Cineplex, Plexon Inc, TX) for offline analysis. Our preliminary behavioral data suggests a difference in motor behavior and social isolation between PWI and healthy control. PWI animals showed higher locomotion distance (M = 2,429.89 cm, SD = 435) than healthy controls (M = 1914.84 cm, SD = 491) and lower social interaction compared to control group. Isolated rats spent 30% of the session in some sort of social interaction (i.e: sniffing, following each other). Whereas control rats interaction last for half of their session (50%). Cognitive and social deficits in schizophrenia are resistant to pharmacological therapy, and the understanding of its neurophysiological underpinnings can lead to new therapeutic approaches.

Keywords: Schizophrenia, social interaction, post-weaning isolation

B41 Rapid estrogenic enhancements of learning and memory within the hippocampus of female mice: A role for membrane-bound receptors

Talya Kuun[1], Sabrina Armstrong[1], Ramneek Brar[1], Melissa Klemens[1], Elena Choleris[1] ; [1]University of Guelph.

Estrogens play an important role learning and memory through genomic mechanisms (Nilsson et al., 2001) and have recently been implicated in rapid mechanisms, which can occur in minutes (Woolley, 2007). Both systemic and intrahippocampal administration of 17β-estradiol (E2) produce enhancements of learning and memory in a rapid 40-minute timeframe in ovariectomized female mice (Phan et al., 2012; 2015). Social recognition, object recognition and object placement learning are all enhanced within this timeframe, too rapid to be caused by the aforementioned genomic mechanisms of estrogen action, however the mechanisms of action remain unknown. This study uses E2 conjugated with a bovine serum albumin (BSA-E2) molecule to learn more about the starting point of these mechanisms. The large BSA molecule prevents the E2 from passing through the cellular membrane and from binding to intracellular receptors, as normal (Taguchi et al., 2004) to help elucidate the binding location initiating these rapid effects. The study uses the aforementioned 40-minute learning paradigms, all involving habituation phases and a final test phase where one of the stimuli is replaced by a novel stimulus to test for recognition learning. Since mice to preferentially investigate novelty, investigative behaviors can be analyzed to determine whether recognition has occurred. Enhancements of learning and memory were reproduced, suggesting that the rapid effects of estrogens in the hippocampus responsible for these enhancements are mediated, at least in part, by membrane-bound receptors. This exposes an important first step, providing a source for further exploration of these mechanisms in the future. Supported by NSERC

Keywords: Estrogens

B42 Cueing to relevant facial features does not alleviate emotion recognition deficits associated with psychopathy in a college sample

Shawn Fagan[1], Yu Gao[2]; [1]CUNY Graduate Center, [2]Brooklyn College.

Successful empathetic responding involves accurate emotion recognition, a skill largely disrupted in individuals high on psychopathy. Recent research proposes that psychopathic individuals have impaired emotion recognition due to deficits in orienting attention to salient facial features like the eyes. Psychopathic individuals also display blunted autonomic responding to emotional stimuli; whether this is due to attention orienting deficits remains to be clarified. Theories of attentional impairment rarely consider sub-factors of psychopathy, which are regularly associated with distinct psychophysiological profiles. In this study, we examined effects of attentional cueing on emotion recognition and physiology, and whether this relationship is moderated by psychopathic subtypes. Attention, affective arousal, and emotion recognition in response to happy, sad, angry, fearful, and neutral facial expressions were examined in undergraduate students who completed the Psychopathic Personality Inventory-Revised (PPI-R). There was no relationship between subtypes of psychopathy and emotion recognition accuracy during the free gaze condition. However, cueing to the eye region impaired accuracy and increased reaction time for fearful faces in those high on Factor 2 psychopathy, though this relationship was only significant for concurrently low on Factor 1 psychopathy. Cueing to facial features did increase arousal to fearful faces, but only for those low on Factor 1 or Factor 2 psychopathy. These results suggest that 1) attention orienting does not alter physiology for those high on psychopathy, and may serve to impair behavioral performance, specifically for those with high Factor 2 levels, and 2) impaired emotion recognition in psychopathy is not a function of deficits in attention.

Keywords: Psychopathy

B43 A neural mechanism candidate for psychological distance in the prefrontal cortex: A meta-analytic review of brain activity related to intertemporal choices

Benjamin Smith[1], John Monterosso[1], Antoine Bechara[1], Stephen Read[1]; [1]University of Southern California.

Temporal discounting describes the psychological process by which people value delayed rewards less than immediate ones. Although almost 200 temporal discounting experiments using fMRI are described in the literature, no meta-analysis currently exists across temporal discounting studies comparing regions related to SmallerSooner or LargerLater reward choices. Specifically, Construal Level Theory suggests that more distant future prospects are represented more abstractly than immediate ones (Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2015). Other theory and evidence (Botvinik, 2008) suggests that more abstract processing occurs in more anterior regions while more concrete processing is related to more posterior regions. We were interested in this 'tangibility axis' and therefore hypothesized that LargerLater choices would be associated with more anterior activation in the PFC while SmallerSooner choices would be associated with relatively posterior PFC activity. We surveyed the literature for temporal discounting fMRI studies and used SDM to calculate trends across thirteen experiments, for which appropriate data was available, including 436 subjects. Consistent with our hypothesis, both SmallerSooner and LargerLater activity was observed in the left inferior frontal gyrus pars triangularis, and the LargerLater activity was observed anterior of SmallerSooner activity. This finding suggests a candidate for the neural underpinnings of Construal Level Theory, specifically, a neural architecture capable of processing a wide variety of forms of abstraction including temporal distance. The Construal Level Theory idea that different forms of psychological abstraction are interrelated makes sense in light of a prefrontal neural hierarchy of abstract to concrete processing.

Keywords: temporal discounting, psychological distance

B44 Men who are sexually risky and safe in real life can be distinguished by insula activity during a virtual safe sex negotiation task in the scanner

Benjamin Smith[1], Feng Xue[1], Vita Droutman[1], Emily Barkley-Levenson[1], A. J. Melrose[1], Lynn C. Miller1, John R. Monterosso[1], Antoine Bechara[1], Paul Robert Appleby[1], Carlos G. Godoy[1], Stephen J. Read[1] ; [1]University of Southern California.

HIV is most prevalent among men who have sex with men (MSM), and although most MSM use condoms consistently during casual sex, some take risks. To better understand the psychology of those risky decisions, we examined neural correlates of playing a virtual sexual "hook up" game in an fMRI scanner in MSM who had, in the past 90 days, been sexually risky (N=76) or safe (N=31). During the game, subjects interacted with computer characters, had sex with them, and made decisions about safe sex along the way. We hypothesized that four different neural regions - the dorsal prefrontal cortex, ventral prefrontal cortex, the insula, and the striatal system may be involved in sexually risky decision-making in interpretable ways. We found that during potentially risky sexual choices, previously risky MSM had more right insula activity than previously safe MSM. This may suggest that decision-making during the sexual risk negotiation process itself is related to the difference between risky and safe men. Real-life sexual risk was related to trait positive and negative urgency, and insula activity, which differentiated risky and safe MSM, was related to trait positive and negative urgency. Future work should further examine if, and to what extent, insula activation during safe sex negotiation drives MSM's rash risky sexual decision-making.

Keywords: risky sexual decision-making

B45 Behavioral and neuroanatomical characterization of the vasopressin system in the bed nucleus of the stria terminalis reveals potential coordination of separate populations of vasopressin neurons in mediating social behavior

Justin A. Smith[1], Remco Bredewold[1], Christina J. Reppucci[1], Alexa H. Veenema[1], [1]Neurobiology of Social Behavior Laboratory, Department of Psychology and Neuroscience Program, Michigan State University

Distinct populations of vasopressin-synthesizing neurons have diverse functions ranging from hydromineral homeostasis to social behavior. However, the potential for separate populations of vasopressin neurons to interact and coordinate social behavior is unclear. One population of neurons located in the posterior aspect of the bed nucleus of the stria terminalis (pBNST) both produce vasopressin and receive vasopressinergic inputs making the pBNST an ideal candidate region for exploring such interactions. Because the number of vasopressin neurons in the pBNST of males is androgen-dependent and increases with sexual maturity, we hypothesized that vasopressin signaling in the pBNST would be an integral part of mediating socio-sexual motivation. Utilizing a three-chamber testing apparatus, adult male rats were allowed to investigate a confined male or estrus female following microinjection of a vasopressin (V1a) receptor antagonist or vehicle into the pBNST. Blocking V1a receptors in the pBNST resulted in an attenuation of both female investigation/sniffing and the time spent in the female chamber compared with vehicle-treated rats. Blocking V1a receptors in the pBNST had no effect on the ability to discriminate between a male and estrus female or between a familiar and novel juvenile male rat, suggesting a specific effect of V1aR antagonism on socio-sexual motivation. Preliminary data further indicate that vasopressin-expressing neurons of the pBNST also express mRNA for the V1a receptor. This suggests a potential

mechanism by which vasopressinergic inputs to the pBNST act to modulate the activity of local vasopressin-producing neurons to facilitate socio-sexual motivation. We are currently testing this hypothesis by utilizing a vasopressin promoter-driven virus, chemogenetics, and electron microscopy to determine whether vasopressin-producing neurons in the hypothalamus synapse onto vasopressin-producing neurons in the pBNST and activate local vasopressin receptors.

Keywords:

Exhibits

Exhibitors

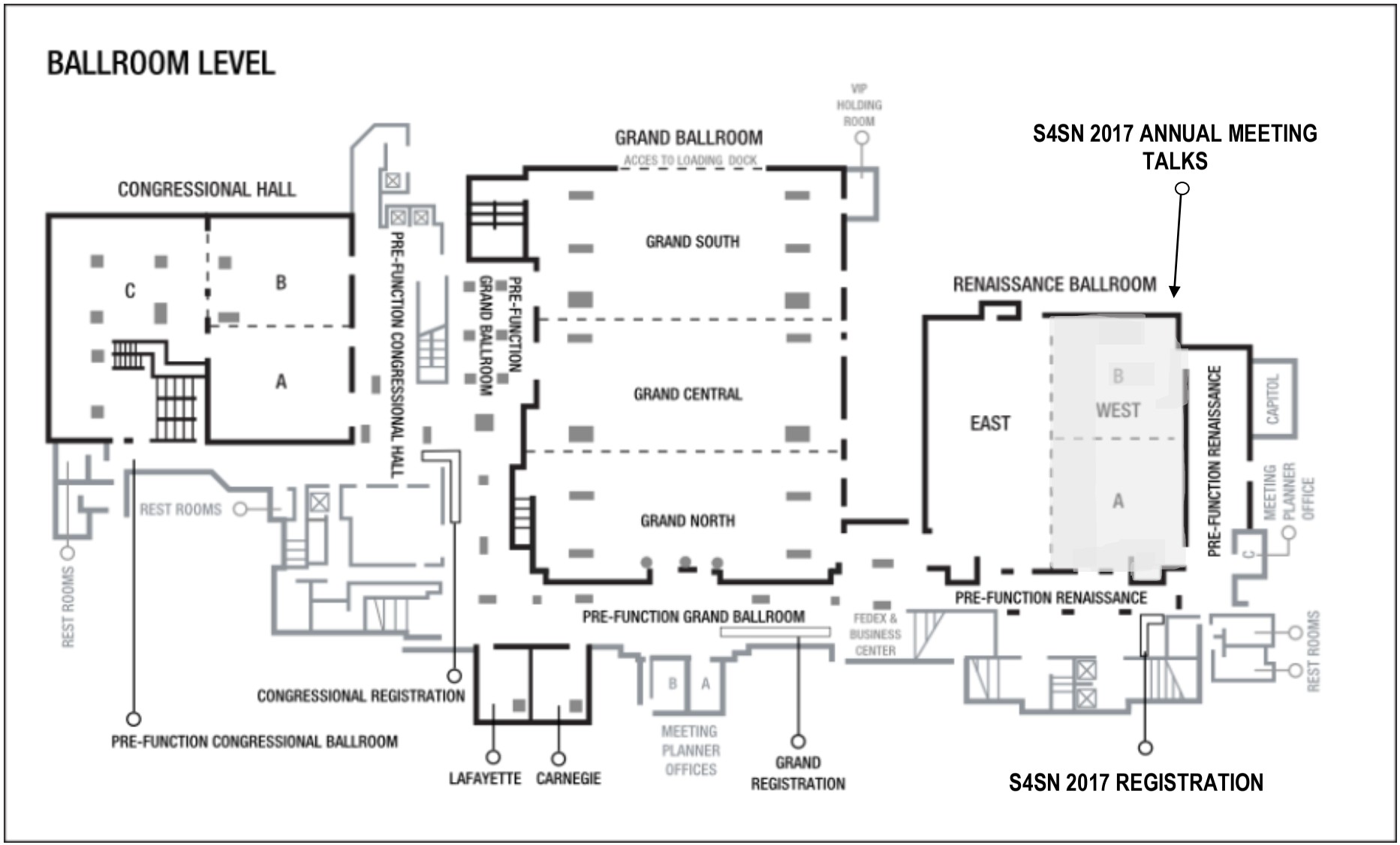
Visit our exhibitors in Ballroom West A&B

Brain Vision LLC
Clever Sys, Inc.

Exhibit Hours

The conference exhibits are located in Renaissance Ballroom West A&B of the Renaissance Washington, DC Downtown Hotel. Located in this room are the general sessions, posters, exhibit tables, and catering. The Exhibit Hall is open to all attendees at the following times:

Friday, November 10 8:30 am – 7:00 pm


BALLROOM LEVEL
VIP HOLDING ROOM
GRAND BALLROOM
ACCES TO LOADING DOCK
S4SN 2017 ANNUAL MEETING TALKS
CONGRESSIONAL HALL
C
B
A
PRE-FUNCTION CONGRESSIONAL HALL
PRE-FUNCTION GRAND BALLROOM
GRAND SOUTH
GRAND CENTRAL
GRAND NORTH
RENAISSANCE BALLROOM
EAST
B
WEST
A
PRE-FUNCTION RENAISSANCE
CAPITOL
MEETING PLANNER OFFICE
C
REST ROOMS
REST ROOMS
PRE-FUNCTION GRAND BALLROOM
PRE-FUNCTION RENAISSANCE
FEDEX & BUSINESS CENTER
CONGRESSIONAL REGISTRATION
PRE-FUNCTION CONGRESSIONAL BALLROOM
B
A
MEETING PLANNER OFFICES
LAFAYETTE
CARNEGIE
GRAND REGISTRATION
REST ROOMS
S4SN 2017 REGISTRATION

SOCIETY for SOCIAL NEUROSCIENCE

WWW.S4SN.ORG