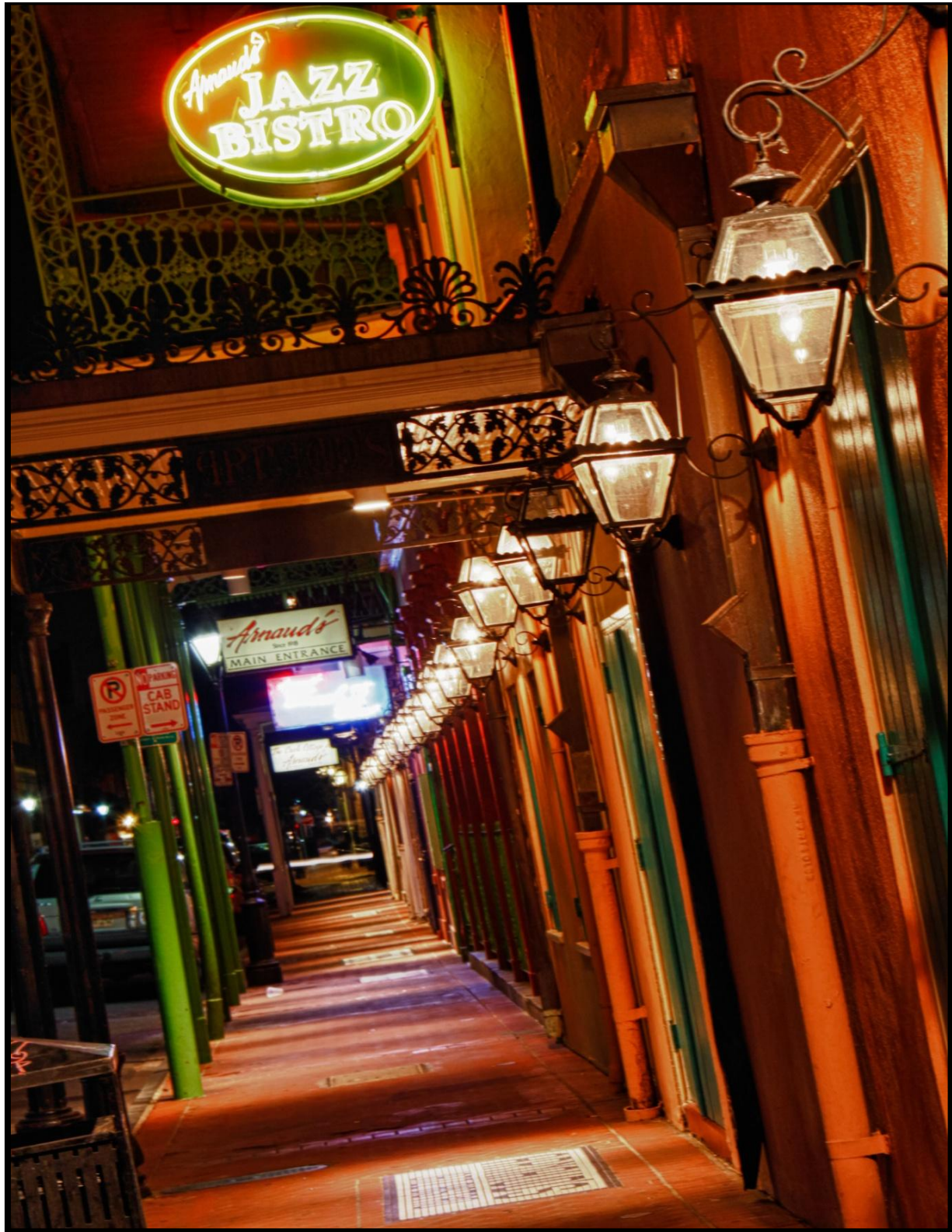


SOCIETY FOR SOCIAL NEUROSCIENCE



NEW ORLEANS, OCTOBER 11-12, 2012

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The 3rd annual meeting of

The Society for Social Neuroscience

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

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S4SN 2012 Meeting
Hilton New Orleans Riverside Hotel
2 Poydras Street | New Orleans, LA 70140

Welcome to S4SN 2012

Welcome to the Third Annual Meeting of the Society for Social Neuroscience.

We are honored to announce that this year's keynote speaker is Professor Giacomo Rizzolatti, from the University of Parma, Italy.

In response to suggestions from the membership, this year's program is based on symposia, talks, and posters proposed by members. If you've attended previous meetings, you'll also notice that each year the Society for Social Neuroscience (S4SN) continues to grow and change at a remarkable pace (see <https://s4sn.org/>). The resulting program reflects both the conceptual diversity of social neuroscience and the international nature of our growing society. A second change this year is the inclusion of a plenary session of short contributed talks. We hope this will facilitate interaction and collaboration as we get to know one another and share our ideas. Lastly, we are happy to report a third change this year as we *were able to* secure the help of a team of professionals— Tara Miller Events (TME), the same management group that runs the Cognitive Neuroscience Society (CNS), and Society for Personality and Social Psychology (SPSP), among others. TME is helping us with management and planning so that we can spend more time doing what we do best—science.

Finally, we would like to thank you all for taking part this year! The success of the society and the direction it takes depends critically on your ongoing participation. We look forward to learning more about your fascinating research and sharing our ideas with you during symposia, contributed talks, and poster sessions. If you can, please try also to attend the business meeting on Friday afternoon, provide feedback on the S4SN meeting overall, and volunteer to contribute to the society's committees. With your help, we can ensure that our new society helps define the interdisciplinary study of social neuroscience.

We would also like to thank the S4SN President, the S4SN Board of Directors, the S4SN Award Committee, all the S4SN Committee Chairs, as well as Kerry, Shawna, Jeff, and Tara at TME—all of whom worked very hard to pull this event together. We would also like to thank our invited Keynote speaker for accepting our invitation.

On behalf of the Program Committee, Welcome to New Orleans!

Program Committee, Society for Social Neuroscience

S4SN 2012 Meeting | Program Overview

Schedule Thursday, October 11, 2012

12:00 pm—8:00 pm	Registration, <i>Grand Ballroom Foyer</i>
12:00 pm—4:00 pm	Board Meeting, <i>Cambridge Room</i>
2:30 pm—4:30 pm	Contributed Talks, <i>Grand Salon D</i>
4:00 pm—8:00 pm	Exhibits Open, <i>Grand Ballroom D</i>
4:30 pm—5:00 pm	Coffee Break, <i>Grand Ballroom D</i>
5:00 pm—5:15 pm	Opening Ceremony Welcome, <i>Grand Salon D</i>
5:15 pm—6:30 pm	Keynote Address by Professor Giacomo Rizzolatti , University of Parma, Italy, <i>Grand Salon D</i>
6:30 pm—8:00 pm	Reception and Poster Session A, <i>Grand Ballroom D</i>

Schedule Friday, October 12, 2012

7:30 am—7:30 pm	Registration, <i>Grand Ballroom Foyer</i>
7:30 am—8:30 am	Continental Breakfast, <i>Grand Ballroom D</i>
8:30 am —10:00 am	Symposia 1 & 2 S1. Brain to Brain Coupling: A mechanism for creating and sharing a social world, <i>Grand Salon C</i> S2. Social Environment and its Effect on Neurochemistry and Behavior, <i>Grand Salon D</i>
10:00am—10:30 am	Coffee Break, <i>Grand Ballroom D</i>
10:00 am—12:00 pm	Exhibits Open, <i>Grand Ballroom D</i>
10:30 am—12:00 pm	Symposia 3 & 4 S3. Situated Cognition and Social Neuroscience: From Animal Models to Neuropsychiatry, <i>Grand Salon C</i> S4. Social Touch and Grooming: How Tactile Interactions Shape Brain Morphology and Function, <i>Grand Salon D</i>
12:00 pm—1:00 pm	Lunch Break
1:00 pm—2:30 pm	Poster Session B, <i>Grand Ballroom D</i>
1:00 pm—7:30 pm	Exhibits Open, <i>Grand Ballroom D</i>
2:30 pm—4:00 pm	Symposia 5 & 6 S5. The Neuroscience of Maternal Attachment and Attachment Style, <i>Grand Salon C</i> S6. Phenotypic Transmission through Social Networks, <i>Grand Salon D</i>
4:00 pm—4:30 pm	Coffee Break, <i>Grand Ballroom D</i> Society Business Meeting, <i>Grand Salon C</i>
4:30 pm—6:00 pm	Young investigator Award Symposium, <i>Grand Salon D</i>
6:00 pm—7:30 pm	Reception and Poster Session C, <i>Grand Ballroom D</i>

S4SN 2012 Meeting | Keynote Address



**Professor GIACOMO RIZZOLATTI
at the Opening Ceremony
5:15-6:30 pm,
Thursday, October 11, 2012,
Grand Salon D**

A neural mechanism for understanding action and emotion

Giacomo Rizzolatti, *Dipartimento di Neuroscienze, Università di Parma, via Volturno 39, 43100 Parma, Italy and Brain Center for Social and Motor Cognition, IIT, Via Volturno 39, 43100, Parma, Italy*

Humans' life is characterized by complex social interchanges. A striking feature of these interchanges is that others' behavior is interpreted as a mark of something as insubstantial as mental activity. Actions of others are clues to their intentions and emotional state just waiting to be captured. In the first part of my talk I will describe the general properties of a neural mechanism – the mirror neuron mechanism- that allows individuals to understand the actions done by others and their emotions. This mechanism produces, in the brain of the viewer, representations of the observed actions or emotions in a motor format. Because the observing individuals know the outcome of their motor representations, they are able to achieve, through the mirror mechanism a *direct* knowledge of what the others do and feel. In the second part of my talk I will present some new physiological data on the organization of the insula in the monkey showing its motor and mirror properties. I will conclude with a discussion of a specific emotion-like human behavior defined "vitality affects" by Daniel Stern.

Generously sponsored by



S4SN 2012 Meeting | Awards

Young Investigator Award Winners

Friday, October 12, 4:30-6:00 pm, *Grand Salon D*

Jay Van Bavel (jay.vanbavel@nyu.edu)

Department of Psychology, New York University



A look inside the hive mind: How group membership shapes perception and evaluation.

The concept of a hive mind is generally used by biologists to describe the collective behavior or hyper-social organisms, such as bees or ants, or by philosophers and sociologists to describe a sense of collective consciousness among

humans. In this talk, I will describe the selection of group-level adaptations, propose a psychological basis for the hive mind in humans, and present a series of behavioral and neuroimaging experiments showing how group based concerns shape a wide range of cognitive processes, including ostensibly hard-wired and/or automatic processes. The first series of experiments will illustrate the influence of group membership and collective identification on person perception and evaluation. The second series of experiments will illustrate the influence of group membership and collective identification on the perception of physical properties (i.e., physical distance and olfaction). Finally, I will link these group-based perceptual biases to intergroup discrimination. Taken together, this research suggests that group membership shapes social perception and evaluation, which gives rise to group-based representations of the social and physical world. Implications for understanding the social nature of the human brain will be discussed.

Zoe Donaldson (zoe.donaldson@gmail.com)

Division of Integrative Neuroscience, Department of Psychiatry, Columbia University



Polymorphic repetitive elements upstream of the vasopressin receptor gene (*Avpr1a*) diversify brain expression patterns and behavior

Social behaviors can vary markedly across individuals and among closely related species, providing an ideal opportunity for exploring genomic mechanisms of phenotypic

diversity. Variation in vasopressin V1a receptor (V1aR) distribution in the brain contributes to diversity in social behavior in voles. A polymorphic microsatellite element upstream of the vole *Avpr1a* gene is associated with variation in V1aR distribution and behavior, but not causally linked. Using homologous recombination in mice, we examined the contribution of distal and proximal 5' flanking sequences to species differences in V1aR distribution in the brain, and confirmed that variation in V1aR distribution impacts behavior. Furthermore, variation in vole *Avpr1a* microsatellite structure contributes to variation in *Avpr1a* expression. This is the first direct evidence that polymorphic microsatellite elements near behaviorally relevant genes can contribute to diversity in brain gene expression profiles, providing a mechanism for generating behavioral diversity both at the individual and species level. Correlational work further indicates that such polymorphic elements may also serve as a source of behavioral diversity in humans and other primate species.

Best Student Abstract Awards

Animal Research

Poster A2, Thursday, October 11, 6:30 – 8:00 pm

Elisabetta Mofardini (monfardini@incm.cnrs-mrs.fr), a PhD

student working at the Mediterranean Institute of Cognitive Neuroscience in Marseilles with Bruno Wicker. Her abstract title is, "Neural basis of social facilitation in monkeys using fdg-pet."

Human Research

Poster C16, Friday, October 12, 6:00 – 7:30pm

Joana Vieira (joanabvieira@gmail.com), her abstract title is "Is altruistic punishment automatic? Electrophysiologic and neuroimaging evidence of the effects of cognitive load and psychopathy in the rejection of unfair offers in the Ultimatum Game"

S4SN 2012 Meeting I Symposia

Symposium 1

Brain to Brain Coupling: A mechanism for creating and sharing a social world

Friday, 8:30—10:00 am, Grand Salon C

Chair: M. Cikara, MIT (mcikara@mit.edu)

Cognition materializes in an interpersonal space. The emergence of complex behaviors requires the coordination of actions among individuals according to a shared set of rules. Despite the central role of other individuals in shaping one's mind, most cognitive studies focus on processes that occur within a single individual. In many cases the neural processes in one brain are coupled to the neural processes in another brain via the transmission of a signal through the environment. Brain-to-brain coupling constrains and shapes the actions of each individual in a social network, leading to complex joint behaviors that could not have emerged in isolation. Communication—verbal and non-verbal—is an excellent case study of how interaction partners inform our ongoing cognitive processes. Feedback via social interaction shapes birds' songs and babies' babbling (Goldstein). Monkeys use conspecifics' facial expressions to coordinate behavior (Shepherd). Greater moment-to-moment coupling between a speaker's and listener's neural signals predicts more successful interpersonal communication (Hasson). In contrast, opposing viewpoints can reduce brain-to-brain coupling (Cikara).

ABSTRACTS

A comparative approach to the development of coupling

M. Goldstein, Cornell University (michael.goldstein@cornell.edu)

In both songbirds and humans, the social environment plays an important role in vocal development. Social interactions that promote vocal learning are characterized by contingent responses of adults to early, immature vocalizations. These interactions are often rapid and comprised of small, seemingly mundane behaviors, but they are crucial for vocal development. In the zebra finch (*Taeniopygia guttata*), young males learn their fathers' songs but the proximal mechanisms that guide learning have received little attention. We videorecorded 10 families during the sensitive phase of vocal development (30-60 days posthatching) and assessed social interactions occurring during or within 15 seconds of juveniles' vocalizations. Timing of parental responses to immature song predicted individual differences in song learning. For example, nonvocal maternal responses, such as wing strokes and fluff-ups, to immature song facilitated the similarity of the juvenile's song to the father's. In a parallel experiment, we presented prelinguistic human infants from English-language environments with feedback containing sound patterns they were capable of pronouncing but rarely produce. We used VCV-patterned words from the Nigerian language Yoruba (e.g., *ada*). We varied the contingency and phonological variability of feedback which was presented via cues given to infants' mothers. Only infants given feedback contingent on their babbling learned the Yoruban pattern. Thus caregivers' reactions to plastic song and babbling afford infants opportunities for vocal learning. Our data indicate that vocal learning is an active process, driven by social interactions that are organized by developmentally early, immature vocalizations. By creating feedback that is both inherently informative and socially relevant, structured social interaction boosts the salience

of patterns in the input and facilitates learning of speech and song.

Intra- and inter-individual coordination of facial behavior

S. V. Shepherd & A. A. Ghazanfar, Princeton University (stephen.v.shepherd@gmail.com)

Humans and other primates coordinate their behavior by perceiving and responding to bodily action and by exchanging specialized communication signals. For example, humans coordinate both their attention and emotion with that of a seen face, and this matching behavior appears to both reflect and to build social bonds. We will briefly review gaze-following behavior, and then turn our attention to recent work on the coordination of facial expressions. By recording electromyographic activity at Society for Social Neuroscience Symposium Proposal multiple sites in the monkey face, we found that monkeys, like humans, exhibit specialized coordination of rhythmic facial behavior in social contexts. Specifically, we find that an affiliative behavior, the lipsmack, involves strongly coordinated rhythmic activity in expressive muscles shaping mouth posture. We next report that, just as humans are known to match facial behavior in friendly interactions, monkeys tend to mimic observed lipsmack displays. By modeling whether these lipsmacks are produced on a second-to-second basis, we found that sent and received signals interact nonlinearly to predict future signal production. These data suggest that monkeys, like humans, consider previously sent signals when interpreting the behavior of other animals.

Exploring the Mechanisms of Dyadic Social Interactions

G. Stephens, NYU; L. Silbert, & U. Hasson, Princeton University (hasson@princeton.edu)

In everyday life we spend most of our time interacting with other individuals. Using fMRI, we recently recorded the brain activity of a speaker telling an unrehearsed real-life story and the brain activity of a listener listening to a recording of the story. To make the study as ecological as possible, we instructed the speaker to speak as if telling the story to a friend. Next, we measured the brain activity of a listener hearing the recorded audio of the spoken story, thereby capturing the time-locked neural dynamics from both sides of the communication. Finally, we asked the listeners to complete a detailed questionnaire that assessed their level of comprehension. Our results indicate that during successful communication the speaker's and listener's brains exhibit joint, temporally coupled, response patterns. Such neural coupling substantially diminishes in the absence of communication, for instance, when listening to an unintelligible foreign language. In addition, more extensive speaker-listener neural couplings result in more successful communication. The speaker-listener neural coupling exposes a shared neural substrate that exhibits temporally aligned response patterns across communicators. The recording of the neural responses from both the speaker brain and the listener brain opens a new window into the neural basis of interpersonal communication, and may be used to assess verbal and non-verbal forms of interaction in both human and other model systems.

Neural processing of (dis)agreeable communication

M. Cikara, MIT; C. Honey, E. L. Paluck, & U. Hasson, Princeton University

Human beings are extremely adept at communicating with one another and yet communicative failures—particularly among

individuals harboring opposing viewpoints—are ubiquitous. Here we examine how political attitudes influence processing of statements with which people agree and disagree. Participants, who strongly support or strongly oppose gay marriage, listened to statements in support of and opposition to gay marriage in an fMRI scanner. Assessing inter-subject correlation indices of neural response reliability within and between groups, we identify networks that are shared across groups (i.e., irrespective of agreement with a statement) as well as networks that differentiate between groups (i.e., are more reliable for one group than the other or are reliable within but not between groups). We then examine how individual response profiles are related to comprehension of the statements (e.g., “irrespective of your position, how well do you understand this argument?”), attitude change (i.e., did participants’ viewpoints become more extreme or more moderate after listening to the statements?), perceptions of both speakers (e.g., attributions of intelligence, good intent), and the extent to which people would want to “block” each speaker’s message (e.g., willingness to discuss gay marriage in person, willingness to allow the speaker to present his opinion to students at a local high school). Finally, we use sliding window correlation analyses to identify the particular portions of each statement that drive the greatest divergence in neural responses between both groups.

SYMPOSIUM 2

Social environment and its effect on drugs of abuse

Friday, October 12, 8:30—10:00 am, Grand Salon D

Chairs: Klaus A. Miczek, Tufts University & Zuoxin Wang, Florida State University

The use of addictive drugs can have profound short- and long-term consequences on social behaviors. Conversely, social environment and social interactions may alter the vulnerability to substance abuse. Although reciprocal interactions between drugs of abuse and social behaviors have been well documented in human and animal studies, the neural mechanisms underlying these behavioral interactions remain largely unknown. Speakers in this symposium will present their research findings from rodent, non-human and human primate studies to provide a comprehensive overview of the interactions between social environment and drugs of abuse as well as their underlying neurochemical mechanisms. These data will not only highlight recent developments in the field of Social Neuroscience but also prompt us to consider the importance of social environments on brain and behavioral functions.

ABSTRACTS

Nucleus accumbens dopamine mediates interactions between social-bonding and drug-reward in monogamous prairie voles

Zuoxin Wang, Florida State University, Tallahassee, FL

Although it has been well documented that social bonds have protective effects against drug use and that addicted individuals show impaired social bonding, we know surprisingly little about the neural regulation of interactions between social attachment and drug experience. This is because, in part, such interactions are difficult to model in traditional laboratory rodents that do not exhibit social bonding between adult conspecifics. The prairie vole (*Microtus ochrogaster*) is a socially monogamous rodent species that forms pair bonds after mating. This pair bonding behavior is facilitated by activation of dopamine (DA) D2-type receptor (D2R), but inhibited by activation of DA D1-type receptor (D1R), in the nucleus accumbens (NAcc). Recently, we

demonstrated that amphetamine (AMPH) is rewarding to prairie voles, as it induces a conditioned place preference (CPP), and that this behavior is mediated by activation of D1R in the NAcc. Interestingly, sexually naïve male voles that experienced AMPH failed to show mating-induced pair bonding, whereas pair-bonded voles conditioned with the threshold dose of AMPH did not display CPP - demonstrating reciprocal interactions between social bonding and AMPH reward. Although AMPH treatment induced DA release in the NAcc similarly in both sexually naïve and pair-bonded males, it increased D1R binding in sexually naïve males but decreased D1R binding in pair-bonded males. Furthermore, pharmacological blockade of NAcc D1R rescued mating-induced pair bonding in AMPH-treated males. In contrast, activation of NAcc D1R prior to AMPH conditioning enabled AMPH-induced CPP in pair-bonded males. Together, our data indicate that AMPH experience results in the impairment of pair bonding, pair bonding experience decreases the rewarding properties of AMPH, and such interactions are mediated by NAcc DA in a receptor-specific manner. (Supported by NIMHR01-058616, NIDAR01-019627 & NIDAK02-023048).

CRF modulation of amines in social stress and aggression

Klaus A. Miczek, Tufts University, Medford and Boston, Massachusetts, USA

Extra-hypothalamic CRF modulates ascending monoaminergic pathways mainly via CRF1 receptors, particularly during episodes of stressful life events. Earlier data demonstrated that brief episodes of social defeat stress led to increased DA activity in NAC, increased BDNF in VTA, activating the MEK-ERK cascade, engendered behavioral sensitization and intensified cocaine binges, whereas continuous subordination stress had the opposite effects. Pre-treatment with either NMDAR antagonists or the CRF R1 antagonist CP 154526, systemically or intra-VTA, prior to each episode of social defeat stress protected against the ensuing behavioral sensitization and intense cocaine binge. Recent evidence focuses on social stress in females using newly developed experimental protocols in which a female rat confronts a lactating aggressive female either in brief episodes or continuously behind a protective screen. When exposed to four intermittent episodes of social defeat stress over the course of 10 days, females, like males, become sensitized to the psychomotor stimulant effects of cocaine and self-administer cocaine for a longer time and in larger amounts during a prolonged binge. They also respond to a cocaine challenge with a larger phasic DA peak than non-stressed controls. By contrast, females that are subjected to continuous subordination stress for three weeks, show a blunted DA response to a cocaine challenge, disrupted endocrine cycles and signs of anhedonia such as lower preference for cocaine. The energizing and activating effects of intermittent episodes of social defeat stress involve CRF modulation of DA activity in the VTA-NAC circuit, whereas continuous subordination stress shares features of depressive-like symptoms (Supported by DA and AA).

Alcohol in a primate model of anxiety and adoption

Dee Higley, Department of Psychology, Brigham Young University, Provo, Utah and Christine Barr, NIAAA, NIH, Bethesda, MD

Background – Nonhuman primate studies investigating the effect of early rearing show that even after identical rearing, some individuals are at greater risk for substance abuse than others. This is in part due to genetic differences, but our data show that when considering genetic risk, not only are early rearing experiences important, but one must also consider, the testing

setting, the type of stressor, and gender. While such GxE interactions have not replicated well in humans, they are often replicated in macaques.

Methods - Rhesus monkeys were reared in adult-absent, peer-only social groups or with their mothers in groups that approximate the natural condition. Alcohol was freely available to consume daily during adolescence or young adulthood, and studies were designed to assess how different stressors and settings affect genotype-mediated intake.

Results – Peer-reared subject who possessing the rh-5HTT short repeat variant, demonstrated extraordinary alcohol intake, but only when they drink alone. These same peer-reared monkeys are largely unaffected by genotype when they drink in social settings. Minor rearing variations modulate these genotype-mediated effects. It is also clear that the chronic nature of the stressor interacts with genotype, with prolonged repeated stress increasing alcohol intake, but more so in females than in males. Males, on the other hand drink more alcohol when alone than when social groups. These GxE effects on alcohol intake are not limited to the 5HTT genotype, but are also present in peer-reared subjects with other genotypic differences such as a CRF C-to-T SNP and a high activity MAOA repeat variant.

Conclusions - Our studies suggest that GxE effects on alcohol intake may be present in a number of genes. Our data show how different settings affect genotype-induced alcohol intake, which may also explain why GxE interactions are less likely to replicate in humans than in the macaque model.

Neuropsychiatry of impulsivity and aggression in drug-dependent humans

Scott Lane, UTHSC-Houston, TX

Individuals with substance use disorders frequently have problems with appropriate social interaction, including maladaptive impulsive and aggressive behaviors. Such problems become magnified in the presence of co-morbid personality disorders such as antisocial personality disorder (ASPD) and borderline personality disorder. This presentation will focus on investigation of neural mechanisms of aggression and impulsivity in individuals with SUD and ASPD, as well as pharmacological manipulation of these behavior patterns. Topics will cover alcohol and cocaine dependence, effects of acute and chronic exposure to these substances, and effects of pharmacotherapeutic compounds.

SYMPOSIUM 3

Situated Cognition and Social Neuroscience: From Animal Models to Neuropsychiatry

Friday, 10:30 am—12:00 pm, Grand Salon C

Chair: Agustín Ibanez, Laboratory of Experimental Psychology & Neuroscience (LPEN), Institute of Cognitive Neurology (INECO) & CONICET. Buenos Aires, Argentina

Theoretical approaches of situated cognition propose that knowing is inseparable from acting. Cognition is situated in activity bound to social, cultural and physical contexts. In brief, cognition (from perception to social behavior) would be essentially context-dependant, instead of being an abstract, universal and decontextualized phenomenon. Situated social cognition approaches have important implications in translational neuroscience in both animal models and human research. This symposium highlights the impact of those approaches in empirical specific research programs.

Regarding animal models, the symposium will highlight how embodied and distributed cognition influence animal social behavior (Barrett); and more specifically how climatic and biotic effects shape individual differences on *Degus* social rodents (Vasquez). Regarding human studies, we will propose social cognition as an intrinsic contextual process related to fronto-insular-temporal network (Ibanez); and an ecological approach in social cognition and executive functions more related to everyday cognition, as a more sensitive evaluation of frontal disorders (Manes). These four talks will provide complementary perspectives on situated cognition approaches relevant to social neuroscience and also translational neuroscience.

Understanding cognition within its social and physical environment is critical for different research programs, and will appeal to a wide audience including neurologists, general biologists, cognitive neuroscientists, and also psychologists and neuropsychiatrists who are working in social neuroscience.

ABSTRACTS

The social nature of primate cognition

Louise Barrett, Professor and Canada Research Chair in Cognition, Evolution and Behaviour. Department of Psychology. University of Lethbridge. Email: louise.barrett@uleth.ca.

The hypothesis that the enlarged brain size of the primates was selected for by social, rather than purely physical, factors has been strongly influential in studies of primate cognition and behaviour over the past two decades. However, the Machiavellian intelligence hypothesis, also known as the social brain hypothesis, tends to emphasize certain traits and behaviours, like exploitation and deception, at the expense of others, such as tolerance and behavioural coordination, and therefore presents only one view of how social life may shape cognition. This review outlines work from other relevant disciplines, including evolutionary economics, cognitive science and neurophysiology, to illustrate how these can be used to build a more general theoretical framework, incorporating notions of embodied and distributed cognition, in which to situate questions concerning the evolution of primate social cognition. We argue for greater attention to embodied and distributed theories of cognition, which get us away from current fixations on representational component of social behavior, and allow for the generation of testable hypotheses that combine neurobiology, psychology and behaviour in a mutually reinforcing manner. Moreover, new empirical proposals for the so called “social brain hypothesis” are proposed.

Behavioral substrates for social neuroscience research in the rodent *Octodon degus*: Inter and intra-population behavioral variability.

Rodrigo A. Vásquez, Instituto de Ecología y Biodiversidad, Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Santiago, Chile. Email: rvasquez@uchile.cl

Intra-specific phenotypic variability is the raw material on which natural selection acts to shape evolutionary change. However, few studies have assessed behavioral variability within species. Intra-specific behavioral variability can have important consequences for social living, particularly since different behavioral phenotypes can be adaptive under different ecological and social scenarios. We have been studying behavioral variability within and between populations in the caviomorph rodent *Octodon degus*. This species is a diurnal and highly social Chilean rodent that exhibits complex vocalization, bi-parental care, communal living and social foraging, making it an exciting

model for the integrative study of social neuroscience. Experimental evidence shows that degus use learning to gather information about food sources as well as in social interactions, particularly in kin recognition interactions. Kin recognition mechanisms seem to have a role in infant and adult attachment bonds, making the species an interesting model for social-affective neuroscience research. Social recognition is also influenced by exploratory behavior, which is related to measures of emotionality. Within population variability in exploratory behavior was assessed in detail, where we found that (i) the population is characterized by having two different phenotypes, exploratory and non-exploratory animals, and (ii) exploratory behavior is negatively correlated with trapping capture success. These results have important behavioral, ecological, and neurobiological implications, and stress the importance of taking into account intra-specific variability. (FONDECYT 1090794, ICM-P05-002, PFB-23-CONICYT)

Contextual social cognition and fronto-insular-temporal networks

Agustín Ibañez. Laboratory of Experimental Psychology & Neuroscience (LPEN), Institute of Cognitive Neurology (INECO) & CONICET. Buenos Aires, Argentina. Diego Portales University, Santiago, Chile. Email: aibanez@ineco.org.ar

The significance of social situations is commonly context-embedded. Although the role of context has been extensively studied in basic sensory processing or simple stimulus-response settings, its relevance for social cognition is unknown. We propose the social context network model (SCNM), a fronto-insular-temporal network responsible for processing social contextual effects. The SCNM may (a) update the context and use it to make predictions, (b) coordinate internal and external milieus, and (c) consolidate context-target associative learning. We suggest that several frontal disorders can be described as context impairments due to deficits in the SCNM. In considering context as an intrinsic part of social cognition, we highlight the need for a situated cognition approach in social cognition research as opposed to an abstract, universal and decontextualized approach. The assessment of context-dependent social cognition paradigms, the SCNM and their possible application to neuropsychiatric disorders (frontotemporal dementia, frontal lesions, Asperger syndrome and schizophrenia) may provide new insights into social neuroscience.

Ecological measures of social behavior and neuropsychiatric research

Facundo Manes. Institute of Cognitive Neurology (INECO). Buenos Aires, Argentina. Email: fmanes@ineco.org.ar

Several frontal disorders present with behavioral problems despite normal performance on neuropsychological tests (sometimes referred to as the "frontal lobe mystery"). The mismatch between everyday impaired cognition and proper neuropsychological performance in frontal disorders can be partially explained by the abstract processing of standard assessment tasks, which makes patients perform better than in real life situations. Traditional cognitive tests may not be sensitive for the early detection of executive and social cognitive impairments in several frontal disorders. Our laboratory has developed a more ecological and specific executive and social cognitive battery (ESCB) sensitive to frontal lobe dysfunction. Our results suggest that ecological executive and social measures are more sensitive in detecting executive and social cognitive impairment deficits in several disorders (including early behavioral variant of frontotemporal dementia, vascular lesions, Parkinson's

disease, developmental disorders and bipolar disorder) than classical cognitive measures of executive functioning. The ESCB includes tasks that mimic everyday scenarios (e.g., affective decision-making, planning and organization, theory of mind). We discuss the relevance of said ecological approaches in neuropsychiatry in the light of recent models in situated cognition.

SYMPOSIUM 4

Social touch and grooming: How tactile interactions shape brain morphology and function

Friday, 10:30 am—12:00 pm, Grand Salon D

Chairs: Siri Leknes¹ & Annett Schirmer²

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²*National University of Singapore, Singapore (schirmer@nus.edu.sg)*

Humans touch each other during greetings, partings, in moments of celebration and distress. Moreover, in most cultures, touch occurs in casual interactions with close friends and family and often outside conscious awareness. Despite and perhaps because of this lack of awareness, touch has powerful effects on recipients. The goal of this symposium is to outline these effects and to uncover some of the underlying mechanisms.

To this end, we will present evidence from a range of species including zebrafish, rodents and humans and introduce an evolutionarily preserved 'social touch' pathway that may operate outside conscious awareness. Moreover, we will discuss epigenetic effects of social touch on brain development and the programming of social behavior. We will outline affective responses to social touch in healthy individuals and individuals with autism and share insights on how social touch interleaves with ongoing mental processing to bias attention towards social information and to increase the likelihood of prosocial behaviors.

The research outlined in this symposium presents recent advances in social neuroscience. Although, social touch has long been of interest to scholars of nonverbal behavior, it was regarded as a mere signal of affiliation or discord. We extend traditional work by identifying touch as a key factor for the development and adult functioning of the social brain. As such, this symposium is timely and should be of general interest to the social neuroscience community.

The speakers (i.e., Cameron, Olausson, Schirmer, Kaiser) who have agreed to participate in this symposium are established researchers in the area of social neuroscience. Their work has been published in outlets such as *Nature Neuroscience*, *Brain*, *Neuroscience and Biobehavioural Reviews*, *Proceedings of the National Academy of Sciences*, and *Social Neuroscience* among others. Their presentations will draw from both published and unpublished work.

ABSTRACTS

Maternal licking and grooming influence the neuroendocrine control of affiliative and sexual behaviors in female rat offspring.

Nicole Cameron, Center for Development and Behavioral Neuroscience, Binghamton University (ncameron@binghamton.edu)

Maternal behaviors such as licking and grooming have an important influence on the development of young. Using the rat, we examined this influence on affiliative and sexual behaviors. We found that rat female offspring of mothers that show low levels of licking and grooming (Low LG) reach puberty earlier and

are more motivated to mate than female offspring of mothers that show high levels of licking and grooming (High LG). The expression of estrogen-receptor alpha and its phosphorylation in brain areas controlling the hypothalamic-pituitary-gonadal axis and mating behavior are also affected. Compared with Low LG offspring, High LG offspring shows decreased estrogen receptor alpha expression in the anteroventral periventricular nucleus and in the ventral medial hypothalamus, that appear to be linked to differences in affiliative behaviors. Interestingly, oxytocin is involved in both mating and affiliation, and we have found that variation in plasma oxytocin levels during mating and affiliative behaviors is associated with individual differences in maternal care received during development. These results suggest that natural variations in maternal care in the rat influence the display of female daughters' social behaviors through neuroendocrine mechanisms.

Hairy or not: Bottom-up mechanisms mediate positive touch effects in humans and zebrafish

Annett Schirmer & Ajay S. Mathuru, *National University of Singapore, (schirmer@nus.edu.sg)*

Pleasant tactile experiences have been linked to a number of positive effects. For example, it has been suggested that they calm a touched individual and promote positive attitudes towards a toucher. We conducted a series of studies to determine whether these effects are stimulus-driven or whether they depend on touch attribution. To this end, we explored tactile effects in both humans and zebrafish. In humans, we found that touch produced by a tactile device elicited similar effects on heart rate and Event-Related Potentials (ERPs) as touch produced by a friend. Moreover, ERPs indicated that touch, regardless of attribution, increased sensitivity to emotional and socially relevant stimuli. In zebrafish, we observed that, like in humans, tactile stimulation has a calming effect. It reduced cortisol levels and fear behavior after exposure to a threat. Together, these data suggest that at least some of the positive effects of touch result from bottom-up mechanisms and have an evolutionary distant origin.

C-Tactile Afferents Mediate Social Touch

Håkan Olausson, *Department of Clinical Neurophysiology, Sahlgrenska University Hospital, Gothenburg, Sweden*
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Sensory information provides input for affective processing and is hence critical for emotional regulation and social behavior. Accumulating evidence indicates that affectively relevant information about touch is preferentially signaled in a recently-discovered type of nerve fiber in the skin, the mechanoreceptive tactile C (CT) afferent. CT afferents have thin-diameter axons lacking an insulating sheath of fatty myelin. Their conduction velocity is therefore slow and they show a preference for stimulation that moves gently across the skin surface, like a caress. CT afferents were first discovered in the cat and are located in hairy, but not glabrous skin of humans and other mammals. Evidence from patients with specific loss of tactile afferents other than CT indicates that CT afferents project to the insular cortex and are associated with pleasant perceptual qualities. Based on the response properties and cortical projections we have suggested that CT fibers are part of a system for processing pleasant and socially-relevant aspects of touch. Further, recent studies suggest that CT afferents, following certain types of nerve injury, may start signaling unpleasant or even painful sensations. These findings suggest a remarkable plasticity of the nervous system where CT afferents change their functional role from signaling pleasantness to signaling pain.

The social touch experience in humans: The role of oxytocin and opioids

Siri Leknes, *Department of Psychology, University of Oslo, Norway. Siri.Leknes@psykologi.uio.no*

Social touch and grooming are thought to facilitate bonding in both human and non-human animals. Touch-induced release of oxytocin and/or endogenous opioids are possible underlying mechanisms linking touch and affiliation. Yet the functional role of these neuropeptide systems for social touch in humans is still unclear. In a series of studies, we have investigated the role of the oxytocin and opioid systems for the experience of gentle touch in healthy humans. Intranasal oxytocin altered responses to others' faces, but had no effect on the pleasantness or intensity of stroking touch compared to placebo. However, when participants in a subsequent study were presented with research findings suggesting that oxytocin enhances touch pleasantness, these expectation or 'placebo' effects significantly increased pleasantness of both stroking and warm touch. Defining oxytocin's role for human social touch is precluded by the lack of acceptable oxytocin antagonist drugs. In contrast, it is possible to investigate the effects of both agonism and antagonism of the opioid system in humans, and our results support a role of the endogenous opioid system for both the pleasantness of and motivation for gentle touch. Unlike the behavioural effects of oxytocin which may be specific for the social domain, our results support a role for the human opioid system for both social and non-social rewards.

SYMPOSIUM 5

The Social Neuroscience of Maternal Attachment and Attachment Style

Friday, 2:30—4:00 pm, Grand Salon C

Chairs: Pascal Vrticka and Patrick Luyten

Maternal attachment constitutes the most fundamental and essential social/emotional process in animals, including humans. As a consequence, substantial research effort has been devoted over the last decade to better understanding underlying functional neurobiological mechanisms, as well as psychological correlates in terms of attachment style.

In so doing, attachment research has traditionally been carried out using two divergent experimental approaches. On the one hand, animal research, which has defined biological components of maternal attachment behavior, has also inspired neuroimaging studies in humans, which has in turn revealed the neurocircuitry of maternal attachment processes in our species. On the other hand, work based on developmental psychological attachment theory has allowed for the description of the psychological consequences of successful or futile attachment behaviors – reflected in secure versus insecure (anxious and avoidant) attachment styles – and such knowledge has subsequently been incorporated into psychiatric models of social disturbance.

Recently, these two separate research paths have begun to merge, which is reflected in a growing number of interdisciplinary investigations and publications dedicated to the functional neurobiology of maternal attachment and attachment style. Such exciting developments may not only allow for a more comprehensive understanding of both normal and disturbed maternal attachment processes, but also pave the ways for future intervention strategies for conditions involving attachment system

dysregulation and insecurity. This symposium aims to provide a unique interdisciplinary insight into state-of-the-art attachment research. Leading experts in the field will present their latest findings on: the biochemistry of maternal attachment in animal models (Talk 1), the neuro-biology, -psychology and -psychiatry as well as intergenerational transmission of normal and disturbed mother-infant attachment processes in humans (Talks 2 and 3), and finally the influence of attachment insecurity on several fundamental social affective cognitive mechanisms in our species (Talk 4).

ABSTRACTS

Brain oxytocin and vasopressin are mediators of maternal attachment – evidence from animal models

Oliver J. Bosch & Inga D. Neumann, Department of Behavioural and Molecular Neurobiology, University of Regensburg, Regensburg, Germany

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The attachment between mother and infant represents one of the most significant and robust social relationships. Its establishment requires remarkable brain adaptations of the mother peripartum including enhanced brain activity of the pro-social neuropeptides oxytocin and vasopressin. Both play an important role in the fine-tuned establishment and regulation of maternal care and maternal aggression against a conspecific intruder as we have learned from studies in rodents. Pharmacogenetic manipulations of either system can result in altered maternal behavior. In addition, high activity of the brain vasopressin system in a genetic model for hyper-anxiety revealed a correlation between brain vasopressin and the intensity of maternal behavior, providing further evidence for its involvement in mother-infant attachment. Hence, to increase our understanding of how maternal behavior and, consequently, the relationship between mother and infant is regulated, provides important insights into possible dysregulation of maternal attachment as seen, for example, in postpartum mood disorders.

The impact of addiction on the neurobiology of maternal attachment

Helena JV Rutherford, Yale Child Study Center, Yale University
Marc N Potenza, Yale Child Study Center and Department of Psychiatry, Yale University
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Maternal substance use has significant implications for both mother and child health outcomes. From a neurobiological perspective, addiction represents the dysregulation between the neural systems of stress and reward. Notably, these same neural systems appear to underscore the neural correlates of maternal attachment, suggesting a neurobiological mechanism through which substance use may impact parenting. In this presentation, data from converging neuroimaging techniques will be discussed to support this proposition, and implications for intervention and treatment will be described.

The Intergenerational Transmission of Mother-Infant Attachment: Brains, Hormones and Behavior

Lane Strathearn, Sohye Kim, Udit Iyengar, Sheila Martinez
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From non-human animal models, we learn that the maternal caregiving environment programs neuroendocrine development in

the offspring and predicts adult patterns of caregiving behavior. Likewise, human patterns of attachment appear, to a large extent, to be transmitted across generations. Over the past several years, the Attachment and Neurodevelopment Lab has explored mechanisms by which this transmission may occur in human mothers, examining maternal brain, endocrine and behavioral responses to infant cues. We describe how a mother's own childhood attachment experience, measured using the Adult Attachment Interview, predicts dopamine-related reward activation in the brain in response to infant cues, as well as a mother's peripheral oxytocin response. This oxytocin response is also associated with measures of adult temperament; with higher responses associated with more social attunement and mood sensitivity; and less compulsive and task-oriented behavior. Mothers' attachment strategies are also linked to infant directed behavior and the development of infant attachment. Thus, the intergenerational transmission of attachment in humans appears to be mediated via maternal brain, endocrine and behavioral responses.

The neural substrates of attachment insecurity

Pascal Vrticka, Swiss Center for Affective Sciences, University of Geneva; Center for Interdisciplinary Brain Sciences Research, Stanford University

Martin Debbané, Adolescence Clinical Psychology Research Unit, Faculty of Psychology and Educational Sciences, University of Geneva

David Sander, Laboratory for the Study of Emotion Elicitation and Expression (E3Lab), University of Geneva

Patrik Vuilleumier, Laboratory of Behavioral Neurology and Imaging of Cognition, Department of Neuroscience, Medical School, University of Geneva

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According to attachment theory, successful or futile early mother-child attachment behaviors translate into different secure or insecure (avoidant and/or anxious) attachment styles during adulthood, which in turn crucially modulate the formation and maintenance of social bonds throughout the life span. This has recently been confirmed by neuroimaging investigations revealing the respective neural substrates in humans. In the present talk, new evidence from behavioral as well as functional magnetic resonance imaging (fMRI) experiments will be shown, demonstrating that insecure attachment orientations also influence attachment-unrelated processes, including emotion perception, appraisal and regulation, as well as social cognition and outcome anticipation. Such results suggest that a person's relationship history – engraved by means of individual differences in attachment style – has a profound impact on social cognitive affective mechanisms in general and thereby determines a variety of aspects of human social functioning, not only directly attachment-related behaviors.

SYMPOSIUM 6

Phenotypic transmission through social networks

Friday, 2:30—4:00 pm, Grand Salon D

Chairs: Lauren O'Connell¹, Hans Hofmann²

¹Harvard University, ²University of Texas at Austin, Section of Integrative Biology

In social groups, an individual's behavior and physiology are profoundly affected by actions of other individuals. Human mental states and behavioral attitudes can spread in social networks. It is

therefore a fundamental challenge of social neuroscience to a) understand how social information is encoded and processed in the brain; b) decipher the molecular and genetic aspects of social networks; and c) reveal the evolutionary patterns and processes that have resulted in these mechanisms. The goal of the symposium is to introduce interested researchers to several cutting-edge research programs in this area that have greatly increased our understanding on how social networks affect brain function in both human and non-human animals.

ABSTRACTS

Why We Care: The Biology of Social Preferences

Michael L. Platt, Duke University

Observing what happens to others powerfully shapes normal human learning and behavior. Such other-regarding outcomes can drive observational learning, and motivate behaviors such as cooperation as well as spite. Empathic responses associated with rewards delivered to others appear early in ontogeny, and their impairment in neuropsychiatric disorders like autism or psychopathy can have devastating consequences. Understanding and treating social dysfunction will be advanced by discovering and manipulating the neural mechanisms that derive reward and punishment from observation of what happens to others. In my talk, I will discuss our new discovery that rhesus macaques spontaneously derive vicarious reinforcement from rewards delivered to other monkeys and will work to deliver these rewards. We also find that neurons in anterior cingulate cortex (ACC) selectively signal rewards delivered to the other monkey, whereas neurons in orbitofrontal cortex (OFC) signal rewards delivered to self—consistent with prior findings showing OFC neurons encode personal rewards in a common currency and ACC neurons signal rewards that were merely observed or imagined and contribute to empathy. These findings demonstrate distinct channels for self and other reward processing in the primate brain. We speculate that individual variation in social function may derive from differential activation of these two channels. We further show that oxytocin—a mammalian neuropeptide associated with social bonding—amplifies vicarious reinforcement in rhesus macaques, suggesting a potential mechanism accounting for differential social behavior. We further show that individual differences in affiliative social network position—akin to friends of friends in humans—are heritable in free-ranging rhesus macaques and are explainable, in part, by differences in genes regulating serotonergic neural function. Together, these findings endorse the idea that complex aspects of social behavior derive from fundamental cognitive and temperamental scaffolds built into nervous systems by evolution.

Large-scale human neural systems subserving individual differences in social network size

Brad Dickerson, Harvard Medical School

Several theoretical models have been proposed to describe the roles of a number of brain regions mediating social cognitive abilities such as the processing of facial expressions, eye gaze, empathy, and theory of mind. However, there is little work investigating the contributions of individual brain regions and large-scale networks to individual differences in social network size. Here I will review our and others' work demonstrating the central contribution of the size and connectivity of several key brain regions and circuits to individual differences in the size and complexity of social networks in healthy adult humans.

Distributed sensing and decision-making in animal and human collectives

Iain D. Couzin¹, Department of Ecology & Evolutionary Biology, ¹Princeton University, USA

The capacity for groups to exhibit collective intelligence is an often cited advantage of group living. Previous studies have shown that social organisms often benefit from pooling imperfect individual estimates. However, collective properties can also emerge from the structure and dynamics of social interactions among individuals, rather than from enhancement of personal estimates. Using an integrated theoretical and experimental approach (employing computer vision to explicitly reconstruct sensory networks among organisms), we reveal that emergent problem solving is the predominant mechanism by which mobile animal groups sense, and respond to, complex environmental gradients. This distributed sensing requires rudimentary cognition and is shown to be highly robust to noise. Furthermore we demonstrate the crucial role that uninformed individuals play during consensus decision-making in collectives, notably in promoting democratic consensus (despite the inability for individuals in many animal groups, such as schooling fish, to explicitly 'vote') and also enhancing the speed and accuracy of decision-making. Finally, we demonstrate, using manipulative 'field' experiments, how some principles of information transfer among animals relate to those among human pedestrians. Our results emphasize how distributed cognition can emerge from the dynamics of social interactions among organisms, including humans, and suggest general principles by which networks of social interactions may be organized in biological collectives.

Evolutionary insights from behavioral genomics of natural populations of social bees and wasps

Amy L. Toth, Iowa State University

Historically, behavioral genomics has been focused on model organisms in a lab setting. Thus, it has been difficult to relate discoveries about gene-behavior relationships to evolution and the ecological context of the behavior of interest. Breakthroughs in sequencing technology have begun to break down many of the barriers to conducting in-depth genomic studies on natural populations of species of ecological or evolutionary importance. We use next-generation sequencing as a springboard to develop genomic resources and tools for paper wasps in the genus *Polistes*, an important genus for the study of the evolution of social behavior. Here, we will describe a series of experiments with paper wasps that aim to identify sets of genes associated with social behavior using a variety of approaches, including candidate gene studies, transcriptomics, microarrays, RNA-sequencing, and RNA-interference.

Our studies have identified sets of genes associated with queen and worker caste differences, maternal behavior, and social dominance in wasps. These findings have led to three insights: 1) Nutritional physiology and nutrient signaling genes are likely to be important in regulating division of labor for foraging in multiple independent origins of insect sociality. 2) Genes associated with solitary maternal behavior are also associated with "altruistic" worker behavior, supporting an evolutionary link between maternal behavior and eusociality. 3) Meta-analyses of transcriptomic data have identified functional categories of genes associated with sociality across multiple lineages of social animals, suggesting some of the same molecular mechanisms may be recruited repeatedly during evolution to regulate convergent behavioral phenotypes.

S4SN 2012 Meeting | Contributed Talks

Thursday, October 11, 2012, 2:30 - 4:30 pm, Grand Salon D

Ten talks of 12 minutes each.

Talk 1, 2:30 - 2:42 pm

Social buffering requires oxytocin action in the hypothalamic paraventricular nucleus in female prairie voles (*Microtus ochrogaster*)

Adam S. Smith¹, Zuoxin Wang¹; ¹Department of Psychology & Program in Neuroscience, Florida State University, Tallahassee, FL, USA

Presenter: Adam S. Smith

Social living is beneficial for many species, resulting in increased individual survival and fitness. One factor that seems to lead to such benefits is the anxiolytic effects of social contact with a bonded partner, referred to as social buffering. While stressful life events can enhance the risk of mental disorders, positive social interactions, particularly with a significant other, can propagate good mental health and normal behavioral routines. Still, the functional neural system that promotes these benefits via regulation of the HPA axis recovery is undetermined. Prairie voles (*Microtus ochrogaster*) engage in and depend on a social environment, including male-female pair-bonds, biparental care, and living in extended families. Like other monogamous mammals, male-female interactions can reduce basal HPA axis activity while promoting stress-reducing neuropeptidergic pathways in prairie voles. In a series of experiments, we evaluated the effects of social contact on the behavioral, physiological, and neuroendocrine response in pair-bonded female prairie voles to 1 hr immobilization stress. In Experiment 1, immobilized females recovered alone or with their male partner for 30-min before evaluation of the behavioral and physiological stress response via an elevated plus maze (EPM) test and measuring plasma corticosterone (CORT) concentrations, respectively. Social recovery attenuated the biobehavior stress response. In Experiment 2, the content of corticotrophin-releasing hormones (CRH), oxytocin, and vasopressin and their receptors was assessed in brain tissue punches from immobilized females recovering with their male partner or alone and compared to unstressed females. Oxytocin content in the paraventricular nucleus (PVN) was significantly altered in females after 30-min of social interaction with their male partner but not in any other brain area. No other neuronal markers varied as a function of social buffering. In Experiment 3, the release of oxytocin in the PVN associated with social buffering was confirmed via brain microdialysis. Immobilization lead to increased oxytocin release in the PVN, but more importantly, when females were removed from the stressor and allowed to recover, only females recovering with their male partner had additional PVN oxytocin release. In Experiment 4, the regulatory role of oxytocin in the PVN on social buffering was assessed via site-specific administration of oxytocin or a selective oxytocin receptor antagonist (OTA) at varying doses following immobilization. Intra-PVN oxytocin injections were sufficient in reducing CORT levels and EPM anxiety-like behavior in immobilized females recovering alone compared to vehicle-treated controls. Furthermore, blockage of oxytocin action by intra-PVN OTA injections inhibited social buffering. Together, our data demonstrate that one neurobiological mechanism of

social buffering includes the action of oxytocin in the PVN. (Supported by NSF Graduate Research Fellowship and NIMHF31-095464 to AS and NIMHR01-058616 to ZW).

Keywords: Oxytocin; Stress; Social buffering; Pair bonding

Talk 2, 2:42 - 2:54 pm

Oxytocin modulates ventral tegmental area activation during anticipation of social reward and punishment

Katja N Spreckelmeyer^{1,2}, Anna Gossen¹, Lena Rademacher¹, Alexa Hahn¹, Luzie Westphal¹, Gerhard Gründer¹, Sarah E Groppe¹; ¹RWTH Aachen University, Germany, ²Stanford University

Presenter: Katja N Spreckelmeyer

Animal data suggests that the neurohormone oxytocin promotes social approach and avoidance behavior by boosting dopaminergic projections from the midbrain ventral tegmental area (VTA) to the nucleus accumbens (NAcc), hereby influencing the neural mechanisms by which an organism learns to recognize an environmental cue as predictor of a good or bad social outcome. The aim of the present study was to test the hypothesis that in humans, too, oxytocin modulates activation in the VTA (and NAcc) during processing of cues signaling socially relevant stimuli. Twenty-eight healthy heterosexual women (mean age = 26.6 years, non-smokers, nulliparous, and not taking any hormones or other medication) participated in a double-blind placebo-controlled functional magnet-resonance imaging (fMRI) study. Participants were randomly assigned to the oxytocin group or the placebo group. Twenty minutes before scanning participants self-applied 5 puffs of Syntocinon®-nasal spray or the placebo solution. We used functional imaging and a social incentive delay task to assess VTA and NAcc activation during processing of cues announcing potential social feedback (reward or punishment) in the form of faces with different emotional expressions, or neutral control cues. Blood samples were taken immediately before nasal spray application and at 2 consecutive time points afterwards (before and after fMRI scanning) to assess serum levels of oxytocin, testosterone, estradiol, progesterone, and prolactin. Groups did not differ significantly with regard to age or hormone levels prior to scanning. Prolactin levels were found to decrease over time. This effect was significantly more pronounced in the oxytocin group than the placebo group. fMRI analysis revealed a significant interaction effects of the factors 'group' x 'cue type' in the VTA ($p < 0.05$, family error wise-corrected for small volume), and the NAcc ($p < 0.001$, uncorrected) reflecting significantly greater activation in the oxytocin group than the placebo group, specifically in response to cues signalling the highest level of social reward or punishment relative to control cues. Our findings are in line with recent findings in social animals, and provide evidence for the hypothesis that oxytocin enhances the salience of a social cue, thereby facilitating detection and reaction to the cue if it happens to occur again. As prolactin is under inhibitory control of dopamine, and prolactin decrease has been shown to reflect

dopamine increase, the additional finding of greater prolactin decrease in the oxytocin group supports the assumption that oxytocin enhances the dopamine signal during social reward processing.

Keywords: social reward, hormones, neuroimaging

Talk 3, 2:54 - 3:06 pm

Single unit activity in the primate amygdala during the production of facial expressions

Prisca E. Zimmerman¹, Andrew J. Fuglevand¹, Clayton P. Mosher¹, Katalin M. Gothard¹; ¹The University of Arizona

Presenter: Prisca E. Zimmerman

The detection and evaluation of sensory stimuli with socio-emotional relevance is a key function of the primate amygdala. The anatomical connectivity of the amygdala and some deficits caused by amygdala lesions, however, suggest that the amygdala might also be involved in generating outputs that control social behaviors. To test the hypothesis that the amygdala contributes to the production of facial expressions, we examined the temporal relation between single cell activity in the monkey amygdala and the onset of facial expressions. Facial expressions were elicited by video segments that depicted social behaviors of other monkeys. Neural activity was recorded from the right amygdala using a 7-channel Thomas system. Onset times of facial expressions were identified based on video recordings of the subject's face and electromyographic recordings of facial muscles. Of the 129 neurons recorded thus far, 33 (26%) showed a marked change in firing rate (21 facilitated, 12 inhibited) associated with the production of facial expressions. In most cases, such changes in firing rate occurred after the onset of facial expressions. These results suggest that neurons in the amygdala are probably not directly involved in issuing motor commands to facial muscles. Instead, these neurons most likely respond to the sensory feedback generated during facial expressions..

Keywords: amygdala, facial expressions, monkey, EMG, facial muscle

Talk 4, 3:06 - 3:18 pm

The representation of group membership concepts

Pascal Molenberghs¹, Samantha Morrison¹, Jean Decety^{2,1}; ¹The University of Queensland, ²The University of Chicago

Presenter: Pascal Molenberghs

The present study aimed to uncover the neural activity associated with specific in-group and out-group word related stimuli, to examine the neuroanatomical basis of group membership concept representation, and investigate to what extent neural processes represent "in-group" differently from "out-group". Participants' brain activity was measured with functional MRI while they had to categorize social, in-group and out-group words and non-social, living and non-living words. The results showed that a network of brain regions previously identified as the "social brain", including the cortical midline structures, temporo-parietal junction and the anterior temporal gyrus showed enhanced activation for social words versus non-social words. Crucially, the processing of in-group words compared to the out-group words activated a specific network including the ventral medial prefrontal and anterior and dorsal cingulate cortex. These regions correspond to a neural network previously identified as the "personal self". Our results suggest that the "social" and "personal

self" are closely related and that we derive our self image from the groups we belong to.

Keywords: fMRI; group membership; social identity; social neuroscience

Talk 5, 3:18 - 3:30 pm

Social decision making influenced by personal implication in rhesus monkeys

Sebastien Ballesta¹, Matthieu Pozzobon¹, Jean-Rene Duhamel¹; ¹Centre de Neurosciences Cognitives, CNRS - Université de Lyon

Presenter: Sebastien Ballesta

Beyond brain areas that are responsible for perceiving others' identity and retrieving the associated social information, other neural networks are devoted to the evaluation of behavioral outcomes during social interactions and decision making. Recently, we have shown that neurons in the macaque orbitofrontal Cortex (OFC) encoding the value of future rewards are modulated by the social context, such as the likelihood that another individual will also be obtaining a reward (Azzi et al. PNAS, 109 :2126-31, 2012). However, the cognitive mechanisms involved in the perception of others' outcome remain poorly understood. For instance, it is unclear if in non-human primates, rewards obtained by others are vicariously rewarding for the observer, whether monkeys exhibit inequity aversion, or what governs social preferences and altruism. Because the use of animal models precludes direct assessment of personal perceptions, defining objectively the significance of "other" is required for behavioral interpretations. To this end, we developed a novel behavioral paradigm to study the cognitive encoding of the perception of "outcome for other" and "outcome for self" in monkeys. Two rhesus monkeys alternated in making choices that conditioned the distribution of rewards among them. The monkeys sat face to face and indicated their choices by manually touching one of two visual targets that were virtually projected on a transparent touch-sensitive panel interposed between the two animals. Each target had a distinctive shape and was associated with rewards for the active monkey, the passive monkey or nobody (a plastic container), and four types of alternatives were presented in interleaved trials: (A): Reward for Self vs. Reward for Nobody, (B): Reward for Self vs. Reward for Other, (C): Rewards for Self and Other vs. Rewards for Self and Nobody, (D): Reward for Other vs. Reward for Nobody. The results showed, unsurprisingly, that in the (A) and (B) conditions, monkeys systematically preferred Reward for Self. In the (D) condition, where the monkeys had no direct self-incentive, they more often rejected both alternatives and showed longer reaction time than in the three other conditions, reflecting a lower of motivation when not rewarded. Also, monkeys were overall slower to respond in the (C) condition compared to (A) and (B) conditions. This result could be explained by the implication of other, in addition to self in one of the alternatives. Of particular interest were the choices made by the monkeys in conditions (C) and (D). The preference for giving to other or to nobody were not equal in the (C) and (D) conditions. We found a consistent variability of the monkeys' preferences across sessions and these variations showed strongly positive correlations between the two conditions. These results indicate that, in monkeys, the "outcome for self" influences the perception of the "outcome for other". Furthermore, the natural variability of the preferences for others was correlated with the weight of the animal (and likely with its blood osmolarity), suggesting that intrinsic physiological states of the animals also influence altruism.

Keywords: decision-making non-human primate

Talk 6, 3:30 - 3:42 pm

A dyadic fMRI study on the default-mode network's response to social interaction

Ray Lee¹; ¹Princeton University

Presenter: Ray Lee

INTRODUCTION: Dyadic fMRI (dfMRI) (1) can directly quantify the social interaction at the brain network level. In the presence of the same sampling environment, the dependency among the activated regions in dyadic brains can be mathematically defined by ICA which provides a platform to simultaneously observe multiple brain networks' responses during social interaction. In this study, the dyadic default-mode network (DMN)'s response to eye contact is quantitatively characterized. **METHODS:** The dfMRI hardware, protocols, and the eye-contact experiment design, are detailed in the Ref. (1). The dyadic data is first preprocessed with in-house Matlab codes. Then using ICA (FSL's MELODIC) generates a set of independent components (IC). The ICs containing DMN are selected as masks to extract the time series from four DMN nodes: PCC, MPFC, left and right IPL. The correlations between the four nodes are calculated; and their correlation differences are tested by Steiger's Z1 and Z2 (3). **RESULTS:** 20 pairs of subjects were studied. Three of the major findings regarding DMN are: (i) Any two subjects' DMNs are always independent (in different ICs). The DMN of one can be coupled with other's non-DMN networks, but no DMN-DMN coupling was observed. (ii) Eye contact causes left-right asymmetry in a subset of DMN (dorsal PCC, ventral MPFC, left and right IPL). Using Steiger's Z1 to test the differences in correlation $r(\text{dPCC}, \text{lIPL})$ vs. $r(\text{dPCC}, \text{rIPL})$, the average asymmetry scale (Z1) without and with eye contact are 0.074 and 0.7999; in the case of the correlation $r(\text{vMPFC}, \text{lIPL})$ vs. $r(\text{vMPFC}, \text{rIPL})$, Z1 changes from 0.1797 to 0.6295. All correlation used in Z1 calculation has $p < 0.05$. (iii) If Steiger's Z2 is used to describe the DMN modulations due to eye contact, and the coupling between the DMN of one brain and the other brain is defined as the sum of square of all crossing brain correlations, then the coupling is a function of both Z1 and Z2. **CONCLUSION:** Certain aspects of social interaction can be directly quantified by measuring asymmetry, modulation and coupling of the DMN. **Ref.:** (1) Lee, et al, *Magnetic Resonance in Medicine* 2011, DOI: 10.1002/mrm.23313; (2) Steiger, *Psych, Bulletin*, 1980, vol 87, No. 2, p. 245.

Keywords: Dyadic fMRI, Social interaction, Default-mode network

Talk 7, 3:42 - 3:54 pm

Differential encoding of social decision outcomes by neurons in primate orbitofrontal cortex, dorsal anterior cingulate cortex and anterior cingulate gyrus

Steve W.C. Chang^{1,2}, Jean-Francois GariÃ©py², Michael L. Platt^{1,2}; ¹Department of Neurobiology, Duke University School of Medicine, ²Center for Cognitive Neuroscience, Duke University

Presenter: Steve W.C. Chang

Decisions made during social interactions are critical for normal social behavior. Vicarious responses associated with rewarding events occurring to other individuals appear early in development, and their impairments in neuropsychiatric disorders like autism, psychopathy, and schizophrenia can have devastating consequences. Despite this importance, the neural circuit mechanisms mediating decisions made with regard to others

remains poorly understood. To address this gap, we investigated reward outcome encoding during social decision-making by neurons in three regions in primate prefrontal cortex: the lateral orbitofrontal cortex (IOFC), anterior cingulate sulcus (ACCs), and anterior cingulate gyrus (ACCg). We probed neuronal responses while rhesus monkeys performed a reward donation in which donor monkeys were presented with the choices of delivering juice reward to himself or no one, to himself or a recipient monkey, or to the recipient monkey or no one. Previously, we reported that donors prefer to deliver juice to the recipient rather than to no one, consistent with vicarious social reinforcement. We also reported that activity of neurons in IOFC predominantly encodes rewards directly received by the donor, whereas ACCs neurons predominantly encode rewards that are not received by the donors. Here we present data from ACCg neurons in the reward donation task in order to compare the neuronal encoding of social decision outcomes across ACCg ($n = 81$), ACCs ($n = 101$), and IOFC ($n = 85$). We found two major classes of ACCg neurons: one class selectively encoded rewards donated to the recipient monkey, while the other class selectively encoded rewards delivered to the donor. Finally, neurons in IOFC, but not in ACCs and ACCg, encoded received reward outcomes in a push-pull manner relative to omitted reward outcomes by the donors. Specifically, there was a negative relationship between the slopes of firing rates as a function of reward size for received and omitted rewards across IOFC neurons. Our findings endorse the view that distinct regions in primate prefrontal cortex compute social decision outcomes with respect to self and other. We speculate that differential activation of these areas may underlie individual and species-specific differences in motivation to give to others.

Keywords: Social decision-making, orbitofrontal cortex, anterior cingulate sulcus, anterior cingulate gyrus

Talk 8, 3:54 - 4:06 pm

The neural basis of persuasion on social norms

Yukihito Yomogida^{1,2}, Madoka Matsumoto¹, Ryuta Aoki^{1,2}, Ayaka Sugiura³, Kenji Matsumoto¹; ¹Brain Science Institute, Tamagawa University, Tokyo, Japan, ²Japan Society for the Promotion of Science, Tokyo, Japan, ³Department of Life Sciences, GSAS, University of Tokyo, Tokyo, Japan

Presenter: Yukihito Yomogida

Social norms are the rules for acceptable behaviors shared in a group. Social norms regulate individual's behavior not only because of interpersonal sanctions, but also because those social norms are internalized as beliefs by individual group members. Within a society, social norms are not stable but dynamically changing. In such a social norm change process, interpersonal or mass media persuasive communication plays a substantial role, however, neural basis under such process is hardly understood. So, we aimed to clarify the neural basis of social norm change by persuasion by using functional magnetic resonance imaging. Twenty-seven subjects participated in this study. All participants gave informed consent for the study and protocol was approved by the Ethic Committee of Tamagawa University. Brain activity was recorded while subjects were reading four types of persuasion messages presented on the screen in a pseudorandom order. The first two types of messages persuaded subjects to change a social norm (Norm Change: NC) or to reinforce another social norm (Norm Reinforce: NC). The other two types of messages were served as controls, and persuaded subjects to change a non-social belief (Belief Change: BC) or reinforce another non-social belief (Belief Reinforce: BR). Before

and after the persuasion task, subjects rated their attitudes for various social norms and non-social beliefs, including those served as the target of persuasion in the persuasion task. From those ratings, subjects' attitude changes by the persuasion were assessed. The subtraction analysis using the contrast (NC+NR)-(BC+BR) was conducted to identify brain regions involved in persuasion for both changing and reinforcing social norms, and revealed the activation in several social cognition-related brain regions, such as bilateral medial prefrontal cortex, dorsolateral prefrontal cortex, inferior frontal gyrus, precuneus, inferior parietal lobule, lateral temporal lobe, temporal pole, cerebellum, and left parahippocampal gyrus. Furthermore, the interaction effect analysis using the contrast (NC-BC)-(NR-BR) was conducted to identify brain regions involved in persuasion specific for social norm change, and revealed the activation in the left middle temporal gyrus (MTG). More importantly, each subjects' left MTG activity during the persuasion was positively correlated with subjects' subsequent attitude change. These results suggest that persuasion on social norms are processed through multiple brain regions thought to be involved in social cognition, and that left MTG plays a crucial role in changing social norms by persuasion.

Keywords: fMRI, Social norms, Persuasion

Talk 9, 4:06 - 4:18 pm

Juvenile protocadherin-10 haploinsufficient mice as a model of reduced sociability, an autism -relevant phenotype

Arati S. Kreibich¹, Cara Piccoli¹, Yunxian Liu¹, Margaret M. Wong¹, Holly C. Dow¹, Shinji Hirano², Masatoshi Takeichi³, Robert T. Schultz¹⁶, Ted A. Abel⁵, Edward S. Brodtkin¹; ¹Department of Psychiatry, Perelman School of Medicine, University of Pennsylvania, ²Department of Neurobiology and Anatomy, Kochi Medical School, Okoh, Nankoku-City, Japan, ³RIKEN Center for Developmental Biology, Minatogima-Minamimachi, Chuo-ku, Kobe, Japan, ⁴Center for Autism Research, Children's Hospital of Philadelphia, ⁵Department of Biology, University of Pennsylvania, ⁶Department of Pediatrics, Perelman School of Medicine at the University of Pennsylvania

Presenter: Arati S. Kreibich

Social withdrawal is a profoundly disabling, core symptom of autism; however the genetic and neurobiological basis of this behavioral symptom is not well understood. Human genetic studies have implicated Protocadherin-10 (PCDH10) as an autism-susceptibility gene. Mouse models may be useful for testing the role of Pcdh10 in autism-relevant phenotypes. Mice homozygous for a deletion of Exon 1 of Pcdh10 show developmental deficits in thalamocortical and striatal axon migration and die several weeks following birth. However, mice haploinsufficient for Pcdh10 (Pcdh10+/-) survive to adulthood with no gross brain anomalies. We tested the hypothesis that juvenile Pcdh10+/-mice would show reduced sociability. We measured sociability of juvenile male and female Pcdh10+/- and wildtype (WT) control mice toward gonadectomized A/J stimulus mice in a Social Approach Test. Our data demonstrate a significant reduction in sociability only in the male Pcdh10+/- juveniles, relative to WT littermate controls, as reflected by reduced social sniffing scores (rmANOVA, genotype x phase interaction F(1,18) = 57.7, p<0.001; main effect of genotype: F(1,18) = 71, p<0.001;

n=12 and 8 for WT and Pcdh10+/- mice, respectively). In contrast, female juvenile Pcdh10+/- mice show no significant deficits in social sniffing. In addition, none of the groups show alterations in olfactory, motor or anxiety-like behaviors. While the postnatal function of Pcdh10 is not well understood, some evidence suggests that it mediates dendritic development or remodeling, implying a role in synaptic development, maintenance, or plasticity, all of which have been recently implicated in the pathophysiology of autism. Therefore, future experiments will be aimed at elucidating changes in these molecular mechanisms which may underlie the sociability deficits in the Pcdh10+/- mice.

Keywords: mouse model, sociability, protocadherin, sex differences

Talk 10, 4:18 - 4:30 pm

The man who feels two hearts: different pathways of interoception and social cognition

Lucas Sedeño¹, Blas Couto^{1,2,3}, Alejo Salles⁴, Margarita Peradejordi⁶, Pablo Barttfeld⁴, Andrés Canales⁵, Yamil Vidal Dos Santos⁴, Tristán Bekinschtein⁷, Mariano Sigman⁴, Roberto Favaloro⁶, Facundo Manes^{1,2}, Agustín Ibanez^{1,2,3,5,1}; ¹Institute of Cognitive Neurology (INECO), Buenos Aires, Argentina, ²Institute of Neuroscience, Favaloro University, Buenos Aires, Argentina, ³National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, ⁴Integrative Neuroscience Laboratory, Physics Department, University of Buenos Aires, ⁵Laboratory of Cognitive Neuroscience, Universidad Diego Portales, Santiago, Chile, ⁶Department of Cardiology and Cardiosurgery, Favaloro University, Buenos Aires, Argentina, ⁷The Medical Research Council Cognition and Brain Sciences Unit, Cambridge, UK

Presenter: Juan Blas Couto

Advances in neuroscience have provided new insights into heart-brain interaction. Afferent cardiac information seems to rely on two different pathways, terminating in the insular (IC) and anterior cingulate (ACC) cortices, along with the somatosensory cortex (S1-S2). Interoception has been shown to modulate social cognition. We report the case study of C.S., a patient with an "external heart" (an extracorporeal left-univentricular cardiac assist device, LVAD). The patient was assessed with behavioral/neural measures of cardiac interoception and measures of social cognition. The patient's performance on the interoception task (heartbeat detection) seemed to be guided by signals from the artificial LVAD, which provides a somatosensory beat, rather than by his endogenous heart. Cortical activity indicated a decreased heart-evoked potential (HEP) in comparison to normal volunteers, particularly during interoceptive states. The patient recognized basic emotions, but showed impairments on empathy, theory of mind and decision-making tasks. This evidence suggests (a) an imbalance in the patient's cardiac interoceptive pathways that enhances sensation driven by the artificial pump over that from the cardiac vagal-ICC-ACC pathway and (b) the presence of specific social cognition deficits previously linked to interoception. A patient with two hearts presents a unique opportunity to explore models of interoception and heart-brain interaction.

Keywords: Interoception, LVAD, heart-evoked potential, heartbeat detection, social cognition

S4SN 2012 Meeting I Poster Sessions

Grand Ballroom D

Poster Session	Date & Time	Set-up Begins	Session Begins	Session Ends	Take-down Complete
A	Thursday October 11	4:00 pm*	6:00 pm	8:00 pm	8:15 pm
B	Friday October 12	9:30 am*	1:00 pm	2:30 pm	2:45 pm
C	Friday October 12	2:45 pm*	6:00 pm	7:30 pm	7:45 pm

*Earliest set up time will allow viewing during coffee break

Poster sessions are scheduled for Thursday-Friday in the Grand Ballroom D of the Hilton Riverside Hotel. All attendees must present their S4SN 2012 name badge to enter Grand Ballroom D. Please 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 after the "Set-up Begins" time (listed below), but before the beginning of the assigned poster session. You must remove your poster promptly no later than the time listed above in "Take-down Complete." Any posters left after take-down complete may be removed and discarded.

Poster A1, Thursday, October 11, 6:30 – 8:00 pm Evolutionary Convergence of Gene Modules Regulating Social Systems

Lauren O'Connell¹, Benjamin Goetz¹, Allen Moore², Steven Phelps¹, Tamás Székely³, Brian Trainor⁴, Hans Hofmann^{1,1}, ¹Section of Integrative Biology, University of Texas at Austin, ²Department of Genetics, University of Georgia, ³Department of Biology and Biochemistry, University of Bath, ⁴Department of Psychology, University of California Davis

Presenter: Lauren O'Connell

Monogamous mating systems have evolved repeatedly in a wide range of animals, yet little is known about the underlying neural and molecular substrates and their evolution. We test the hypothesis that the convergent evolution of monogamy across wide evolutionary distances involved in part the recruitment of homologous gene modules. We sequenced the brain transcriptomes of mated males from closely related species (one monogamous, one non-monogamous) of *Microtus* voles, *Peromyscus* mice, *Ectodini* cichlids, Parid songbirds, as well as paired and non-paired *Nicrophorus* burying beetles using SOLiD RNA-sequencing to compare expression profiles of orthologous genes within and across lineages. We found several gene modules that are similarly regulated in monogamous males, such as neuroendocrine genes and transcription factors, as well as a different set of gene modules that are similarly regulated in non-monogamous males. More detailed analyses as well as transcriptome sequencing of monogamous and non-monogamous sister species of new world primates and poison dart frogs are ongoing. We are currently also using RNA Pol II ChIP-seq on all species in this study to investigate to what extent similarities in gene expression patterns are associated with shared regulatory motifs across the genome. Our results provide insight as to whether common molecular substrates likely underlie the repeated evolution of complex social behavior patterns.

Keywords: evolution, monogamy, behavior

Poster A2, Thursday, October 11, 6:30 – 8:00 pm Neural Basis Of Social Facilitation In Monkeys Using Fdg-Pet

Elisabetta Monfardini^{1,2,3}, Jérôme Redouté^{3,4}, Clément Hynaux^{2,3}, Didier Le Bars^{4,5,6}, Franck Lavenne⁴, Pierre Fonlupt⁷, Nicolas Costes⁴, Martine Meunier^{2,3,1}, Institut de Médecine

Environnementale, Paris, France, ²INSERM, U1028; CNRS, UMR5292; Lyon Neuroscience Research Center, ImpAct Team, Lyon, France, ³University Lyon, France, ⁴CERMEP-Imagerie du Vivant, Lyon, France, ⁵Institute of Chemistry and Biochemistry (ICBMS), University Lyon 1, Villeurbanne, France, ⁶Hospices Civils de Lyon, France, ⁷INSERM, U1028; CNRS, UMR5292; Lyon Neuroscience Research Center, Brain Dynamics and Cognition Team, Lyon, F-69000, France

Presenter: Elisabetta Monfardini

The sheer presence of others can influence an individuals performance. When confronted with simple tasks, human subjects do better under social than under solitary testing. In monkeys, food intake is increased and performance in familiar tasks enhanced when other individuals are present compared when animals are tested alone. The facilitation of performance that derives from the mere presence of others has been largely explored, but its neural substrates remain completely unknown. Social psychology describes two main theories about why social facilitation occurs: (i) a drive-based theory, basically claiming that the presence of others increases the global motivation of subjects; (ii) an attention-based theory, which suggests that social presence leads to an helpful restriction in attention focus, thereby enhancing performance. Based on this, we predicted that social facilitation would be related to the activity of brain systems that mediate motivation or, alternatively, attention. To test this hypothesis, we used a non-invasive approach in monkeys for measurement of the regional cerebral glucose consumption (CMR_{glc}), which is a precise index of the integrated local neuronal activity. Three female rhesus monkeys were injected with [18F]-fluorodeoxyglucose ([18F]FDG; 18.5 MBq/kg) and then exposed for 30 minutes to one of two conditions: a social facilitation condition (SF) in which they performed a simple task in the presence of a passive familiar peer, and an alone condition (Al) in which they performed the same task alone. The monkeys were then anesthetized (Zoletil 100) and positioned in a PET scanner for an emission scan. A total of 18 scans were collected. All PET scans were registered to a monkey MRI atlas. Regional [18F]FDG activity was normalized to the gray matter mean activity to control for differential [18F]FDG dosage. Regional values were submitted

to a Rol-based geometric transfer matrix (GTM) method for partial volume effect correction. The behavioral results confirmed a robust social facilitation effect on performance. This effect was not due to changes in stress degree across conditions, as measured by plasma level of cortisol. Preliminary PET results indicate that, compared to AI condition, SF condition yielded higher regional activity in a right-lateralized network encompassing the inferior parietal lobe and frontal areas including the premotor cortex. These regions are known to play a primary role in attentional mechanisms, thereby supporting the attentional view of social facilitation derived from social psychology.

Keywords: Social facilitation, PET, monkeys, non-invasive techniques, attention

Poster A3, Thursday, October 11, 6:30 – 8:00 pm
Neuronal responses to conspecifics and social facial touch in the perirhinal cortex

Rajnish Rao¹, Evgeny Bobrov¹, Michael Brecht^{1,1}, Bernstein Center for Computational Neuroscience, Humboldt University of Berlin, Berlin, Germany

Presenter: Rajnish Rao

While much is known about the role of olfactory cues and early olfactory processing in rodent social interactions, we know less about how other senses contribute to social signaling and how multisensory social information is represented in the rodent forebrain. Lesion studies in the context of the Coolidge Effect have demonstrated that the perirhinal cortex (but not the hippocampus) is required for individual recognition. The perirhinal cortex receives polysensory input from numerous afferent structures that have been implicated in social interactions. We wondered if this brain area integrates polysensory social signals, especially in the context of recent work that has demonstrated that rat hippocampal neurons do not explicitly represent individual specific social information. We have used two different approaches, immediate early gene expression and tetrode recordings in awake, behaving animals interacting across a gap, to explore the role of perirhinal cortices in social representation. Socially isolated rats were allowed to interact with a non-littermate and their brains were analyzed for c-Fos expression using unbiased stereology. Following social interactions, rats showed higher c-Fos immunoreactivity compared to non-interacting controls in both areas 35 and 36 (corresponding to peri- and ecto-rhinal cortices). Firing patterns of putative single units were analyzed specifically during facial interactions that were associated with whisker-to-whisker contacts not only to stimulus animals (male or female) but also to stuffed rats and object controls. Preliminary results reveal the existence of units in the peri-/ecto-rhinal cortices whose firing was modulated during the animal's interaction with a conspecific. Such responses were not observed in the adjacent lateral entorhinal cortex.

Keywords: Social recognition, Conspecific Interactions, Perirhinal Corte

Poster A5, Thursday, October 11, 6:30 – 8:00 pm
Effects of oxytocin on human social approach measured using intimacy equilibriums

Jean CJ Liu^{1,2}, Adam J Guastella³, Mark R Dadds^{1,1}, School of Psychology, University of New South Wales, ²Cognitive Neuroscience Lab, Duke-NUS Graduate Medical School, ³Brain and Mind Research Institute, University of Sydney

Presenter: Jean CJ Liu

Research in animals and humans suggest a role of oxytocin in social approach to strangers. We tested this by introducing undergraduate students to opposite-gendered strangers, with each member of the pair having taken either oxytocin or placebo. One hundred and four undergraduate students were paired up and engaged in a face-to-face conversation structured with a series of intimate topics for discussion. We found that oxytocin increased conversational intimacy in female but not male participants, but that this was matched with compensatory decreases in eye-contact (relative to placebo). Based on Argyle and Deans (1965) intimacy equilibrium theory, our results suggest that oxytocin does not facilitate social approach by increasing the intimacy equilibrium between two strangers.

Keywords: Oxytocin and social approach

Poster A6, Thursday, October 11, 6:30 – 8:00 pm
Developmental differences in the control of action selection by social information

Iroise Dumontheil¹, Hauke Hillebrandt¹, Ian A Apperly², Sarah-Jayne Blakemore^{1,1}, Institute of Cognitive Neuroscience, University College London, UK, ²School of Psychology, Birmingham University, UK

Presenter: Iroise Dumontheil

Several developmental fMRI studies have demonstrated that regions within the social brain, that is the network of brain regions involved in understanding other people, develop both structurally and functionally during the period of adolescence, with consistent decreases in medial prefrontal cortex (MPFC) activation with age. Most previous developmental functional imaging studies in this area have employed tasks that involve explicitly thinking about other peoples mental states (theory of mind or mentalising). However, in every day life we use theory of mind in a much more implicit and online way in order to make appropriate actions and communicate with other people. In the current fMRI study, we employed a paradigm that integrates the requirement to take another individuals perspective into account in an online communicative task. This paradigm is unlike previous perspective taking tasks, which generally explicitly ask participants to make a judgment on the visual perspective of this other person. Using this paradigm we previously showed that, in adults, selecting an action on the basis of either social or symbolic cues was associated with activations in the frontoparietal cognitive control network, while the presence and use of social vs. symbolic cues was in addition associated with activations in the temporal and medial prefrontal cortex (MPFC) social brain network. Here we investigated developmental changes in these two networks. Fourteen adults (age 21-30) and 14 adolescents (11-16) followed instructions to move objects in a set of shelves. Interpretation of the instructions was conditional on the point of view of a visible director or the meaning of a symbolic cue (Director Present vs. Director Absent), and the number of potential referent objects in the shelves (3-object vs. 1-object). No behavioural performance differences were observed between the age groups. 3-object trials elicited increased frontoparietal and temporal activations, with greater left lateral PFC and parietal activations in adults than adolescents. Social vs. symbolic information led to activations in superior dorsal MPFC, precuneus, and along the superior/middle temporal sulci. Both dorsal MPFC and left temporal clusters exhibited a Director x Object interaction, with greater activation when participants needed to consider the directors viewpoints. This effect differed

with age in dorsal MPFC. Adolescents showed greater activation whenever social information was present, while adults showed greater activation only when the directors viewpoints were relevant to task performance. This pattern of results suggests that MPFC activation becomes increasingly specific to perspective taking, or mentalising, with age. This study thus shows developmental differences in domain-general and domain-specific PFC activations associated with action selection in a social interaction context.

Keywords: theory of mind, perspective taking, inhibition, adolescence, social brain, fMRI

Poster A7, Thursday, October 11, 6:30 – 8:00 pm

Left middle temporal gyrus tagging newly established self-association fly-on boosts shape recognition

Jie Sui^{1,2}, Pia Rotshtein³, Glyn W. Humphreys¹; ¹Oxford University, Oxford, ²Tsinghua University, Beijing, ³University of Birmingham, Birmingham

Presenter: Jie Sui

Distinction between ourselves and others is a fundamental axis for social representations. The distinction pervades many aspects of cognition, where we frequently prioritise stimuli related to ourselves relative to stimuli relating to other people. We (Sui, He & Humphreys, in press) have recently shown that we can rapidly 'tag' neutral stimuli by associating them to ourselves, which then conveys a perceptual advantage. Here we examined the neural basis of this self-tagging effect. Participants undertook a short block of training trials in which they associated a geometric shape to the self, a close other, or an unfamiliar person. After learning the associations, participants performed a simple shape-label matching task while being scanned. The behavioural data demonstrated that responses were faster and made with higher accuracy to self-associated stimuli than to stimuli associated to others, suggesting rapid transfer of self prioritization to a simple shape recognition task. This benefit was associated with enhanced activity to self-associated stimuli over the left middle temporal gyrus (LMTG) and ventromedial prefrontal cortex (vmPFC), whereas other-associations recruited a fronto-parietal attentional network including the bilateral dorsal prefrontal cortex and parietal cortex. In particular, the LMTG exclusively responded to matches of the self-shape and label, mirroring the behavioural performance and possibly reflecting the neural representation of a new self-template; in contrast, activity in the vmPFC linked to the self-label may reflect a central process of self-evaluation. The results indicated that this new self-association paradigm is a powerful way to decode the functions of complicated self-related neural networks and can address the relations between controlled and more automatic aspects of self processing.

Keywords: self-association, matching task, middle temporal gyrus, ventromedial prefrontal cortex

Poster A8, Thursday, October 11, 6:30 – 8:00 pm

Integrating intention and context: assessing social cognition in adults with Asperger syndrome

Sandra Baez^{1,2}, Margherita Melloni¹, Alexia Rattazzi³, Teresa Torralva¹, María Luz Gonzalez-Gadea^{1,2}, Silvana Viglecca², Jean Decety⁴, Facundo Manes¹, Agustin Ibanez^{1,2,5,1}; ¹Institute of Cognitive Neurology (INECO) & Institute of Neuroscience, Favaloro University, Buenos Aires, Argentina, ²National Scientific and Technical Research Council (CONICET), Buenos Aires,

Argentina., ³Argentinean Program for Children, Adolescents and Adults with Autism Spectrum Disorders (PANAACEA), ⁴Departments of Psychology and Psychiatry, and Center for Cognitive and Social Neuroscience, University of Chicago, Chicago, IL, USA., ⁵Laboratory of Cognitive Neuroscience, Universidad Diego Portales, Santiago, Chile.

Presenter: Blas Couto

Deficits in social cognition are an evident clinical feature of the Asperger syndrome. Although many daily life problems of adults with Asperger syndrome are related to social cognition impairments, few studies have conducted comprehensive research in this area. The current study assessed multiple domains of social cognition in adults with Asperger syndrome. We controlled for the effect of executive functions and explored within-group variability. Fifteen adults diagnosed with Asperger syndrome and 15 matched healthy controls completed a battery of social cognition tasks. This battery included measures of emotion recognition, theory of mind, empathy, moral judgment, social norms knowledge and self-monitoring behavior in social settings. The results indicated that adults with Asperger syndrome had a core deficit in several domains of social cognition. We also found high inter-individual variability in the social cognition tasks. In these tasks, Asperger syndrome participants obtained mostly subnormal performance. Executive functions did not seem to play a major role in the social cognition impairments. Our results also suggest that adults with Asperger syndrome present a pattern of social cognition deficits characterized by the decreased ability to implicitly infer the intentionality of actions and to integrate mental states (intentions, beliefs, emotions) with contextual information. Nevertheless, when social information is explicitly presented or the situation can be navigated with abstract rules, performance is improved. Our findings have important implications for the diagnosis and treatment of Asperger individuals as well as for the neurocognitive models of this syndrome.

Keywords: Asperger syndrome; social cognition; executive functions; individual variability.

Poster A9, Thursday, October 11, 6:30 – 8:00 pm

Neural correlates of reward processing and decision making in adults with attention deficit/hyperactivity disorder (ADHD) or euthymic bipolar disorder

Margherita Melloni¹, Marcelo Cetkovich¹, Agustín Petroni^{2, 4}, Hugo Urquina¹, Sandra Baez¹, Juan Kamienkowsky⁴, Teresa Torralva¹, Fernando Torrente¹, Sergio Strejilevich¹, Julia Teitelbaum¹, Facundo Manes¹, Agustin Ibanez^{1, 2, 3, 1}; ¹Institute of Cognitive Neurology (INECO), Favaloro University, Buenos Aires, Argentina, ²National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, ³Laboratory of Cognitive Neuroscience, Universidad Diego Portales, Santiago, Chile, ⁴Integrative Neuroscience Laboratory, Physics Department, University of Buenos Aires, Buenos Aires, Argentina

Presenter: Agustin Ibanez

Attention-deficit/hyperactivity disorder (ADHD) and bipolar disorder (BD) share DSM-IV criteria in adults and cause problems in decision-making. Nevertheless, no previous report has assessed a decision-making task that includes the examination of the neural correlates of reward and gambling in adults with ADHD and those with BD. We used the Iowa gambling task (IGT), a task of rational decision-making under risk (RDMUR) and a rapid-decision gambling task (RDGT) which elicits behavioral measures as well as event-related potentials (ERPs: fERN and P3) in connection to

the motivational impact of events. We did not observe between-group differences for decision-making under risk or ambiguity (RDMUR and IGT); however, there were significant differences for the ERP-assessed RDGT. Compared to controls, the ADHD group showed a pattern of impaired learning by feedback (fERN) and insensitivity to reward magnitude (P3). This ERP pattern (fERN and P3) was associated with impulsivity, hyperactivity, executive function and working memory. Compared to controls, the BD group showed fERN- and P3-enhanced responses to reward magnitude regardless of valence. This ERP pattern (fERN and P3) was associated with mood and inhibitory control. Consistent with the ERP findings, an analysis of source location revealed reduced responses of the cingulate cortex to the valence and magnitude of rewards in patients with ADHD and BD. Our data suggest that neurophysiological (ERPs) paradigms such as the RDGT are well suited to assess subclinical decision-making processes in patients with ADHD and BD as well as for linking the cingulate cortex with action monitoring systems.

Keywords: decision making, ADHD, Bipolar Disorder, ERPs

Poster A10, Thursday, October 11, 6:30 – 8:00 pm
Neural correlates of deceptive tactics in the primate prefrontal cortex.

Jean-Francois Gariépy², Steve W. Chang^{1,2}, Emily Du^{1,2}, Michael L. Platt^{1,2,1}, Department of Neurobiology, Duke University School of Medicine, ²Center for Cognitive Neuroscience, Duke University

Presenter: Jean-Francois Gariépy

Social animals possess abilities to communicate diverse information to conspecifics. The function of the social signals used by animals can be to compete or to cooperate, depending on the social context. In sociobiological terms, functional deception consists in acts that provide misleading information to other animals to the benefit of the signaller. Although functional deception has been extensively described by sociobiologists in multiple animal species, the underlying neural processes remain unknown. To investigate this question, we developed a virtual Penalty Kick game, played using joysticks by a competing pair of rhesus macaques (*Macaca mulatta*). In this game, one player controls a ball and obtains juice for scoring a goal (kicker). Another player controls a paddle and obtains juice for blocking the ball (goalkeeper). When playing against each other, monkeys naturally adopted dynamic behaviors, including curvilinear trajectories that functioned as deceptive movements, triggering reactions of the goalkeeper in the wrong direction. We refer to these functionally-deceptive movements as feints. Analysis of eye movements revealed that kicker monkeys look at the goal during a preparatory period well before their first movement. On feint trials, these early saccades directed to the goal were correlated with the location where the kickers ultimately ended their trajectory. This suggests that the kickers establish part of their tactics at the very beginning of trials. During the Penalty Kick games, preliminary single-unit recordings from two kicker monkeys were obtained from the dorsomedial and dorsolateral prefrontal cortex (DMPFC [$n = 31$], DLPFC [$n=23$], respectively), known to participate in deception in humans. We classified trials according to the following categories: straight trajectories, upward feints and downward feints. We were interested in the neural activities during the early part of the trials that could predict selected tactics before their execution. Task-related neurons in the DMPFC all showed strong activation during the performance of the final movement ($n = 13$) but did not show differential activation in the early part of the trial. In contrast, early activities of task-related neurons in the DLPFC were predictive of the presence of a feint in the trial ($n = 12$) and a subset showed directional tuning ($n = 10$). Our results suggest that monkeys

interacting with a dynamic partner can learn to perform deceptive tactics and that these tactics are planned ahead at the beginning of the trial. We propose that DLPFC is a critical part of the primate prefrontal network generating functionally deceptive behaviors in primates.

Keywords: social, neuroscience, game theory, decision-making, deception

Poster A11, Thursday, October 11, 6:30 – 8:00 pm
N170 modulation of emotional facial and semantic expression processing in adults with euthymic bipolar disorder and its association with theory of mind

Margherita Melloni¹, Hugo Urquina¹, Agustín Petroni^{2, 4}, Sandra Baez¹, Micaela do Nascimento¹, Raphael Guex⁸, Esteban Hurtado^{3, 5}, Alejandro Blenkman^{2, 6, 7}, Leandro Bertachini^{2, 7}, Mariano Sigman^{2, 4}, Alicia Lischinsky¹, Teresa Torralva^{1,1}, Institute of Cognitive Neurology (INECO), Favaloro University, Buenos Aires, Argentina, ²National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, ³Laboratory of Cognitive Neuroscience, Universidad Diego Portales, Santiago, Chile, ⁴Integrative Neuroscience Laboratory, Physics Department, University of Buenos Aires, Buenos Aires, Argentina, ⁵Pontificia Universidad Católica de Chile, ⁶Epilepsy Center, IBCN-CONICET-University of Buenos Aires, ⁷Laboratory of Industrial Electronics, Control and Instrumentation (LEICI), National University of La Plata, ⁸Laboratory for Behavioral Neurology and Imaging of Cognition, University of Geneva, Geneva, Switzerland

Presenter: Agustin Ibanez

Adults with bipolar disorder (BD) have cognitive impairments that affect face processing and social cognition. However, it remains unknown whether these deficits in euthymic BD have impaired brain markers of emotional processing. We recruited twenty six participants, 13 controls subjects with an equal number of euthymic BD participants. We used an event-related potential (ERP) assessment of a dual valence task (DVT), in which faces (angry and happy), words (pleasant and unpleasant), and face-word simultaneous combinations are presented to test the effects of the stimulus type (face vs word) and valence (positive vs. negative). All participants received clinical, neuropsychological and social cognition evaluations. ERP analysis revealed that both groups showed N170 modulation of stimulus type effects (face > word). BD patients exhibited reduced and enhanced N170 to facial and semantic valence, respectively. The neural source estimation of N170 was a posterior section of the fusiform gyrus (FG), including the face fusiform area (FFA). Neural generators of N170 for faces (FG and FFA) were reduced in BD. In these patients, N170 modulation was associated with social cognition (theory of mind). This is the first report of euthymic BD exhibiting abnormal N170 emotional discrimination associated with theory of mind impairments.

Keywords: ERPs, theory of mind, bipolar disorder, emotional processing

Poster A13, Thursday, October 11, 6:30 – 8:00 pm
The Social Contagion of Itch

Jamie Ward¹, Anil Seth¹, Hugo Critchley¹, Kimberley Warne¹, Henning Holte^{2,1}, University of Sussex, UK, ²University of Hull, UK

Presenter: Jamie Ward

Watching someone scratching themselves can elicit subjective sensations of itchiness in the perceiver – this is a form of sensorimotor contagion. In this fMRI study participants watched movies of someone itching themselves versus control movies of tapping the same body part and participants also rated their subjective itchiness. Observing itching (relative to tapping) activated most major areas implicated in the veridical perception of itch, including the thalamus, primary somatosensory cortex (BA2), premotor cortex (BA6) and the insula. This suggests a shared system between the veridical perception of itch and the social perception of itch – analogous to that reported for pain. Whereas the observer of pain does not typically report painful sensations from observing pain, the same is not true for itch. Most people report subjective sensations of itchiness during the itch trials and the intensity of these sensations correlated with the BOLD response in many of the key regions. In addition, individual differences in ‘itch contagion’ were positively correlated with the personality dimension of agreeableness (but not empathy) and this dimension also correlated with the degree of activity within the primary somatosensory cortex.

Keywords: contagion, personality, fMRI, itching, empathy

Poster A14, Thursday, October 11, 6:30 – 8:00 pm
Insular networks for emotional processing and social cognition: A double lesion case report

Lucas Sedeño¹, Juan Blas Couto^{1,2,3}, Luciano Sposato^{1,2}, Mariano Sigman⁴, Patricia Riccio^{1,2}, Alejo Salles^{3,4}, Facundo Manes^{1,2}, Agustín Ibáñez^{1,2,3,5,1}, ¹Institute of Cognitive Neurology, Favaloro University, Buenos Aires, Argentina, ²Institute of Neuroscience, Favaloro University, Buenos Aires, Argentina, ³National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina, ⁴Integrative Neuroscience Laboratory, Physics Department, University of Buenos Aires, ⁵Laboratory of Cognitive Neuroscience, Universidad Diego Portales, Santiago, Chile

Presenter: Agustín Ibáñez

Introduction. The processing of the emotion of disgust is attributed to the insular cortex (IC), which is also responsible for social emotions and higher cognitive functions. We distinguish the role of the IC from its connections in regard to these functions through the assessment of emotions and social cognition in a double case report. These subjects were very rare cases that included a focal IC lesion and a subcortical focal stroke affecting the connections of the IC with frontotemporal areas. **Materials & Methods.** Both patients and a sample of 10 matched controls underwent neuropsychological and affective screening questionnaires, a battery of multimodal basic emotion recognition tests, an emotional inference disambiguation task using social contextual clues, an empathy task and a theory of mind task. **Results.** The insular lesion (IL) patient showed no impairments in emotion recognition and social emotions and presented with a pattern of delayed response times (RTs) in a subset of both groups of tasks. The subcortical lesion (SL) patient was impaired in multimodal aversive emotion recognition, including disgust, and exhibited delayed RTs and a heterogeneous pattern of impairments in subtasks of empathy and in the contextual inference of emotions. **Conclusions.** Our results suggest that IC connections, and not the IC itself, are related to negative emotional processing and social emotions. We discuss these results with respect to theoretical approaches of insular involvement in emotional and social processing and propose that IC connectivity with frontotemporal regions might be relevant for emotional processing and social cognition.

Keywords: insula

Poster A15, Thursday, October 11, 6:30 – 8:00 pm
Human pheromones and nutrient chemicals: epigenetic effects on ecological, social, and neurogenic niches that affect behavior.

James V. Kohl¹, Linda C. Kelahan², Heather Hoffmann^{2,1}, ¹Independent Researcher, Epworth, GA, ²Knox College, Galesburg, IL

Presenter: James V. Kohl

Background: The 2007 iteration of the “FDA Critical Path Initiative” (FDACPI) is a systems biology approach to disease prevention and pharmacogenomics. It stresses the need to examine healthy behavioral development by including interactions among the evolved gene, cell, tissue, organ, organ-system pathway. This pathway links the epigenetic effects of nutrient chemicals and pheromones directly to the organization and activation of behavior in species from honeybees to humans. The 2011 American Society of Addiction Medicine (ASAM) Public Policy Statement: ‘Definition of Addiction’ dictates the integration of the FDACPI’s neuroscientific principles of epigenetic cause and effect, which are required to understand differences between genetically predisposed brain disease, naturally occurring variations of behavioral development, and choice. These neuroscientific principles include focus on how sensory input influences behavior. ASAM specifically mentions food and sex along with drugs and alcohol. Each of these influences chemically conditions changes in hormones and in behavioral responses. **Study design:** Nutrient chemical signals are associated with food odors. Pheromones are chemical signals associated with social odors and sex differences. We incorporated what is currently known about the ability of chemical signals to condition behavior. This conditioning occurs via epigenetic effects that calibrate and standardize the molecular biology of intracellular signal transduction and stochastic gene expression, which controls the feedback loops of developmental processes required for movement, ingestion, reproduction, and the diversification of species from microbes to man. **Method:** Pre-existing, adaptively evolved, nutrition dependent, hormone-driven, cyclic peak fertility in fourteen women was assessed by a non-invasive measure of luteinizing hormone (LH). During a double-blind social construct, the women were exposed for fifteen minutes to a man who had applied either a control mixture (n=7), or a mixture of androstenol/androsterone (n=7). Both mixtures contained the same masking odor. **Summary:** Evaluated video recordings of interactions showed increased flirtatious behaviors of women, which were statistically attributed to the effect of androstenol on LH and the unconscious affect of androsterone. Measures of self-reported increased attraction correlated with the increased flirtatious behaviors. **Conclusions:** Across species comparisons of epigenetic effects on nutrition dependent and hormone-driven invertebrate and vertebrate social and sexual behavior indicate that the androstenol/androsterone mixture contains pheromones, which may increase opportunities for properly timed reproductive sexual behavior. Neuroscientifically established epigenetic effects of sensory input on hormones that affect behavior suggest that this mixture of human pheromones causes changes in ecotypically organized neural pathways that directly link nutrient chemicals and social niches to 1) neurogenic niches; 2) the molecular biology of evolved neural circuitry; 3) genetically predisposed physiological changes, and to 4) unconscious affects on behavior in species from invertebrates to mammals. The molecular biology is conserved and transgenerational epigenetic inheritance establishes the pre-existing genetic variation. Our results tentatively extend epigenetic

effects on intracellular signaling, gene expression, hormones, and unconscious affects on behavior, which are due to food odors and pheromones in insects, to socioaffective neuroscience in people despite pre-existing genetic variation and phenotypic differences in nutrition dependent hormone-driven development of the brain, and differences in the development of social and sexual behaviors.

Keywords: neuroscience, social, ecological, neurogenic, affect, effect, olfaction, pheromones, odor, evolution

Poster A16, Thursday, October 11, 6:30 – 8:00 pm

An ERP Study of Empathy on Internet Addiction of City Left-behind Adolescent

Ting Wang¹, Ying Ge¹, Jin Liu¹,¹School of Education, Laboratory of Cognition and Mental Health, Chongqing University of Arts and Sciences, Chongqing, China

Presenter: Ying Ge

Using the method of event-related potentials (ERP) in this research, it explored the empathy ability of city left-behind adolescent with internet addiction from cognitive neuroscience point of view, according to explore the negative effects of internet addiction on city left-behind adolescent's interpersonal communication, emotional needs and personality development, which can be the physiological reference of future research. Behavioral results showed that the reaction time that individuals with internet addiction response to the judgment of pain and non-pain pictures was longer than individuals with non-internet addiction, and judgment accuracy of the individuals with internet addiction was lower than individuals with non-internet addiction. ERP results showed that the individuals with internet addiction and non-internet addiction have the effect of pain in N1 component, which reflected the automation process of the empathy for pain; this showed that there was no difference in the automation process between the two types of subjects. There was a significant interaction in the subsequent P2 and N2 components between types of internet addiction and pain, it meant that there was no significant in the internet addiction group but in the non-internet addiction group. P2 and N2 components maybe reflected the cognitive processing and evaluation process of empathy for pain; the results indicated that internet addiction affected the cognitive processes of the city left-behind adolescent's empathy for pain. In the last 550-850ms, both groups of subjects were induced by a larger late positive component, and the component reflected that the subjects used life common sense and rational to judge in the last stage, and internet addiction did not affect the process. In short, this research found out that internet addiction affected city left-behind adolescent's empathy ability, and its role was mainly occurred in the cognitive processing and evaluation stage of empathy.

Keywords: internet addiction?city left-behind adolescent?empathy?ERP

Poster A17, Thursday, October 11, 6:30 – 8:00 pm

The Observation of Interpersonal Touch Modulates Perceptions of Warmth and Competence

Claris Zhao¹, Christy Reece¹, Annett Schirmer¹,¹National University of Singapore

Presenter: Claris Zhao

It is well known that being casually touched by an interaction partner positively biases the touchee's perception of or attitude towards the partner. We asked whether a similar effect may be elicited in individuals who simply observe the interaction. Specifically, we sought to explore whether and in what way interpersonal touch influences observer attitudes towards the toucher and touchee. To this end, we developed a set of 288 line drawings displaying dyadic interactions with and without touch. Touch and no-touch drawings differed only in whether the hand of one person lay on shoulder, arm or hand of the other person. The drawings were presented to 96 participants who were asked to rate one of the individuals in each drawing on a warmth scale or a competence scale. The results revealed that individuals are perceived to be warmer and more competent when they actively touch an interaction partner as compared to when they do not touch. Individuals are also perceived as warmer when they are touched than when they are not touched. However, this latter effect is comparatively smaller than the effect for individuals who engage in active touch. Moreover, touchees are perceived as less rather than more competent. Together, these results indicate that touch in a dyadic interaction modulates observer attitudes. In line with the idea that touch is related to pro-sociality, we found substantial touch effects on the perception of warmth, a basic personality dimension associated with pro-social traits including friendliness, helpfulness, sincerity, and trustworthiness (Fiske, Cuddy, & Glick, 2007). Moreover, these effects were larger for the toucher than the touchee suggesting that the observation of touch influences primarily attitudes towards the former rather than the latter. Touch effects on the perception of warmth were stronger and more consistent than touch effects on the perception of competence, the second major dimension in person perception (Fiske et al., 2007). Nevertheless, touch effects on competence were significant indicating that social touch implicitly modulates observer perception of both social (i.e., warmth) and non-social (i.e., competence) person characteristics. Future research will have to determine a possible role of tactile embodiment in these effects. References: Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, 11(2), 77-83.

Keywords: social perception, touch, embodiment, attitudes

Poster A18, Thursday, October 11, 6:30 – 8:00 pm

On the Role of Social Touch for the Encoding of Social and Non-Social Information

Maria Teresa Wijaya¹, Shawn Tan¹, Annett Schirmer¹,¹National University of Singapore

Presenter: Maria Teresa Wijaya

Gentle stroking has been shown to activate a special set of tactile receptors called CT-afferents. It has been proposed that these receptors form part of a system specifically evolved for the appreciation of grooming or social touch. We asked whether and how activation of this system affects ongoing mental processing. Specifically, we sought to determine whether activation of this system enhances the encoding of socially relevant information. To this end, we presented 30 participants (14 females and 16 males) with a stream of visual images consisting of faces and houses. For half the images, the participants were concurrently stroked on the forearm. The remaining images were presented without stroking. We recorded and analyzed the electroencephalogram (EEG) to image presentations. Specifically, we computed event-related potentials (ERPs) time-locked to image onset and investigated the amplitude of the N170, a temporal ERP component previously

implicated in the processing of social information. In line with previous work, we found the N170 to be larger for faces than houses. Additionally we observed an effect of stroking on this component. Notably, the effect was modified by the participants' sex. Female but not male participants showed an increased N170 when being stroked as compared to when not stroked. Moreover, this effect was present for both faces and houses. Thus, we conclude that gentle stroking enhances the activity of neuronal sources involved in the encoding of social information perhaps by making both social and non-social information more socially relevant. However, this enhancement does seem sex-specific suggesting that CT-afferent influences on social processing may be more important in women than in men.

Keywords: Touch, CT afferent, Face processing, ERP, N170, Sex differences

Poster A19, Thursday, October 11, 6:30 – 8:00 pm
On the Role of Maternal Touch for Social and Emotional Child Development

Christy Reece¹, Richard Ebstein¹, Annett Schirmer^{1,2,1}, National University of Singapore, ²Duke/NUS Graduate Medical School

Presenter: Christy Reece

Extant research in non-human animals has revealed that maternal touch influences offsprings' social behavior by shaping the development of neural systems involved in social and emotional processing. We asked whether maternal touch could play a similar role in humans. As a first experimental step towards addressing this question, we recorded tactile interactions between mothers and their 4-6 year old children (N=40) in a structured 10 minute play session. Following this session, the child completed two short behavioral tasks assessing social and emotional sensitivity, respectively. In the social sensitivity task, the child categorized geometrical objects overlaid on distractor images of faces or houses. Social sensitivity was quantified as increased distraction by faces relative to houses. In the emotional sensitivity task, the child identified the emotional expression of full faces and partial faces showing the eye region only. Emotional sensitivity was quantified as correct emotion recognition. The frequency of affectionate maternal touch positively correlated with both social and emotional sensitivity. Together these results raise the possibility that, similar to maternal touch in non-human animals, maternal touch in humans may be critical in shaping the neural systems involved in social and emotional child development.

Keywords: touch, face processing, emotion recognition

Poster A20, Thursday, October 11, 6:30 – 8:00 pm
A Survey of the Public's Attitude to the Public Service Advertising

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Presenter: Wu Xuemei

The public service advertising is a kind of advertising which conveys some civilization and morality to the social public, advances the social civilization and obtain the social benefits. The purpose of the public service advertisements is to affect the public's attitudes on some social issues, to takes their interest in solving the common social problems and change their unmoral behaviors. The level of the public service advertisements is an important index of measuring the civilization and social

atmosphere of a city, a region, even a nation . This study adopted a self-designed " the Questionnaire of Attitude to Public Service Advertising", to survey 242 people's attitude to the public service advertising from five cities in China. The findings indicated that: (1) The public showed positive emotions to the public service advertising overall. (2) The age difference of the public's attitude was significant. With the age growth , the public's attitude to service advertising was more and more positive. (3) The gender differences of the public's attitude was not significant as a whole. But in the factor of emotion experiencing, the female displaid a more positive manner than the male. (4) The people whose degree of education was master or beyond showed more negative attitude to service advertising than those people whose degree was lower ,especially in the factor of behavior and emotion experiencing.(5) The difference from the workers' attitude to students' was significant too. The student group displaid a more positive manner than the worker group obviously. (6) The public from different cities showed significantly different attitude to the service advertisings. The people from developed city had more negative attitude than those from developing city in all respects.

Keywords: Public service advertizing; Attitude; Cognition; Emotion experiencing; Behavior

Poster A21, Thursday, October 11, 6:30 – 8:00 pm
Neural correlates of semantic for actions: Convergent evidence from neuropsychological, intracranial and electrophysiological measures

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Presenter: Agustin Ibañez

Converging neuroscientific evidence suggests that the mechanisms involved in the perception and comprehension of meaningful actions may be similar to those associated with the processing of language information. Our findings provide neuroanatomical, behavioral and electrophysiological evidence supporting this hypothesis. At a behavioral level, we evaluated the Action Sentence Compatibility Effect (ACE) in Parkinson's disease and normal controls. The ACE can be defined as a longer reaction time in the action-sentence incompatible compared to the compatible condition. We found that patients showed a much diminished ACE relative to controls. At a neuroanatomical level, intracranial recordings in epileptic patients demonstrated simultaneous bidirectional effects in language and motor systems with modulations in frontotemporal and motor regions. Finally, we obtained an electrophysiological component associated with the processing of meaning (N400) using videos about actions as stimuli. The 3 aforementioned studies provide converging evidence about motor-language coupling during semantic processing.

Keywords: Motor-Cognition

Poster A22, Thursday, October 11, 6:30 – 8:00 pm
An Eye Movement Research on Typesetting of Print Public Service Advertisings

Wu Xuemei¹, He Huamin¹, Huang Chuan¹; ¹Chongqing University of Arts and Sciences, China

Presenter: Wu Xuemei

Aim: Within the limited space of a print public service advertising, how to arrange the position of the advertising's text and pattern, and how to design their area, only then can effectively attract the public attention. **Methods:** This study, through repeated three-factors measurement, 3 (area: 1/3, 1/2, 2/3) × 4 (position: up, down, left, right) × 2 (types: text, pattern), explored the Eye Movement characteristics of 20 college students when they were watching print public services advertisements. **Results:** The difference of the AD texts' area was significant on fixation duration, fixation count and pupil size. The Eye Movement indexes increased with area enlarging. The difference of the AD pattern' area was significant on fixation count and pupil size. The two Eye Movement indexes reached to the maximum when the pattern areas was half of the AD. (2) The difference of the AD texts' position was significant on fixation duration, fixation count and pupil size. The difference of the AD pattern' position was significant on fixation count, pupil size. The Eye Movement indexes when the pattern or text in the upper half part was higher than the indexes when the pattern or text was in the lower half part, and the ones in the left part was higher than the ones in the right part. (3) The difference of two types, pattern and text, was significant on fixation duration, fixation count. The Eye Movement indexes of pattern was higher than the text's indexes. **Conclusion:** With the varying of position, area and type, the print public service advertisements drew the participants' attention to different extent.

Keywords: print public service advertising; eye movement; fixation duration; fixation count; pupil size.

Poster A23, Thursday, October 11, 6:30 – 8:00 pm

Effects of one's emotional state on perspective taking and prosocial behavior

Henryk Bukowski¹, Dana Samson¹; ¹Université catholique de Louvain, Belgium

Presenter: Henryk Bukowski

Little is known about the influence of our emotional state on our ability to take another's perspective. We designed a pseudo-interactive virtual card game in order to induce guilt, anger or joy through the interaction with the game partner. After performing the card game, each participant completed a visual perspective-taking task in which they were asked to judge from their own or the perspective of their game partner. Participants also completed a tombola tickets sharing task to measure prosocial behaviour. Physiological recordings and retrospective self-reports confirmed that the guilt and anger induction were successful and resulted in emotional responses. As expected from previous studies, participants in the guilt condition shared more tombola tickets with their game partner than participants in the anger condition. Interestingly, the emotional state had not only effects on prosocial behaviour but also on participants' performance in the visual perspective taking task: participants in the anger condition gave more weight to their own perspective than their partner's perspective whereas the opposite was found for the participants in the guilt condition. In conclusion, this study demonstrates that emotions can influence perspective taking even its most cognitive aspects and in very different ways depending on the emotion.

Keywords: Social cognition, emotion, perspective taking, theory of mind, prosocial behavior

Poster A24, Thursday, October 11, 6:30 – 8:00 pm

The effect of intimacy on empathy for pain: an event-related potential study

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Presenter: Ting Wang

Intimate relationship plays an important role in human experience, because it provides a strong affective attachment for people. Empathy is generally defined as the ability to recognize and share feelings of others. Recently, a functional MRI study showed that intimacy influenced the bottom-up information processing involved in empathy for pain. However, how intimacy modulates the temporal dynamic of neural mechanisms involved in pain empathy remains to be determined. This was investigated in the present study by recording event-related brain potentials (ERPs) from 15 healthy undergraduate students. Subjects were exposed to the pictures of hands or feet in painful and non-painful situations and performed a pain judgment task. Meanwhile, they were instructed to imagine these pictures from three different perspectives: self, lover and stranger. Results showed that, painful pictures induced positive shifts of early N110 at frontal-central electrodes and late P3 over the centro-parietal regions than non-painful pictures from all three perspectives. However, there were significant interactions between pain and intimacy on early N240 component, a more positive N240 was induced by painful pictures than non-painful pictures only from the lover perspective. It is generally considered that the temporal dynamics of pain empathy consisted of an early automatic process stage, represented by the components of N110 and N240, and a late cognitive evaluation stage, reflected by the late P3. However, this study found that intimacy only modulated the early N240 (not the early N110 and the late P3), which indicated that the N110 and N240 might represented two different processing stages. N110 might reflect the "negative bias" to threatening information, while N240 might reflect the emotional sharing of early automatic processing stage. Thus, our present study demonstrated that the intimacy between observer and sufferer modulated the early emotional sharing processing, while there was no intimacy effect on early "negative bias" process and the late cognitive evaluation stage.

Keywords: intimacy; event-related potential (ERP); empathy for pain

Poster A25, Thursday, October 11, 6:30 – 8:00 pm

Trusting one's own religion more than a different one: a behavioural and fMRI study of temporal discounting

Vanda Viola^{1,2}, Ruben T. Azevedo^{1,2}, Valerio Santangelo^{2,3}, Frieder L. Schillinger^{1,2}, Emiliano Macaluso², Salvatore Maria Aglioti^{1,2}; ¹University of Rome "La Sapienza", Rome, Italy, ²IRCCS Fondazione Santa Lucia, Rome, Italy, ³University of Perugia, Perugia, Italy

Presenter: Vanda Viola

Temporal discounting (TD) refers to the devaluation of offered rewards as a function of the time until their delivery. Although the

phenomenon has great societal implications, little is known about how interpersonal factors like trust or group coding influence TD. Religion is a belief system that may promote group affiliation and group bias, and thus may have a strong impact on inter-temporal choices. We designed a task in which volunteers had to choose between immediate and delayed rewards proposed by an offerer belonging to the same vs. different religious group. We expected to find larger TD (i.e. decrease of the subjective value of the reward as time elapses) when offerer and recipient belong to different religious group. 12 Muslim and 12 Christian individuals were asked to perform an inter-temporal choice task during fMRI scanning. Participants had to choose between an immediate reward of 20 € and a greater-but-delayed reward offered by either a Muslim or Christian offerer. Delayed rewards varied as a function of the combination of rewards (from 21 to 91 euros) and delays (7, 30, 60, 180 days). Indices of inter-temporal choice patterns (k) were computed separately for Outgroup and Ingroup offerers and compared using a two-tailed t-test. The results showed increased TD for Outgroup than Ingroup offerers. In keeping with a seminal fMRI study of intertemporal choice, we found a parametric decrease of activity in the medial prefrontal cortex as delays increased (see also Kable & Glimcher, 2007). Notably, the intertemporal modulation in these regions was stronger for Outgroup than for Ingroup offerers. This pattern of results indicates higher devaluation of delayed payoffs offered by religious outgroup than ingroup individuals. Thus, we demonstrate for the first time that religious group coding may have a strong impact on complex decision processes, such as those involved in inter-temporal choice.

Keywords: Temporal discounting; Religion, Group bias, fMRI, Subjective value

Poster A26, Thursday, October 11, 6:30 – 8:00 pm

Weighing the stigma of weight with fMRI: neural reactivity to the pain of obese individuals

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Presenter: Ruben T. Azevedo

Obese individuals are highly stigmatized in western cultures facing numerous forms of prejudice and discrimination. Explicit negative attitudes and blameful beliefs (e.g. poor diet, laziness) are well documented and are pervasive even among health professionals. Information on whether knowing the cause of obesity may modulate stigma is lacking. Here we used a cognitive neuroscience approach to study the bias towards obese individuals and explore the underlying psychological mechanisms and neural substrates. Current models posit that the mere perception of someone else in pain triggers neural and physiological reactions similar to those involved in the first-person experience of pain. Believed to be a central aspect of the empathic experience, such neurophysiological resonance has been consistently shown to be reduced for the pain of socially distant or disregarded individuals (e.g. other-race, unfair, stigmatized groups), and thus constitutes a privileged framework to study prejudice at an implicit level. During fMRI, twelve normal-weight female participants observed short clips depicting normal-weight (Nw) and obese models (Ob) being painfully stimulated. Importantly, participants were induced to believe that half of the Ob suffered from a hormonal disorder leading them to be overweight (HdOb) and ignored the cause of obesity of the

remaining models (Unspecified obese models; UOb). Models associated with HdOb and UOb were counterbalanced across subjects. Analyses of hemodynamic responses showed increased activity to the pain of Nw compared to that of Ob in areas associated with pain processing (i.e. bilateral insula, somatosensory cortices and thalamus) and early visual processing (i.e. fusiform face area, occipital cortex), revealing biased resonance with both the sensory and affective aspects of Ob' pain experience. Moreover, the comparison between the two Ob conditions revealed decreased activity to HdOb' pain compared to UOb' pain in the right inferior frontal gyrus, an area associated with emotion recognition and regulation. We demonstrate not only that stigma for obese individuals can be observed at an automatic and implicit level, but also that it is modulated by the information available regarding the etiology of obesity. In specific, we show that providing an external biological cause for obesity does not necessarily reduce stigma. In fact, the acknowledgment of a deterministic disease-related cause for obesity might promote further categorization and result in greater stigmatization. These findings are of importance for understanding stigma and the role of health professionals' attitudes towards obesity and disease in general.

Keywords: Empathy; Stigma; fMRI; Obesity; Pain

Poster A27, Thursday, October 11, 6:30 – 8:00 pm

How do chimpanzees understand others' actions? Brain activation, white matter connectivity, and behavior

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Presenter: Erin Hecht

Culture rests on the ability to understand and reproduce others' actions. Other primates share these abilities with us, but with an important difference: even chimpanzees, our closest living relatives, focus on observed actions' physical results, while we focus on the methods used to achieve them. In macaques and humans, action understanding involves the mirror system, a set of frontal and parietal brain regions that are active during both the execution and observation of similar actions. In humans, the mirror system is also involved in imitation, although macaques notably do not imitate. Furthermore, the macaque mirror system does not respond to observed movements that lack a goal or physical result, while the human mirror system does. These things suggest that adaptations to the mirror system may be related to the evolution of social learning. We have previously reported differences in mirror system connectivity between macaques, chimpanzees, and humans. We have also reported functional activations in the chimpanzee mirror system which differ from macaques and humans. Since behavior is the result of brain function, which itself is the result of brain structure, we have suggested that differences in structural connectivity might alter the way the mirror system functionally processes information, affecting whether the results or methods of observed actions are "mirrored" and thus available for behavioral copying. In order to further test this hypothesis, we performed a behavioral imitation test, in vivo functional neuroimaging, and structural neuroimaging all within the same set of 4 chimpanzees. In the imitation test, chimpanzees were scored on the extent to which they copied the results vs. methods of an experimenter's demonstrated use of an object. In

the functional neuroimaging study, we performed FDG-PET scans during action execution, action observation, and rest. "Mirror activations" were identified as overlapping activations during both action execution and observation. These activations were used to seed tractography analyses in diffusion tensor imaging scans. We measured connectivity between mirror regions within each brain. Mirror system connectivity was normalized by geniculostriate tract connectivity in order to control for any differences in scan quality. We then performed a correlation analyses on individual chimpanzees' behavioral imitation indices, amount of functional activation, and degree of white matter connectivity. These results provide bottom-up mechanistic information that is relevant to theories about the evolution of social learning and culture.

Keywords: social learning, chimpanzees, neuroimaging, imitation, mirror system

Poster A28, Thursday, October 11, 6:30 – 8:00 pm
Language and Sociability in Children with High Functioning Autism and Williams Syndrome During the Cookie Theft Picture Description Task

Philip Lai^{1,2,3}, Wenny Wong^{1,2}, Doris Trauner², Judy Reilly³, Ursula Bellugi¹,¹Salk Institute for Biological Studies, ²University of California San Diego, ³San Diego State University

Presenter: Philip Lai

Williams syndrome (WS) and autism (ASD) are both neurodevelopmental disorders characterized by abnormal social profiles. In social situations, both disorders display noticeably different behavioral phenotypes; individuals with WS are often hyper-social, gregarious, and display little social fear; in contrast, those with ASD often lack a desire to engage others in social interactions, are socially avoidant, and have impaired communication skills. The goal of the present study is to investigate the relationship between language and sociability to see whether patterns of each group's social phenotype are expressed during an elicited picture description task. Children (ages 7-14) included High Functioning Autism (HFA, n=23), Williams Syndrome (WS, n=9), and typically developing children (TD, n=23). Participants described the Cookie Theft picture description from the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1983). Language measures for both receptive and expressive vocabulary were collected through the Peabody Picture Vocabulary Test-Third Edition (PPVT-III; Dunn & Dunn, 1997) and Expressive One-Word Picture Vocabulary Test (EOWPVT-III; Brownell, 2000). Sociability was measured through eye contact with the experimenter during the picture description task. Language data were transcribed and video data were analyzed through Eudico Linguistic Annotator (ELAN; Lausberg & Sloetjes, 2009). ELAN is a software platform that is able to gather frequency, duration, and latency data. Finally, as a measure of production on the Cookie Theft, the numbers of words and propositions were counted for each child. Results from the PPVT-III and EOWPVT-III revealed differences: the TD group scored significantly higher than both the HFA and WS groups, while the HFA group scored significantly higher than the WS group. Even with differences in vocabulary, when examining the production of the Cookie Theft, a significant difference was found between the TD and HFA groups only, where the TD group produce the larger amount of words and propositions. For measures gauging sociability, the proportion of frequency of eye contact over time was not significant in any of the groups. Differences in duration of eye contact were significant: WS have more than TD or HFA. The WS group spent 22% of the time engaging in eye contact with the

experimenter, compared to 9.3 % in the TD group and 7.6% in the HFA group. This study begins to provide a detailed portrait of how children behave both linguistically and socially during an elicited picture description task. The degree of sociability required for each task reveals that children with WS exhibit more social expressivity when given the chance (Cookie Theft); while the HFA group performed better during tasks that requires less social interaction (Vocabulary). Differences in sociability, specifically eye gaze in WS, may point to the fact that the WS sociability is manifesting itself once again, suggesting the power of the genetic underpinnings of the disorder.

Keywords: William Syndrome, Autism, Social Expressivity

Poster A29, Thursday, October 11, 6:30 – 8:00 pm
Naturalistic emotional stimuli preferentially activate the human dorsal stream visual system

Hagar Goldberg¹, Son Preminger², Rafael Malach^{1,1},¹Weizmann institute of science, ²Interdisciplinary center

Presenter: Hagar Goldberg

A large body of brain imaging research highlighted a set of specific regions in the limbic, insular and prefrontal cortex as sensitive to static visual images of high emotional content. Here we report that when using more naturalistic stimuli (short audio visual video clips) the main site of preferential activation to emotional content was centered on the dorsal, action related, stream of visual areas. Subjects underwent fMRI scanning while watching a set of highly emotional as well as neutral video clips. The chosen scenes included human characters in varied emotional states. Following the scan, clips were rated by each subject for arousal and valence. The post scan questionnaires revealed that empathy was the most prevalent emotion to be elicited by the movie clips. Surprisingly, activity in dorsal stream visual areas (such as IPS and SPL) showed the highest emotional arousal selectivity compared to all other brain areas. In contrast, ventral stream visual areas showed a significantly weaker emotional selectivity. Other cortical regions showing significant emotional enhancement included: posterior cingulate (PCC) anterior cingulate (ACC) and dorsolateral pre-frontal cortex (dlPFC). Reduced activity in Emotional vs. Neutral clips was exhibited in temporal regions, including medial temporal gyrus (MTG) and superior temporal sulcus (STS). Control experiments ruled out low level visual or auditory cues as contributing factors to this effect. Furthermore, the specific pattern of emotion-related activations was incompatible with a general arousal or attentional effects. Given the established role of dorsal stream visual areas in action related functions, these results support the long held hypothesis associating emotion and preparation for action.

Keywords: visual dorsal stream, emotion - action link, empathy

Poster A30, Thursday, October 11, 6:30 – 8:00 pm
OTR and V1aR density in the social decision-making network predicts female prairie vole decisions to mate and reproductive success within alternative mating tactics.

Da-Jiang Zheng¹, Britta Larsson¹, Steven Phelps², Alexander Ophir¹,¹Department of Zoology, Oklahoma State University, ²Integrative Biology, University of Texas

Presenter: Alexander Ophir

The decision to mate may be one of the most important decisions that animals make. For monogamous species, this decision can carry the added weight of limiting future mating opportunities. The mechanisms that govern these decisions have presumably been shaped by evolution in ways that optimize these decision-making processes. In particular, a so-called social decision-making network (SDM) has been proposed, which integrates brain structures comprising the 'social behavior network' with a neural system associated with reward. Here, we discuss the neural phenotypic differences for oxytocin and vasopressin receptors of female socially monogamous prairie voles living in naturalistic conditions with respect to the SDM. We focus on these receptors because they are profoundly involved in mammalian social behavior. We found that reproductive success (i.e., pregnancy) was largely predicted by the reward component of the SDM, while reproductive success within mating tactics was well predicted by brain structures across the SDM, particularly those serving as the interface between the two component systems. Our data provide support for the existence for the SDM, and suggest that the decisions to mate and adopt monogamous or non-monogamous mating tactics may be optimized by evolutionary pressures shaping the brain.

Keywords: Monogamy, Reproductive Decisions, Mating Tactics, Cognitive Ecology, Oxytocin, Vasopressin, *Microtus ochrogaster*

Poster A32, Thursday, October 11, 6:30 – 8:00 pm

Clinical Utility and Concurrent Validity for Two Measures of Social Cognition in Moderate to Severe TBI

Amanda Hull¹, Kelly McCoy¹, Alyssa Adams¹, Megan Kelly¹, Barbara Schwartz¹,¹Washington DC VA Medical Center

Presenter: Amanda Hull

Goals: Social cognition relies on broadly distributed neural networks with primary areas in the limbic and prefrontal brain regions, which are vulnerable to traumatic brain injury (TBI). Sufficient research documenting deficits in social cognition following TBI has led to the translation of research measures into clinical assessment tools. The Awareness of Social Inference Test (TASIT; McDonald, Flanagan, & Rollins, 2002) and the Social Perceptions Task from the Wechsler Adult Intelligence Scale – Fourth Edition, Advanced Clinical Solutions (ACS-SPT; Pearson, 2009) have been shown to be sensitive to social perception deficits in those with TBI (McDonald et al., 2004; McDonald, Flanagan, Rollins, & Kinch, 2003; Holdnack & Drozdick, 2010; Kansaalt et al, 2012). The research aim is to investigate the concurrent validity and clinical utility of the TASIT and the ACS-SPT in a sample of Veterans with moderate to severe TBI. **Methods:** Participants included five Veterans attending a social cognition group at the Washington, DC Veterans Affairs Medical Center. All participants sustained a TBI, experience current psychiatric symptoms, and demonstrate a need for improved social functioning in daily life. Group members were administered baseline assessments, which included TASIT, a measure of dynamic emotion, sarcasm, and sincerity perception, and ACS-SPT, which assesses the ability to process static emotional displays and vocal prosody. **Results:** On average, participants performed in the low average to impaired range on all subtests of the TASIT ($z = -1.03$ to -2.30) except on the Sincere subtest, where they performed in the average range ($z = .028$). Notably, while performance on most TASIT subtests were clinically lower than expected compared to average (>1 SD from the mean), only performance on the Lie subtest was significantly below the expected mean ($t = -4.33$, $df = 4$, $p = .01$). Statistical significance

for the other TASIT subtests trended towards significance ($p = .06$ to $.13$). In contrast, participants performed within the average range on all ACS-SPT subtests ($z = -.41$ to $-.54$); scores were not significantly below the expected mean or trending towards significance ($p = .21$ to $.51$). Group performance on the ACS subtests was not significantly correlated to any TASIT subtests. **Conclusion:** Consistent with existing research, group performance on the TASIT indicated that participants misinterpret displayed emotion and sarcasm, while retaining the ability to accurately identify sincerity (McDonald, Flanagan, & Rollins, 2002). However, performance on the ACS-SPT identified participants as performing within normal limits in similar domains. Thus, although the sample size is small, the findings of this study speak to the clinical utility of these two measures. Clinical interpretation of the TASIT but not the ACS consistently identified participants as impaired, in line with their reported functional abilities and current literature. Furthermore, ACS-SPT subtests were designed to measure similar constructs as the TASIT, but the ACS-SPT subtests were not significantly correlated to TASIT subtests. Further research investigating the clinical utility of the TASIT and ACS-SPT and the neural networks assessed by these two measures in a larger sample would contribute to our understanding of these preliminary findings.

Keywords: Social Cognition, Assessment, TBI

Poster A33, Thursday, October 11, 6:30 – 8:00 pm

Intranasal oxytocin attenuates attentional biases to arousing images in male rhesus monkeys

Lisa Parr¹, Erin Siebert², Lauren Murphy²,¹Center for Translational Social Neuroscience, Emory University, Atlanta GA, ²Yerkes National Primate Research Center, Emory University, Atlanta GA

Presenter: Lisa Parr

In the last 10 years, the growth of studies focused on the role of oxytocin (OT) in facilitating prosocial behavior has been extraordinary. Researchers have suggested that OT may function to enhance prosocial behavior by specifically impacting early stages of attentional processing (Bartz, 2011). In humans, for example, IN-OT reduces the attentional bias towards negative stimuli (Ellenbogen et al., 2012; Evans et al., 2010) and attenuates the arousal associated with emotional images (Norman et al., 2010). These findings are consistent with fMRI studies that have repeatedly demonstrated that IN-OT reduces the amygdala's response to negative emotional faces (Baumgartner et al., 2008; Domes et al., 2007; Kirsch et al., 2005; Petrovic et al., 2008). Researchers hypothesize that these early attentional effects could have downstream impact on the subsequent memory and evaluation of social images leading to the enhanced prosocial outcomes reported in many human studies, such as cooperation, empathy and trust. Little is known about the effects of IN-OT on social perception and social cognition in other species, like monkeys, that share many neuroanatomical and behavioral similarities with humans. We conducted several studies that examined the effect of IN-OT on social perception in male rhesus monkeys. Monkeys were trained to sip juice for 4 minutes while their face was positioned over an aerosolized stream of oxytocin (48IU) or placebo (saline). Subjects then performed a dot-probe task using a computerized touchscreen to evaluate their automatic attentional biases to arousing compared to nonarousing social images. Monkeys first touched a fixation cross and then two images were presented simultaneously on either side of the monitor for 500 ms. Immediately following this, monkeys were required to touch a target that appeared in a location that was

congruent with one of the primed images. Reaction time to touch the target was the dependent variable. One hundred trials were performed that measured attentional bias (RT nonarousing image – RT arousing image) to neutral faces versus scrambled faces, negative facial expressions versus scrambled expressions, and direct versus averted gaze faces. Compared to the placebo condition, IN-OT nonsignificantly enhanced the attentional bias to neutral faces, and significantly reduced the attentional bias to negative facial expressions, $t(4) = p < 0.05$, two-tailed. Subjects showed an attentional bias to the averted gaze faces, consistent with reports that these faces are arousing for monkeys (Hoffman et al., 2007) and there was a trend for this to be reversed with IN-OT, switching to an attentional bias to direct gaze faces, $p = 0.09$. These results suggest that IN-OT functions to reduce the aversive quality of social images in rhesus monkeys, similar to previous reports in humans (Ellenbogen et al., 2012). These results help to validate the usefulness of the rhesus monkey for the preclinical screening of IN-OT as a potential pharmacotherapy for treating humans that suffer from social impairments.

Keywords: oxytocin, social perception, facial expression, rhesus monkey

Poster A34, Thursday, October 11, 6:30 – 8:00 pm
EPISTASIS OF 5-HTTLPR AND COMT Val158Met GENES IMPACTS ON STRUCTURE AND FUNCTION OF BRAIN REGIONS INVOLVED IN EMOTION PROCESSING

Simon Surguladze¹, Joaquim Radua², Wissam El-Hage³, Gemma Monte², Mary Phillips⁴; ¹King's College London Institute of Psychiatry, UK, ²FIDMAG, CIBERSAM, Barcelona, Spain, ³Université François Rabelais, Tours, France, ⁴Western Psychiatric Institute and Clinic, University of Pittsburgh School of Medicine, Pittsburgh, USA

Presenter: Simon Surguladze

Imaging genetic studies provide for the possibility to uncover endophenotypes for neuropsychiatric disorders. The aim of this study was to establish neuroimaging correlates of the joint effect of serotonergic (5-HTTLPR) and dopaminergic (COMT) genes on effective connectivity and regional brain volume in healthy individuals. Ninety one healthy Caucasian adults underwent functional magnetic resonance imaging (fMRI) and structural MRI. In fMRI study the participants were presented with videoclips of dynamic emotional facial expressions of fear, sadness, happiness and anger. The effective connectivity within the emotion processing circuitry was assessed with Granger causality method. In the structural neuroimaging part of the study we applied diffeomorphic anatomic registration through exponentiated Lie algebra (DARTEL) whole-brain voxel-based morphometry (VBM). The results of the fMRI experiments showed that in fear processing condition, an interaction between 5-HTTLPR (S) and COMT(met) low activity alleles was associated with reduced effective connectivity within the facial emotion processing circuitry including bilateral inferior prefrontal cortex, right superior temporal gyrus, bilateral fusiform/inferior occipital regions, and right amygdala. The results of the structural data analysis showed an interaction of COMT and 5-HTTLPR genotypes with regional grey matter volume in bilateral parahippocampal gyrus, amygdala, hippocampus, cerebellum and right putamen. In particular, the gray matter volume in these regions was smaller in individuals who were both COMT-met and 5-HTTLPR-L/L, or COMT-val/val. We conclude that the epistatic effect of COMT-met and 5-HTTLPR-S

markers impacts on both the brain function and structure and may underlie an inefficient emotion regulation.

Keywords: neuroimaging, emotion processing, genetics

Poster A35, Thursday, October 11, 6:30 – 8:00 pm
Pharmacological characterization of oxytocin and vasopressin 1a receptor radioligands and nonradioactive ligands for use in primate receptor autoradiography

Sara M Freeman¹, Aaron L Smith¹, Larry J Young^{1,2}; ¹Emory University

Presenter: Sara M Freeman

Oxytocin (OT) and vasopressin (AVP) play important roles in regulating social cognition in mammals, including primates. While the neuroanatomical distribution of OT and AVP receptors have been well described in rodents using highly selective radioligands, there are few reports of central OT receptor (OTR) or vasopressin 1a receptor (V1aR) distribution in primates. The rhesus macaque is an important primate model for social behavior, and while OT has recently been shown to modulate social behavior in this species, the pharmacological tools used to map OTR in rodents have failed to yield convincing selective binding results in rhesus macaque brain tissue. This is due to the fact that the radioligands and non-radioactive ligands that are highly selective in rodents display more promiscuous binding characteristics in primates, binding to both OTR and V1aR. In order to optimize receptor autoradiography conditions to selectively reveal OTR and V1aR binding distributions in primate brain tissue, we have pharmacologically characterized the binding properties of commercially available radioligands and small molecule competitor ligands using the human OTR and V1aR as proxies for the respective rhesus macaque receptors. Ligand binding assays were performed using membrane preparations from CHO cell lines that constitutively express either human OTR or V1aR (hOTR, hV1aR). Saturation binding assays using the iodinated OTR radioligand (125I-OVTA) or the iodinated V1aR radioligand (125I-LVA) determined for the first time their binding affinities for the human receptors. 125I-OVTA shows a high affinity for both the hOTR ($K_d = 90 \pm 17$ pM) and the hV1aR ($K_d = 420 \pm 58$ pM). Similarly, 125I-LVA also shows a high affinity for the hV1aR ($K_d = 30 \pm 3.0$ pM) and the hOTR ($K_d = 420 \pm 280$ pM). Competitive binding assays were performed on hOTRs and hV1aRs using a novel small molecule OTR ligand (ALS-II-69) and a small molecule reported to be selective for hV1aR (SR49059). In competition with 125I-LVA, ALS-II-69 has a K_i of 2.6 nM for the hOTR and effectively no affinity for the hV1aR, with a $K_i > 400,000$ nM. In competition with 125I-OVTA, SR49059 has a K_i of 20 nM for the hOTR and a K_i of 1.1 nM for hV1aR. Analysis of the competition curves suggests that performing OTR autoradiography with 125I-OVTA in combination with 10 nM SR4905 would reveal OTR binding by displacing ~85% of the radioligand binding to V1aR. Due to its high selectivity, ALS-II-69 can be co-incubated with 125I-LVA at concentrations up to 1 μ M to selectively displace radioligand binding to OTR and reveal V1aR. These conditions will be useful for more accurately mapping these receptors in rhesus brain using receptor autoradiography.

Keywords: oxytocin, vasopressin, receptor binding, primate neuroanatomy

Poster B1, Friday, October 12, 1:00 – 2:30 pm

Perception of Teammate Competence during Task Performance Alters Neurophysiological Correlate of Motivation Orientation

Matthew W. Miller¹, Jeremy C. Rietschel², Craig G. McDonald³, Bradley D. Hatfield^{4,1}, Auburn University,²Veterans Health Administration, ³George Mason University, ⁴University of Maryland

Presenter: Matthew W. Miller

To maximize human performance it is important to understand factors influencing performance. A critical factor is the orientation of motivation, which refers to an individuals drive to interact with the task at hand. Approach-oriented motivation refers to a tendency to engage with a task, and withdrawal-oriented motivation refers to a tendency to disengage from a task. The environment in which a task is performed can impact motivation orientation, thus influencing performance. As tasks are often performed in the context of teams, wherein a group of two or more individuals work together towards a common goal, the impact of the environment resultant of team members perceptions of one another on motivation orientation is of interest. Holding task incentives constant, it could be expected that a team member who perceives his/her teammates as being incompetent would feel helpless in successfully accomplishing the task and, thus, exhibit withdrawal-oriented motivation. Conversely, it could also be predicted that the team member would feel a greater need to engage in the task to compensate for his/her teammates ineptitudes and, therefore, exhibit approach-oriented motivation. The purpose of this study was to test these competing hypotheses. Accordingly, the electroencephalographic frontal asymmetry difference score (FADS) index of motivation orientation (a higher FADS indicates more approach-oriented motivation) was employed while participants performed a task in three conditions wherein performance was equally incentivized. During the Competent Teammate condition, participants engaged in the task with the assistance of a teammate perceived to be highly competent at the task. During the Incompetent Teammate condition, participants engaged in the task with the assistance of a teammate not perceived to be very competent at the task. Finally, during the Neutral condition, participants engaged in the task in the presence of teammates but without any assistance from them. In accord with the second hypothesis, while performing the task in the Incompetent Teammate condition participants exhibited significantly greater FADS relative to the Competent Teammate and Neutral conditions, which were undifferentiated. Results suggest that while performing a task with an incompetent teammate, individuals become more approach-oriented as they become more engaged in the task to compensate for their teammates ineptitude. Conversely, while performing a task with a competent teammate, individuals become more withdrawal-oriented as they allow their teammate to exert his/her expertise.

Keywords: Team Environment, Motivation Orientation, EEG

Poster B2, Friday, October 12, 1:00 – 2:30 pm

Common neural circuitry underlying social and physical warmth

Tristen Inagaki¹, Naomi Eisenberger^{1,1}, University of California, Los Angeles

Presenter: Tristen Inagaki

Many of our closest bonds grow out of socially warm exchanges and the warm feelings that stem from being connected with another. Indeed, temperature-related language is often used to

describe positive social exchanges (they shared a warm moment). This linguistic overlap may be paralleled in the body such that the neurobiological mechanisms underlying thermoregulation are shared by social attachments (Panksepp, 1998). That is, physical warmth and social warmth-the pleasant feelings that arise when we feel connected to those we love and care about-may increase bonds via shared mechanisms. As evidence for the interplay between social and physical warmth, holding a hot cup of coffee leads participants to rate an experimenter as interpersonally warmer than when they hold a cold, iced coffee (Williams & Bargh, 2008). However, the neural bases of social warmth and potential overlap with physical warmth have not been examined. To test this hypothesis, participants read socially warm messages (e.g., I love you for being so thoughtful) and neutral messages from friends and family (You have black hair) while in a fMRI scanner. In a separate run, warm and neutral, room temperature objects were held. After the scan, participants rated how connected they felt during each condition. As expected, participants felt more connected after reading the socially warm than neutral messages ($p < .001$) and in line with hypotheses, more connected when holding the warm than neutral object ($p = .01$). A conjunction analysis, which examines overlapping activations between conditions, of social (social warmth-neutral statements) and physical warmth (warm-neutral object) revealed activations in the ventral striatum and insula, regions associated with processing affectively pleasant or rewarding stimuli and physical warmth. Interestingly, ventral striatum activity during the social warmth run was also positively correlated with self-reported helping behavior toward the friends and family members one month after the scan. Together, these results suggest a common neural mechanism by which physical and social warmth are pleasing and sheds light on one way by which these types of positive exchanges may increase bonding.

Keywords: social connection; social warmth

Poster B3, Friday, October 12, 1:00 – 2:30 pm

The effect of the X-linked EFHC2 gene on social cognition and neural activation in healthy males

Carla M Startin¹, Michelle De Haan¹, David H Skuse^{1,1}, University College London

Presenter: Carla M Startin

Facial emotion expression recognition and theory of mind (ToM) abilities are important aspects of social cognition. Both of these abilities are often impaired in Autism Spectrum Disorders (ASDs) and Turner Syndrome (TS, X-monosomy); these impairments include poorer facial fear recognition abilities and poorer performance on the Reading the Mind in the Eyes task (RMET), a ToM task which requires subjects to correctly identify mental states from images of eyes. Both ASDs and TS are also associated with altered gaze fixation patterns while viewing faces, with decreased fixations to the eye region and increased fixations to the mouth region. The poorer social cognitive abilities of TS women compared to unaffected women suggest a potential role for the X chromosome in the development of these abilities; this is further supported by the more frequent occurrence of ASDs in males compared to females (3:1). In TS women, a rare single nucleotide polymorphism (SNP rs7055196) within the EFHC2 gene on the X chromosome has been associated with impaired facial fear recognition (prevalence ~ 9%), with women possessing this rare G allele showing poorer fear recognition abilities than women possessing the common A allele. Further, we have also found an influence of SNP rs7055196 on social cognition in

healthy males, who are also X-monosomic. These results suggest males possessing the G allele show poorer facial fear recognition accuracy and poorer ToM abilities (as measured using the RMET) compared to males possessing the A allele. We have extended this work to investigate possible underlying causes of these differences in groups of males possessing the different variants of SNP rs7055196. Firstly, we investigated gaze fixation patterns of these males to determine possible differences in fixations made to the eye and mouth regions of faces between the two groups. Secondly, we investigated differences in neural activation between the two groups using event related potentials while subjects viewed angry and fearful faces. Thirdly, we investigated differences in neural activation using fMRI between the two groups while subjects viewed images from the RMET. Results suggest there may be an effect of SNP rs7055196 on face processing style in healthy males, with males possessing the G allele showing a more feature based style compared to the more configural style of males possessing the A allele. These differences support the suggested role of the EFHC2 gene in the development of social cognitive abilities. Further, the location of the EFHC2 gene on the X chromosome may contribute towards explaining why impairments in social cognition occur more commonly in males than females.

Keywords: social cognition, genetics

Poster B4, Friday, October 12, 1:00 – 2:30 pm

The impact of family income, financial strain, and life stress on children's mental health: evidence from a longitudinal cohort study.

Garth E. Kendall^{1,2}, J. Anke M. van Eekelen², Eve Blair², Stephen R. Zubrick²,¹Curtin University, ²University of Western Australia

Presenter: Garth E. Kendall

Evidence in both animal and human research is strongly suggestive of a causal relationship between the experience of adversity pre and postnatally and later neurocognitive and mental health outcomes. The underlying mechanism is likely to include stress-induced perturbations in the development of the neuroendocrine stress axis and functional circuitry in the limbic system of the forebrain. To date, most studies in human populations have examined the direct impact of very strong, or "toxic", levels of early life stress exposure, such as recurrent physical and/or emotional abuse or extreme poverty. While the influence of extreme, or absolute, poverty is a very significant issue, it is also important to know if relative poverty, as identified by socioeconomic gradients, contributes to early-life adversity and subsequent alterations in life trajectories. There is little research that has looked at the relationships between family income, or more broadly wealth, the experience of life-stress, and the possible effect on children's neurocognitive development. The aim of the present study was to explore the hypothesis that family life-stress mediates the relationship between family income, or wealth, and fundamental behavioural manifestations of neurocognitive development, children's emotional, attentional, and social regulation. Prospective data were obtained from 1949 mothers and their children. A measure of family life-stress was administered during pregnancy and early childhood, as well as measures of family income and financial strain. The children's mental health was assessed at eight years of age via the Child Behaviour Checklist. Multivariate analysis adjusted for potential effect modifiers. Financial strain was reported as a family life-stress in over 80% of families who experienced multiple stressors. Family income was low in 50% of families who reported financial strain. Children exposed to family life-stress either in utero, in infancy and

toddlerhood, during their preschool period or in middle childhood only were at a slightly higher risk of developing mental health problems than children not exposed to periods of family life-stress. When children were exposed to a trajectory of family life-stress throughout more than one developmental period the prevalence of mental health problems increased greatly. Adverse mental health as a result of trajectories of family life-stress during critical periods of intrauterine and childhood development supports the notion of the biological embedding of experience. It is very likely that higher income, or wealth, gives rise to better material conditions for children and simultaneously improves the financial security of parents so as to reduce family life-stress which, in turn, benefits children's neurocognitive development through neuroendocrine pathways. Children whose early development is less than optimal are much more likely as adults to have poor educational attainment, low prestige occupations and low incomes, which places them at risk of life-long socioeconomic disadvantage.

Keywords: Social gradient, socioeconomic disadvantage, mental health problem, family life-stress, stress response, biological embedding

Poster B5, Friday, October 12, 1:00 – 2:30 pm

Dissociable early attentional control mechanisms underlying cognitive and affective conflict

Tao-Lin Chen¹, Yue-Jia Luo^{1,1},¹State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing, China

Presenter: Tao-Lin Chen

Conflict adaptation has been commonly observed in cognitive conflict tasks. However, whether affective conflict resolution employs the similar adaptation mechanism is unclear. In the current study, we examined similarities and differences in the temporal dynamics of cognitive and affective control. Participants were recorded electroencephalogram when they separately performed a cognitive and an affective version of the face-word Stroop task. By varying the proportion of congruent and incongruent trials in a testing block, we demonstrated a context-modulation effect on different processing levels of the cognitive and affective conflict. We observed an increase in the amplitude of the early anterior N2 ERP component in the mostly cognitive incongruent context as well as in the mostly affective congruent context. Moreover, when comparing the N2 effects between the mostly incongruent and the congruent contexts using the sLORETA inverse solution, the N2 effects across the two tasks were localized to the dorsolateral prefrontal cortex, but displayed positive and negative activities in the cognitive task and the affective task, respectively. In addition, the amplitude of the later posterior conflict sustained potential enhanced and showed a positive correlation with the response interference in the mostly congruent context during the two tasks. Our findings suggest the presence of early dissociable attentional control mechanisms and a common conflict response system underlying cognitive and affective conflict.

Keywords: N2; conflict SP; cognitive control; affective control; event-related potentials.

Poster B6, Friday, October 12, 1:00 – 2:30 pm

My anterior insular cortex unattentively hears your disgust

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Presenter: Chenyi Chen

Although a general consensus holds that the anterior insular cortex (AIC) has a critical role in disgust recognition, available neuroimaging studies have yet not found that the AIC activation is related to hearing disgust in voices. This study measured the magnetic counterparts of mismatch negativity (MMNm) and P3a (P3am) using magnetoencephalography while the emotionally meaningless syllables 'dada', spoken as neutral, happy or disgusted prosodies, along with acoustically matched simple and complex tones were presented in an auditory oddball paradigm. The results show the involvement of the AIC in the automatic perception of disgusted voices, as indicated by the MMNm-related AIC activation specific to the disgusted syllables rather than the happy syllables. Their acoustic equivalents, simple and complex tones, did not activate the AIC in the same manner. This specific activation was associated with the accuracy of the emotional categorization task. Furthermore, P3am-related insular activation was correlated with alexithymic traits. These findings may shed some light on the neural mechanisms of emotional MMNm and lend support for a role of the AIC in the perception of disgusted voices.

Keywords: mismatch negativity (MMN); magnetoencephalography (MEG); anterior insula (AIC); disgust; voice

Poster B7, Friday, October 12, 1:00 – 2:30 pm

Attentional Bias for Facial Pictures between High and Low Shyness Individuals

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Presenter: Yuanyan Hu

Shyness is a common phenomenon in human beings (Zimbardo, 1990), it may be defined experientially as discomfort and/or inhibition in interpersonal situations that interferes with pursuing one's interpersonal or professional goals. Next, it was suggested that shyness and social phobia are related constructs but not completely synonymous (Chavira, Stein, & Malcarne, 2002). Wealth of research have demonstrated that attention is biased towards negative stimuli in individuals with social phobia or social anxiety. (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Bradley, Mogg, Millar, Bonham-Carter, Fergusson, Enkins, & Parr, 1997). However, few research concerned about attentional bias in individuals with different level of shyness. To examine the characteristics and internal mechanism of attentional bias in individuals with different level of shyness, the Spatial Cueing Task designed by Posner & Boies (1971, 2008) was used to measure attentional bias for emotional faces because this paradigm can differentiate the components of attentional bias (vigilance, difficulty in disengagement or both). In this study, 32 subjects (16 lowly shy and 16 highly shy) were recruited from 200 undergraduates based on scores on the Shyness Scale (SS, range 13-65; Cheek & Buss, 1983). Participants' score over 38 were recruited for the highly shyness

group, below 25 were recruited for the lowly shyness group. In the Spatial Cueing Task, 72 facial expressions were used as cues including three types. Each consists of 24 positive, neutral or negative facial expressions. All of them were selected from the Chinese Affective Picture System (CAPS: Bai, Ma, Huang, & Luo, 2005). Targets appeared either in the same location as the image (valid trials) or in the different location to the image (invalid trials). A 2 (shyness: high, low) \times 2 (cue validity: valid, invalid) \times 3 (emotional facial type: positive, neutral, negative) mixed ANOVA was conducted on the average reaction time of Spatial Cueing Task. The results established a significant interaction among the three factors. $F(2, 60) = 3.986, p = .24$. Then, the Simple Effect Test was conducted. It revealed that high shyness individuals showed significantly longer reaction time, when the cue of face was negative relative to neutral and positive on invalid trials. Low shyness individuals cost less reaction time to a target when the cue of face was positive or negative relative to neutral on valid trials. The results suggested that attentional bias in high shyness individuals may have difficulty in disengaging from negative stimuli. On the contrary, the low shyness participants were not sensitive to the emotional faces, thus, they got the longest time to processing the neutral stimuli. Although low shyness is typically viewed as beneficial for individuals, this finding revealed 'dark side' to low shyness.

Keywords: Social cognition

Poster B8, Friday, October 12, 1:00 – 2:30 pm

Growing More or Less Empathy with Age? An fMRI study

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Presenter: Yao-Chu Chen

Empathy is crucial for social interaction throughout human life. To provide a better understanding of the aging changes of empathy, we used the well-validated fMRI paradigm to investigate the component processes involved in perceiving others in pain. The current study recruited three groups of subjects: young (YOU, age $M \pm SD = 23.4 \pm 2.5$ years, $n = 21$), middle (MID, 43.7 ± 3.1 , $n = 21$) and old age (OLD, 69.4 ± 4.4 , $n = 21$). Behaviorally, the OLD scores lower in the subscales of the interpersonal reactivity index except the perspective taking subscale than the YOU and/or MID. Neuroimaging results showed that the YOU and MID rather than the OLD had a pain effect in anterior insula. The inferior frontal gyrus revealed a pain effect only in the YOU whereas the TPJ exhibited a pain effect only in the OLD. Significant negative correlations between age and hemodynamic activity were found in anterior insula, anterior mid-cingulate cortex, temporoparietal junction and inferior frontal gyrus. Our result suggested the decline of regional brain activities in areas processing pain empathy might contribute to the empathic difficulties in elderly.

Keywords: Empathy, Aging, Functional MRI

Poster B9, Friday, October 12, 1:00 – 2:30 pm

Differential states of subjective power influence spontaneous facial mimicry.

Evan Carr¹, Piotr Winkielman¹, Christopher Oveis^{1,1}; ¹University of California, San Diego

Presenter: Evan Carr

Subjective power involves the feeling of being able to control or influence the actions of others. Evidence from psychology and neuroscience has also identified behavioral mimicry as an index for interpersonal affiliation and rapport. Yet, research into how different levels of subjective power directly impact mimicry behavior is surprisingly limited. We used facial electromyography (fEMG) to measure motor unit action potentials (MUAPs) from two muscles in the face: zygomaticus major ("smiling muscle" that brings up the corners of the mouth) and corrugator supercilii ("frowning muscle" that furrows the brow). To examine mimicry behavior, subjects watched dynamic videos after completing a writing prime to induce feelings of high- or low-power. Videos were of happy and angry expressions for 4 different FACS-coded models that were randomly assigned to high- and low-status jobs. We measured fEMG response at 500ms intervals across 80 5-second video trials and used linear mixed models (ReML) for repeated measures analyses. Zygomaticus analysis showed a significant 3-way interaction, where control participants showed standard mimicry with more zygomaticus activity to happy videos; however, high-power subjects mimicked low-status models more, and showed a reversed mimicry pattern for high-status models compared to other conditions, $p < 0.05$. Low-power subjects did the opposite, where they seemed to reverse mimic low-status models, although this pattern did not reach significance, $p = n.s.$ Data from the zygomaticus also revealed that reactivity unfolded differently across the 5000ms trials in a significant condition*status*time 3-way interaction, $p < 0.05$. Corrugator evaluation showed a main effect of valence, where all participants reacted with more mimicry (more corrugator response to angry videos), $p < 0.01$. This was qualified by a subordinate significant 2-way interaction that showed more mimicry occurred to high-status models across all conditions, $p < 0.05$. Therefore, we have shown that (1) feelings of high- and low-power lead to distinct changes in spontaneous facial mimicry (and these changes are different between high- and low-power states), and (2) these effects are impacted by the perceived status of the mimicry target. Correspondingly, the present research establishes a relationship between power and mimicry. The results suggest that subjective states of high-power and low-power can have fundamental impacts on emotional awareness and perception, which are evident in nonverbal behaviors such as mimicry. The current study spurs interesting and immediately applicable questions for research in emotion, relationships, and social hierarchies.

Keywords: Electrophysiology, emotion, facial

Poster B10, Friday, October 12, 1:00 – 2:30 pm
Face Recognition in 3D: An Eye-Tracking Study

Olga Chelnokova¹, Bruno Laeng^{1,1}; ¹University of Oslo

Presenter: Olga Chelnokova

One unresolved question about face perception is: what is the role of three-dimensional information in face perception? In normal circumstances of a social encounter, as well as in the course of childhood development, face learning occurs in the situation of

contact over short distances, when 3D cues are available for the observer. This creates the possibility that 3D information is used and plays a role in forming internal face representations. In this study, recognition performance was compared across changes in viewpoint in different depth conditions: a 2D condition without stereo information and a 3D condition, where stereo information was present (by viewing the same face images as anaglyphs through the 3D glasses). Subjects' eye-movements were recorded during both 3D and 2D sessions. The findings revealed that participants were more accurate in the 3D condition. Moreover, individual differences in inter-pupillary distance also predicted recognition performance in the 3D but not in the 2D condition. A 'region of interest' analysis of gaze data showed that rich volumetric properties provided by certain facial features (e.g., the nose and the cheeks) were attended more in the 3D condition compared to the 2D condition. Taken together, these findings support the conclusion that face recognition across viewpoint transformation is facilitated by the addition of stereoscopic depth cues.

Keywords: face perception, eye movements

Poster B11, Friday, October 12, 1:00 – 2:30 pm

Perceiving Naturalness in Nonverbal Behavior: Neural Correlates of Processing Movement Kinematics and Interpersonal Contingencies in Dyadic Interactions

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Presenter: Alexandra Livia Georgescu

The present study aimed to determine the differential contributions of the action observation network (AON) and the social neural network (SNN) in assigning meaning to nonverbal behavior as observed in dyadic social interactions. This enabled us to also characterize the contribution of two key features of movement activity to the perception of meaning in social stimuli: movement kinematics and interpersonal contingency. Short animations of nonverbal social interactions between two virtual characters were used and were developed based on live-action video recordings. Kinematics was varied by realizing either a smooth or a rigid velocity profile. Contingency was varied by showing either the two original characters or one character together with its reflection. Scrambled videos served as a control condition. A group of 21 male participants rated the "naturalness" of the observed scenes on a four-point scale while undergoing fMRI. Behavioral results revealed that both contingency and kinematics information had an effect on perceived naturalness. In addition, neural results showed that this relied on a differential recruitment of the AON and the SNN. The AON was preferentially engaged when processing contingent movement patterns but did not discriminate with regard to kinematics. In contrast, regions of the SNN were engaged more strongly when observing rigid movements, which are likely perceived as an expectancy violation and thus prompt inferences about the agents' intentions.

Keywords: social neuroscience, fMRI, social interaction

Poster B12, Friday, October 12, 1:00 – 2:30 pm
The role of the opioid system in reward responsiveness

Marie Eikemo¹, Guido Biele¹, Jeppe Kjær Riegels¹, Guro Engvik Løseth¹, Frode Willoch², Siri Graff Leknes¹; ¹University of Oslo, Department of Psychology, ²University of Oslo, Department of Medicine

Presenter: Marie Eikemo

Studies of non-human animals have provided ample evidence that opioids are involved in reward processes (e.g. Berridge, 2003, Brain Cogn). Pharmacological manipulation of central opioid levels also modulates phasic dopaminergic activity in the striatum via opioid actions on the VTA (Nestler, 2005, Nat Neurosci) and thus suggests a role of opioids for reinforcement learning. Compared to the clear results from animal experiments, less is known about the role of the opioid system for human reward processes. We hypothesized that an opioid agonist would increase, and an opioid antagonist would decrease responsiveness to rewards in healthy humans. We tested 30 healthy male participants on a reward responsiveness task (adapted from Pizzagalli et al, 2005, Biol Psychiatry) using a randomized, placebo-controlled double-blind design. Participants received oral treatment with a μ -opioid agonist (morphine 10 mg), a non-selective opioid antagonist (naltrexone 50 mg) or placebo on three separate days. One of three locally developed versions of the reward responsiveness task was completed 1-2 hours after administration of each drug/placebo. The reward responsiveness tasks were two-alternative signal detection tasks with a skewed reward schedule. For the 'rich' stimulus, 75% of correct answers were rewarded, whereas 25% of correct answers for the 'lean' stimulus were rewarded. Reward responsiveness is operationalized as a bias towards identifying stimuli as 'rich'. Stimuli were schematic faces which differed in the size or position of the mouth. In line with our hypothesis, the results showed that opioid agonist treatment (morphine) significantly increased bias relative to placebo and that opioid antagonist treatment (naltrexone) significantly decreased bias relative to placebo. These effects could be due to either a direct effect of opioid agonism/antagonism on the neural reward system, or due to indirect effects of opioid signaling on striatal dopamine functioning. Notably, although our naltrexone condition would be expected to block endogenous opioid function, reward responsiveness was not completely eliminated. This could indicate that opioids may be involved in, but not necessary for this effect. Overall, our findings confirm a role for the opioid system in human reward responsiveness.

Keywords: Human Reward, Opioid, Reinforcement

Poster B13, Friday, October 12, 1:00 – 2:30 pm
Neural systems related to paternal empathy in humans

Jennifer Mascaro^{1,2,3}, Patrick Hackett¹, James Rilling^{1,2,3,4,1}; ¹Emory University Department of Anthropology, ²Center for Behavioral Neuroscience, ³Emory University Department of Psychiatry and Behavioral Sciences, ⁴Center for Translational Social Neuroscience

Presenter: Jennifer Mascaro

Mounting evidence highlights the importance of fathers not only for decreasing deleterious childhood behaviors, but also for fostering childhood flourishing. While father absence is associated with increased incidence of substance abuse, aggression and conduct disorder, and risky sexual behavior, the presence of an empathic

and nurturing father is linked with children's enhanced intelligence, academic competence, empathy, and relationship quality. However, very little is known about the neural systems related to paternal empathy and nurturance. To explore the neural correlates of paternal empathy, the current study compares neural responses of fathers and non-fathers to child picture stimuli. Fathers of children age 1 or 2 (n = 34) and age-matched, non-married, non-fathers (n = 26) underwent functional magnetic resonance imaging (fMRI) while viewing unknown children (U) and unknown adults (A) with emotional facial expressions: happy (H), sad (S), and neutral (N). In addition, fathers viewed photographs of their own children (O). Participants were instructed to try to share the emotions of the person in each photograph. Collapsing across all emotions, fathers had increased activation to unknown children relative to unknown adults in brain areas known to be important for face perception including the fusiform gyrus, for empathy including the right anterior insula, for mentalizing including the dorsomedial prefrontal cortex (dmPFC), and for reward and attachment including the medial orbitofrontal cortex (mOFC), nucleus accumbens (nACC), and ventral tegmental area (VTA) (p<0.001). This response was primarily driven by a larger response to happy unknown children (UH – AH). In response to their own children's happy faces (OH – ON), fathers had more activity in the superior temporal sulcus (STS) and hypothalamus, regions important for perception of facial expressions and parental behavior respectively. These results are consistent with animal studies of fathering (hypothalamus) as well as human neuroimaging studies of maternal empathy and attachment (insula, STS, mOFC, and nACC), and are among the first to elucidate the neural systems important for paternal empathy.

Keywords: Paternal; Empathy; fMRI

Poster B14, Friday, October 12, 1:00 – 2:30 pm
Targeted gene expression in oxytocin neurons of prairie voles

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Presenter: Zack Johnson

Oxytocin (OT) is a nonapeptide that acts both peripherally and centrally by binding to target oxytocin receptors (OTRs) to mediate a range of functions, from uterine contraction during labor to social bonding between reproductive partners. Neuroanatomically, OT neurons are organized most densely in the hypothalamus. Large magnocellular neurons project from the hypothalamus to the posterior pituitary, where OT is released into the bloodstream to act peripherally. The details of central OT circuitry and release are less clear. Recent evidence suggests that the same magnocellular OT neurons projecting to the posterior pituitary may also send collateral projections to target forebrain regions containing OTRs, allowing for direct, local release. Thus, further investigation of these magnocellular OT neurons may offer valuable insights into the neural circuitry underlying complex behaviors. One of the most prominent animal models for investigating oxytocin and its role in complex social behavior is the prairie vole, *Microtus ochrogaster*. OT action in specific brain regions (e.g. Nucleus accumbens) is necessary for lifelong bonding between prairie vole partners. Our lab is particularly interested in developing strategies for targeted gene expression in magnocellular OT neurons of prairie voles,

both to enhance our understanding of this cell population in general and to further delineate neural circuits underlying complex social behaviors (e.g. using optogenetics). Recently, a recombinant adeno-associated viral vector was developed using 2.6 kb of conserved mouse OT promoter sequence to selectively drive expression of either Venus or Channelrhodopsin-2-mCherry in rat OT neurons. The goal of our experiment was to determine whether this mouse regulatory sequence could also be used to selectively drive gene expression in the prairie vole brain. We injected the same viral vector into the paraventricular hypothalamic nucleus (PVN) of prairie voles (n=10). Using immunohistochemistry, we observed ectopic expression at high injection volumes (~1 μ l), but at lower injection volumes (200 nl), we found that 100% of transfected neurons were also OT neurons. We plan to continue optimizing our injection protocol and also plan to perform triple labeling immunohistochemistry for Venus, OT, and arginine-vasopressin to further validate these findings.

Keywords: oxytocin, paraventricular nucleus, gene expression, viral vectors

Poster B15, Friday, October 12, 1:00 – 2:30 pm

Neural circuitry of social play: Distinct modes of interplay between septal vasopressin and GABA in males and females

Remco Bredewold¹, Caroline Smith¹, Kelly Dumais¹, Alexa Veenema¹; ¹Neurobiology of Social Behavior Laboratory, Department of Psychology, Boston College, Chestnut Hill, MA, USA

Presenter: Remco Bredewold

Social play is an affiliative and rewarding behavior that is displayed by nearly all mammals and peaks in juveniles. Social play is essential for the normal development of social behavior and is impaired in social disorders like autism. We recently showed that vasopressin within the lateral septum regulates social play in sex-specific ways. Moreover, recent in vitro studies suggest that vasopressin activates GABA interneurons in the lateral septum. We hypothesized that septal vasopressin regulates social play in sex-specific ways by interacting with septal GABA interneurons in sex-specific ways. To study this, single-housed 5-week-old juvenile male and female rats were exposed in their home cage to a sex- and age-matched unfamiliar rat for 10 min. We confirmed that administration of the specific vasopressin V1a receptor antagonist (CH2)5Tyr(Me2)AVP into the lateral septum enhanced social play in males, but reduced social play in females. Importantly, we showed that the GABAA receptor agonist muscimol blocked the V1a receptor antagonist-induced change in social play in both males and females. However, administration of the GABAA receptor antagonist bicuculline decreased social play in both males and females. Administration of vasopressin into the lateral septum of males and females had no effect on social play, despite a strong anxiogenic effect of vasopressin in males when tested on the elevated plus-maze. None of the other treatments altered anxiety-related behavior in males or females. Together, these findings demonstrate a complex and sex-specific interplay between vasopressin and GABA in the lateral septum in the regulation of social play. Alexa Veenema was supported by the Brain and Behavior Foundation (formerly NARSAD).

Keywords: vasopressin, lateral septum, social play, GABA, sex differences

Poster B16, Friday, October 12, 1:00 – 2:30 pm

Neural basis of self-efficacy in relation with persistence after failure

Ayaka Sugiura¹, Kou Murayama^{2,3}, Madoka Matsumoto⁴, Keise Izuma^{3,5}, Yukihito Yomogida^{3,4}, Ryuta Aoki^{3,4}, Toshikazu Hasegawa¹, Kenji Matsumoto^{4,1}; ¹Department of Life Sciences, GSAS, University of Tokyo, Tokyo, Japan, ²University of California, Los Angeles, CA, ³Japan Society for the Promotion of Science, Tokyo, Japan, ⁴Brain Science Institute, Tamagawa University, Tokyo, Japan, ⁵Caltech, Pasadena, CA

Presenter: Ayaka Sugiura

Self-efficacy (SE) is a belief that one is capable of carrying out actions needed to accomplish a goal. Previous psychological studies indicated that individuals with high SE would invest more effort to attain a goal over many failures than those with low SE. We hypothesized that this difference in the amount of effort investment depends on the processing of failure feedback in the medial prefrontal cortex (mPFC), a region associated with feedback processing in cognitive tasks. Participants (n=29) performed two sessions of an achievement task, in which they had to stop a stopwatch in the range of 5±0.05 sec after it started automatically. We examined the hemodynamic response of mPFC to task feedback using functional magnetic resonance imaging. Participants' task-specific SE was manipulated using false feedback. Participants received failure feedback in 30% (n=14, High group) or 70% (n=15, Low group) of trials in Session 1, and then experienced an increase or decrease in failure rate to 50% in Session 2 in order to emphasize surprise against failure or success in Session 2, respectively. Self-report task-specific SE (i.e. Motivated Strategies for Learning Questionnaire) was measured after each session, and the tendency to persist after failure was measured outside the scanner as the number of trials they voluntarily worked on the same task that always provided failure feedback. Self-report task-specific SE significantly dropped in High group (p=0.001, paired t-test) and significantly went up in Low group (p=0.001, paired t-test) after Session 2 compared to the task-specific SE before Session 2. Task-specific SE after Session 2 varied among participants and correlated with their behavioral tendency to persist after failure (r=0.36, p=0.026, one-tailed), suggesting that persistence after failure is a crucial determinant of task-specific SE. The mPFC showed significant interaction between group (Low group vs High group) and feedback type (Success vs Failure) in Session 2 (p<0.001, uncorrected). In High group, the activation of mPFC was greater for Failure feedback than Success feedback, and vice versa for Low group, corresponding to the amount of surprise (i.e., unsigned reward prediction error) against feedback. Moreover, the mPFC activation by failure feedback showed significant negative correlation with the tendency to persist after failure across participants only in High group (r=-0.75, p=0.002). These results suggest that the mPFC responsiveness to failure feedback determines the persistency to failure, and thereby the amount of effort investment to attain a goal, which is reflected in task-specific SE.

Keywords: Motivation, Anterior Cingulate Cortex, Prediction Error

Poster B17, Friday, October 12, 1:00 – 2:30 pm

The relationship between facial affect processing and empathy following moderate to severe TBI

Alyssa Adams¹, Kelly McCoy¹, Amanda Hull¹, Megan Kelly¹, Barbara Schwartz¹; ¹Washington, DC Veterans Affairs Medical Center

Presenter: Alyssa Adams

Goals: The ability to accurately identify what someone else is feeling is imperative to meaningful social interactions (Bornhofen & McDonald, 2008). Empathy and identification of facial expressions are two important components of social competence, and both are often affected in individuals following traumatic brain injury (TBI). Research has suggested that emotional empathy (experience sharing) and cognitive empathy (perspective taking) may rely on different neural networks (Zaki & Ochsner, 2012); we sought to examine how these different components of empathy relate to facial affect processing in patients with TBI. **Methods:** Participants included five Veterans who sustained a TBI and experience current psychiatric symptoms. They were administered a computer-based, facial affect recognition task (FAR) that assessed the ability to identify static facial expressions (e.g., happy, sad, angry), the Interpersonal Reactivity Index (IRI; Davis, 1983), a self-report measure of cognitive and emotional empathy, and The Awareness of Social Inference Test (TASIT; McDonald, Flanagan, & Rollins, 2002) that assessed the ability to accurately perceive dynamic emotion, sarcasm, and sincerity. **Results:** Results of a repeated measures, one-way ANOVA on FAR task performance showed a significant main effect for emotion ($F(6, 24) = 3.520, p = .012$). Participants' performance on the FAR task differed by type of emotional expression, such that participants were more accurate in their identification of happy and neutral faces and poorer in their identification of sadness, anger, and fear. On the IRI, participants reported experiencing more affective empathy than cognitive empathy ($t = 2.598, df = 4, p = .06$). In addition, empathy was correlated with FAR performance. Results indicated that participants who were better at identifying happiness on the FAR task reported higher levels of cognitive empathy $r(5) = .885, p = .04$. Participants who more often correctly identified sadness on the FAR task also reported experiencing more cognitive empathy $r(5) = .868, p = .05$. Empathy was not significantly associated with any TASIT scores. **Conclusion:** The facial expressions of happiness and neutral appear to be most easily identified by individuals with TBI. Sadness, anger, and fear were more difficult to accurately perceive. Individuals with TBI appear to be more likely to experience emotional empathy than cognitive empathy. Perspective taking, the cognitive component of empathy, requires the ability to intellectually appreciate the experience or expected experience of another. This may be particularly challenging to individuals following TBI. Results suggest that empathy is an important contributor to how individuals process emotion, perceive emotional displays, and convey understanding of emotion to others. Taken together, these findings are consistent with TBI literature, which suggests that individuals with TBI often have difficulties with perspective taking and identifying facial expressions.

Keywords: facial affect recognition, empathy, TBI

Poster B19, Friday, October 12, 1:00 – 2:30 pm

Neuropeptide and Hormone Receptor Changes in Mongolian Gerbils Following Parental Experience in Mongolian Gerbils

Elena Choleris¹, Anna Phan¹, Kathleen Laing¹, Laura Mison², Vithya Vivekananthan³, Virginia Roberts³, Rochelle Abadilla⁴, Jessica Mong⁵, Mertice Clark^{4,1} ¹Psychology and Neuroscience Program, University of Guelph, ²Molecular and Cellular Biology, University of Guelph, ³Biomedical Sciences, University of Guelph, ⁴Psychology, Neuroscience and Behaviour, McMaster University, ⁵Pharmacology and Experimental Therapeutics, University of Maryland

Presenter: Anna Phan

Mongolian gerbils (*Meriones unguiculatus*) are a social species that live in small family units with a reproductive male and female, both of which contribute to raising pups. In other rodent species, the neuropeptides oxytocin (OT) and vasopressin (AVP), and the hormone receptors for estrogen (ER?), progesterone (PR), and androgen (AR) are involved in a variety of sexually dimorphic social behaviours and parental behaviours. Therefore we examined sex differences and the effect of sexual and parental experience on the expression of these neuropeptides and hormone receptors in gerbils. Six females, 36 virgin males and 19 experienced males (which had mated and raised pups) were tested for various social and parental behaviours (e.g., time spent scent marking and mating, number of times the male gerbils were found in the nest, and the amount of time males spent with their pups when given a choice between either their pups and mate, or their pups and an empty chamber). Physiological measurements were also taken from the gerbils (e.g., including body, testes, seminal vesicles, and penile muscle weights). Brains were extracted and fixed with paraformaldehyde, then sectioned coronally (30 μ m). Sections were divided into 6 groups (every 6th section). Separate groups were immunostained for OT, AVP, ER?, PR and AR, and various brain nuclei were measured for the pixel density of immunostained cells using ImageJ. **Sex Differences:** OT staining did not differ between females and males, but AVP and ER? immunostaining was higher in females than in males, whereas PR immunostaining was significantly higher in males than in females. Preliminary evidence suggests that AR staining largely did not differ between the sexes, although males had more AR staining than females in the dorsal medial amygdala (dmAMY). **Sexual and Parental Experience in Males:** Both OT and AVP was lower in virgin males compared to experienced males. ER? staining in the dmAMY, ventromedial nucleus of the hypothalamus (VMN), and medial part of the medial preoptic area (mMPOA) was higher in virgin males compared to experienced males. PR staining was higher in virgin males compared to experienced males in the dmAMY, but did not differ in any of the hypothalamic nuclei examined. Preliminary findings indicate AR expression in the VMN is higher in virgin males compared to experienced males. Overall, neuropeptide and hormone receptor systems appear to respond in opposite directions following the experience of mating and raising pups (or perhaps as a function of age). Funded by NSERC.

Keywords: Paternal Behavior, Pair Bond, Sex Difference, Oxytocin, Vasopressin, Estrogen, Progesterone, Androgen

Poster B20, Friday, October 12, 1:00 – 2:30 pm

Multivoxel pattern analysis reveals a domain-general neural encoding of psychological distance

Carolyn Parkinson¹, Shari Liu¹, Thalia Wheatley^{1,1} ¹Dartmouth College

Presenter: Carolyn Parkinson

Converging theories from cognitive linguistics, social psychology and evolutionary biology suggest that different dimensions of psychological distance are encoded similarly. More specifically, the prevalence of spatial language in descriptions of social and temporal distances (e.g., "close friend," "distant future") may reflect the recycling of neural circuitry originally devoted to spatial processing in order to "plot" increasingly abstract contents as the inferior parietal lobule (IPL) expanded in size and function over the course of primate evolution. The IPL is recruited in spatial,

temporal and social distance processing. Do these overlapping activations reflect a shared neural code or nearby but distinct codes for different dimensions of psychological distance? The current study sought to resolve this question using multivoxel pattern analysis (MVPA) of fMRI data. Sixteen participants viewed photographs of familiar others and acquaintances, phrases referring to the immediate or remote future, and pictures of objects at close and far egocentric physical distances while being scanned in a 3T Philips scanner. Each trial consisted of one stimulus for 0.5 s followed by a second stimulus from the same category (physical, social or temporal) for 1.5 s. Participants were asked to think about the relative closeness, familiarity or "soon-ness" of the second stimulus relative to the first during physical, social and temporal trials, respectively. Two searchlight pattern classification analyses were performed on each subject's data. The first used a linear support vector machine learning algorithm trained on physical distance trials ("closer" vs. "farther") to classify temporal distance trials as either "sooner" or "later." The second used an analogous algorithm trained on physical distance trials to classify social distance trials as "more familiar" or "less familiar." Two independent one-sample t-tests were performed in order to compare participants' Talairach-transformed classification accuracy results for each searchlight analysis to chance performance. A conjunction analysis of these results revealed that representations of both temporal and social distance can be accurately decoded from representations of physical distance in the IPL bilaterally, an area consistently implicated in representing peripersonal space and in sensorimotor coordinate transformations. These findings provide a potential neural basis for a domain-general metric for egocentric psychological distance, and more generally, for suggestions that representations of physical space provide a "scaffolding" for representations of more abstract information.

Keywords: psychological distance, fMRI, grounded cognition

Poster B21, Friday, October 12, 1:00 – 2:30 pm

Tactile stimulation of the face activates single units in the primate amygdala.

Prisca E Zimmerman¹, Katalin M Gothard^{1,†}, The University of Arizona

Presenter: Prisca E Zimmerman

The amygdala receives input from multiple cortical areas that process sensory signals of all modalities. Neurons in the amygdala have been shown to respond to visual, olfactory, gustatory, and auditory stimuli. Here we report that neurons in the monkey amygdala respond to tactile stimulation of the face. The receptive fields of these neurons are typically large and bilateral suggesting that the amygdala contains a high-level representation of the face. Despite a relatively broad topography these neurons retain some features of primary somatosensory receptors: they produce either phasic (rapidly adapting) or tonic (slowly adapting) spike trains and discriminate types of stimulation (e.g., brushing, light pressure with a blunt point, grooming-like touch by the human hand). In addition to exteroceptive stimuli that distort the skin and muscles, these neurons also respond to interoceptive stimulation resulting from the production of facial expressions. For example, one neuron with a baseline firing rate of 76 Hz was entirely silenced (0 Hz) during tactile stimulation of the lips and when the monkey made a fear grimace or lipsmacking facial expression. A different neuron with a baseline rate of 30 Hz doubled its firing rate to 63 Hz when the ears were touched and when the monkey moved his ears as part of an orienting response. Of the 131 recorded neurons 16 (12%)

exhibited a significant response to the quality and/or location of tactile stimulation. These findings suggest that the amygdala contains a somatosensory representation of the face. Given the established role of the amygdala in evaluating the facial expressions of others, it is likely that the amygdala uses this representation of self to evaluate the emotional and social significance of one's own facial movements.

Keywords: monkey, amygdala, face, somatosensory, embodied emotion, neurons

Poster B22, Friday, October 12, 1:00 – 2:30 pm

Looking at the eyes engages single unit activity in the primate amygdala during naturalistic social interactions

Katalin M Gothard¹, Clayton P Mosher¹, Prisca E Zimmerman^{1,†}, The University of Arizona

Presenter: Katalin M Gothard

The eyes convey a wealth of information. A single glance at the eyes is sufficient to extract information about the emotional state (e.g. pupil diameter, frequency of eye movements, facial expressions), motivation, and even the intentions of others (e.g. direct threatening stare, frequently glancing at the same object/individual). Looking at the eyes is critical for complex social behaviors such as gaze-following and eye-contact induced facial mimicry. We induced these behaviors in monkey by exposing them to video clips of conspecifics displaying neutral, agonistic, or affiliative behaviors. In different segments of these videos, the movie monkey's eye gaze was directed toward or away from the viewer monkey. Each movie frame was co-registered with the scanpath of the viewer monkey to identify time periods when the viewer was looking at the eyes of the movie monkey. We hypothesized that these periods of "eye-looking" would induce heightened activation of single neurons in the amygdala. Moreover, we expected that this activation should vary depending on the social information conveyed by the eyes (e.g. eye direction, facial expression). We found that 23/151 (15%) of neurons in the amygdala discharged selectively or exclusively when the viewer monkey looked at the eyes of the movie monkey. These neurons had a response latency of 100-150 ms from the start of fixation on the movie monkey's eyes. They exhibited either excitatory (12) or inhibitory (6) responses to looking at the eyes, and either no response (or a polar opposite response) to looking at other parts of the face or body. Five neurons showed mixed, excitatory/inhibitory responses. While the majority of these neurons showed a phasic response when the eyes were looked at, a subset were tonically active the entire time that the eyes were scanned. Of these "eye-looking" neurons 4 showed significantly greater activity when the movie monkey's gaze was directed at the viewer (eye-contact) than when its gaze was averted. Additionally, 5 neurons differentiated among the eyes of neutral, agonistic, and affiliative expressions. These findings indicate that the amygdala contains neurons that are specialized to extract socio-emotional signals conveyed by the eyes during naturalistic social interactions.

Keywords: monkey, amygdala, eye contact, neurons, gaze following

Poster B23, Friday, October 12, 1:00 – 2:30 pm

Single unit activity in the primate amygdala discriminates social stimuli in a complex scene

Katalin M Gothard¹, Clayton P Mosher¹, Prisca E Zimmerman^{1,†}, The University of Arizona

Presenter: Katalin M Gothard

The majority of studies concerned with face processing in the amygdala used a paradigm where a single stimulus was presented at a time. The natural visual environment, however, consists of a complex array of faces and objects; the viewer is free to attend or ignore any of the items. The first goal of this study was to determine the response properties of neurons in the amygdala while the subject monkeys scanned freely a complex array of images. The second goal was to determine whether the activity of single neurons in the amygdala reflect its purported role in gaze-orienting (e.g., Adolphs et al, 2005; Gamer and Büchel, 2009). We presented monkeys with an array of 8 images (two monkey faces, two human faces, two flowers, and two fractals) arranged in a circle around a central fixation point. Images from each category had equal probability to be displayed at any of the 8 possible locations. In each session the monkey viewed 160 session-unique images. The monkey was free scan the array. We contend that if amygdala plays a role in gaze-orienting, then changes in neural activity are expected to predict the target of future saccades. If, however the amygdala is involved in extracting the emotional significance of the currently fixated element of the visual scene, then neural activity is expected to differentiate between fixations on monkeys, humans, and non-social stimuli. These scenarios are not mutually exclusive. We found that the first saccade (starting from the central fixation point) was most frequently directed to social stimuli (in 60% of cases a monkey face, in 22% a human face). The number of fixations and fixation duration was also significantly higher on social stimuli (on average 6 fixation of 280 ms average duration on monkey faces, compared to 4 fixations on humans, and 1 fixation on fractals and flowers each). None of the 47 recorded neurons thus far showed location-specific activity. Furthermore, firing rate changes strictly followed (rather than preceded) fixations, suggesting that the target of future fixations is not represented at the level of single neurons in the amygdala. Instead, 51% of the recorded neurons showed firing rate changes that were time-locked to fixations. Of these neurons 88% discriminated fixations on monkey faces. For example, a neuron with a baseline rate of 4 Hz, responded with 8Hz during fixations on a monkey face and 2Hz during fixations on humans, flowers, or fractals. These results suggest that the amygdala responds to the currently attended element of a visual scene and this response differentiates elements with high social relevance.

Keywords: monkey, amygdala, scanpaths, eye movements, gaze orienting, single units, face, conspecifics

Poster B24, Friday, October 12, 1:00 – 2:30 pm
Functional connectivity in the executive function network is associated with personality traits from the NEO PI-R

Micaela Y. Chan¹, Ian M. McDonough¹, Denise C. Park^{1,1}; Center for Vital Longevity and School of Behavioral and Brain Sciences, The University of Texas at Dallas

Presenter: Micaela Y. Chan

Past studies have found relationships between personality traits and neural markers, such as structural volume (Jackson et al., 2009) and functional activity (DeYoung et al., 2009) in specific structures. Given the complex dimensions inherent in personality traits, rather than focusing on individual brain structures, we examined the relationship between the big five personality traits and three types of neural networks—the Default Mode Network, (Greicius et al., 2003), the Executive Function Network, and the Salience Network (Seeley et al., 2007). Data were collected from a

large lifespan sample from the Dallas Lifespan Brain study (n=263, age = 20-89), allowing us to determine whether personality/connectivity relationships changed as a function of age. All participants completed a comprehensive personality questionnaire (NEO PI-R) and underwent resting-state fMRI (n=263, age 20-89). Network connectivity was assessed by using a goodness-of-fit measure, which estimates 1) the relative strength of functional connectivity within the network and 2) the degree of a network being spatially well-defined. To estimate goodness-of-fit, templates were created using seed-based functional connectivity analysis from an independent sample of 10 younger and 10 older adults. Using these templates, we calculated separate goodness-of-fit scores (GOF) for each participant, where GOF is the mean within-template connectivity subtracting mean outside-template connectivity for each network. As expected, the GOF in all three networks declined with age. Multiple regression analyses revealed that the Executive Function Network GOF was significantly associated with neuroticism, extroversion, openness, and conscientiousness, after controlling for age. Furthermore, network by age interactions were observed in openness, conscientiousness and neuroticism. Specifically, younger adults with high GOF in the Executive Function Network were found to be more open and conscientious than older adults, and older adults with high GOF in the Executive Function Network were found to be less neurotic than younger adults. Little relations were found between personality traits and the Default Mode and Salience Networks. These results suggest that a strong and well-defined Executive Function Network at rest may represent readiness to engage the network, which may facilitate more openness in younger adults. The Executive Function Network GOF may also provide a neural mechanism underlying the relation between highly conscientious individuals and performance in academic and work environments (Higgins, Peterson, Lee, & Pihl, 2007). Interestingly, Executive Function Network GOF is also linked to less neurotic traits among older adults. In sum, the study of network connectivity will enhance the understanding of how personality traits relate to its neural substrates.

Keywords: functional connectivity, personality, aging, fMRI

Poster B25, Friday, October 12, 1:00 – 2:30 pm
Ventromedial Prefrontal Cortex Modulates Social Pressure Effects On Decision-Making While Driving

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Presenter: Kuan-Hua Chen

Social pressure influences decision-making and behavior across multiple settings, including contributing to unsafe decision-making while driving, but the neural systems underlying this effect remain poorly understood. This study examined the role of ventromedial prefrontal cortex (VMPFC) in decision-making under social pressure using the human lesion approach. Participants were 9 subjects with bilateral VMPFC lesions, 11 brain damaged controls with lesions outside VMPFC, and 17 individuals without brain lesions. All subjects were tested in a go/no-go scenario in a driving simulator, where they had to decide when it was safe to make a left hand turn across oncoming traffic. Gaps between oncoming vehicles ranged from 3 to 9 seconds, and subjects had to select 10 safe gaps in each of 3 experimental conditions: a) social pressure condition with a vehicle honking behind the subjects as they

contemplated the left turn decision, b) a time pressure condition where subjects were asked to complete the condition as quickly as possible, but with no honking vehicle behind, and c) a control condition with no honking vehicle and no time pressure. Analysis of variance (ANOVA) indicated that the effect of time pressure on decision making did not differ among the three groups ($p = 0.61$), but the effect of social pressure was different between groups ($p = .02$). Post hoc comparisons further indicated that the VMPFC group was significantly more influenced by social pressure than the other two groups, i.e., more willing to accept potentially unsafe gaps (shorter times to contact) with oncoming traffic ($ps < .04$). These findings suggest that the VMPFC contributes to modulating the effects of social pressure during decision-making in a simulated real-world task, which is consistent with previous lesions research indicating that VMPFC damage increases a person's susceptibility to immediately present stimuli. The findings of this study also have safety-relevant implications about possible consequences of VMPFC dysfunction in real-world situations, particularly in automobile driving.

Keywords: Decision Making, Social Pressure, Ventromedial Prefrontal Cortex (VMPFC), Driving Simulation

Poster B26, Friday, October 12, 1:00 – 2:30 pm

Perceived Social Isolation Moderates the Relationship between Early Trauma and Pulse Pressure in Older Adults

Aaron B. Ball¹, Greg J. Norman¹, Louise C. Hawkey¹, Gary G. Berntson², John T. Cacioppo¹; ¹The University of Chicago, ²The Ohio State University

Presenter: Aaron B. Ball

Over a million children are subjected to some form trauma in the United States every year. Early childhood trauma has been shown to have deleterious effects on cardiovascular health in adulthood. The present study sought to replicate previous findings of the association between early childhood trauma and cardiovascular health, indicated in this case through elevations in pulse pressure, which has previously been shown to be a proxy for arterial stiffness. Importantly, not all individuals who experience early childhood trauma go on to exhibit cardiovascular health issues. One potential reason for this variation is individual differences in social bonds. For example, the presence of strong social bonds as an adult has previously been shown to buffer individuals against many of the harmful effects of early trauma. Therefore, a lack of strong social bonds, such as that seen in individuals with a high level of perceived social isolation, may exacerbate the harmful effects of early trauma on cardiovascular health. Thus, a secondary goal was to determine the extent to which perceived social isolation moderates the aforementioned relationship between early childhood trauma and heightened pulse pressure. Data were collected as part of the Chicago Health, Aging, and Social Relations Study, a longitudinal examination of cardiovascular health in aging individuals ($n = 229$; mean age = 57.49 yrs.; ethnicity = 34.7% African American, 28.8% Hispanic; sex = 51.4% Female; mean years of education = 13.29). Simple regression analysis revealed that early trauma was significantly related to levels of pulse pressure with higher trauma values associated with higher pulse pressure ($\beta = 2.671$, $SE = 1.043$, $p = 0.009$). Similarly, perceived social isolation was found to be significantly related to individual levels of pulse pressure such that higher levels of perceived isolation were associated with higher levels of pulse pressure ($\beta = 0.244$, $SE = 0.087$, $p = 0.001$). In order to investigate whether perceived social isolation moderates the relationship between early trauma and pulse pressure, we

performed a moderated regression analysis (Aiken & West, 1991). As predictors, we entered centered values for early trauma, perceived social isolation, and the cross-product of early trauma and perceived social isolation. The interaction was subsequently decomposed to examine the potential moderational role of perceived social isolation as previously described (Aiken and West, 1991). A significant positive interaction was detected for the interaction term of perceived social isolation and early trauma ($\beta = 0.189$, $SE = 0.095$, $p = 0.048$). A simple slope analysis showed that pulse pressure was positively predicted by early trauma in participants who scored one standard deviation above the mean of perceived social isolation ($\beta = 4.141$, $SE = 1.236$, $p = 0.001$) but not in participants scoring one standard deviation below the mean of perceived social isolation ($\beta = 0.412$, $SE = 1.548$, $p = 0.791$). Thus, these data suggest that the association between early trauma and cardiovascular health, as indexed by pulse pressure, is dependent upon participant's current state of perceived social isolation.

Keywords: Pulse Pressure, Trauma, Loneliness

Poster B27, Friday, October 12, 1:00 – 2:30 pm

The use of novel operant conditioning paradigms to assess social motivation in BTBR and C57BL/6J mice.

Caleb Wood¹, Bryan Lopez¹, Jared Luttrull¹, Loren Martin¹; ¹Department of Psychology, Azusa Pacific University

Presenter: Loren Martin

Research on mouse models will benefit from the development of novel assays of complex social behavior including social motivation. The goal of this research is to develop and validate new quantitative measures of social motivation for mouse models of autism and other disorders involving social deficits. To this end, two operant conditioning paradigms that allow a test mouse to control access to another mouse have been employed. In the first paradigm (the social motivation task), the test mice were trained to press a lever for a social reward in the form of access to an unfamiliar stimulus mouse for 15 sec. The social reward was set on a progressive ratio schedule with a step size of three. The number of lever presses achieved in the final trial of a testing session (breakpoint) was used as an index of social motivation. In the second paradigm (the valence comparison task), motivation for a food reward was compared to a social reward. The mice were conditioned to associate one lever consistently with a food reward and another consistently with the same social reward described in the previous paradigm. Research has been carried out with the C57BL/6J (B6) mouse, a prosocial inbred mouse strain, and the BTBR T+ tf/J (BTBR) mouse, an inbred mouse strain with previously documented social deficits. Comparisons were made between mouse strains and between individually- and group-housed B6 mice. Thus far, all B6 mice ($n = 15$) have successfully learned to lever press for a social reward, but only 5 of the 9 BTBR mice made this learned association. Mice that acquired the operant tasks were tested over 20 sessions in each paradigm, with asymptotic performance observed for the last 10 sessions. Group comparisons were therefore made using the mean breakpoint over the last 10 test sessions for the social motivation task and the mean ratio of food to social rewards over the last 10 test sessions for the valence comparison task. Results indicated that there was no difference in social motivation between group-housed and individually-housed B6 mice for both paradigms. Preliminary results indicate a trend for the BTBR mice to have a reduced breakpoint compared to the C57BL/6J mice, however, they also show an increased ratio of food versus social rewards in the

valence comparison task. We are therefore conducting a separate probe to determine if the BTBR mice have an increased level of food motivation compared to the B6 controls. In addition to the above novel quantitative measures of social motivation, traditional assessments of social behavior are being conducted through the use of the ANYMAZE video tracking system, including a version of the social choice paradigm.

Keywords: social motivation

Poster B28, Friday, October 12, 1:00 – 2:30 pm
Investigating Ganser Syndrome using neuropsychological measures of effort: A case study

Jennifer Brotsky¹, Elizabeth Houghton-Faryna¹, Arthur DiRocco^{1,2}, Riverview Psychiatric Center

Presenter: Jennifer Brotsky

A 33-year-old male presented for his first inpatient psychiatric hospitalization with Ganser-like symptoms. A combination of inconsistent historical data, the guardian's declination of records, and the client's erratic behaviors led examiners to consider motivation as a contributing factor. Given this client's complex presentation it is imperative to incorporate effort measures when considering atypical neuropsychological symptoms. This case highlights the importance of utilizing effort measures when diagnosing atypical disorders such as Ganser Syndrome, which is not yet standard practice. Immediately prior to hospitalization, the client sustained a concussion followed by a significant functional decline including a loss of expressive language, poor hygiene, odd behaviors, and an inability to state personally identifying information. He was referred for neuropsychological testing based on a history of multiple prior head injuries reported by his mother/temporary guardian. A functional behavioral analysis indicated that maternal presence is negatively correlated with his display of maladaptive behavior. Neuropsychological testing with explicit and embedded effort measures revealed inconsistent effort on every measure administered with many measures "below chance." The client's level of impairment was difficult to reconcile with his professional and academic success as a civil engineer and negative head CT scans. The client's report of impaired memory, personal identity loss, unexplainable medical complaints and inability to perform simple tasks lead the clinician's to consider a diagnosis of Ganser Syndrome. This case demonstrates that Ganser-like symptoms and atypical neuropsychological presentations warrant close scrutiny with measures of effort and motivation.

Keywords: Effort testing, Ganser Syndrome

Poster B29, Friday, October 12, 1:00 – 2:30 pm
A New Intervention Program for Social Cognition Rehabilitation in Traumatic Brain Injury

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Presenter: Kelly McCoy

Goals: Social functioning difficulties following traumatic brain injury (TBI) are well-established in research literature and include loss of employment, constricted social networks, and strained intimate relationships. Individuals with TBI often display persistent deficits in social cognition tasks such as emotion detection, theory of mind,

sarcasm detection, and empathy (e.g., Channon, Pellijeff & Rule, 2005; Green, Turner & Thompson 2004; McDonald & Flanagan, 2004). There is also evidence of difficulty interpreting body posture, emotional scenes, and tone of voice (Braun, Lussier, Baribeau & Ethier, 1989; Jackson & Moffat, 1987; Pettersen, 1991). The goal of this study is to develop an intervention program to rehabilitate social functioning deficits in Veterans with TBI that is informed by current social neuroscience and best practices in cognitive rehabilitation and psychotherapy. The intervention aims to improve social competence, a multi-factorial construct that includes: a) social information processing (i.e., accurate detection, expression, and integration of social information), b) social interaction (i.e., the extent to which an individual engages with others to achieve prosocial goals), and c) social adjustment (i.e., self-perception of having achieved socially desirable goals). Methods: An intervention development model was used to translate neuroscientific findings regarding social cognition in TBI into a feasible and meaningful therapy. Stages of intervention development included: a) specification of problem and development of program theory, b) creation and revision of program materials, and c) refining program components. Two weekly groups lasting over one year each were completed with a 0% attrition rate. A third group was initiated with IRB and R&D approval for data collection. Baseline data assessed TBI symptoms, mental health symptoms, social functioning in daily life, performance on social cognition measures (e.g., Facial Affect Recognition, The Awareness of Social Inference Test (TASIT), Wechsler Adult Intelligence Scale – IV Social Perception Task), and performance on an executive functioning task (Delis-Kaplan Executive Function System Sorting Test). Results: Baseline findings on these measures are consistent with existing TBI research. For example, on average, participants performed in the low average to impaired range on all subtests of the TASIT ($z = -1.03$ to -2.30) except on the Sincere subtest, where they performed in the average range ($z = .028$). Data on these measures will be collected at 6 months and 11 months to track changes in performance associated with the intervention. A structured treatment manual is being developed. Topics include but are not limited to: facial expressions, tone of voice, body language, turn taking, sarcasm, misunderstandings, empathy, self-disclosure, small talk, trust, socializing without alcohol, social beliefs, social confidence, changing roles following TBI, and diffusing conflict. Videotaped role plays with feedback are used to practice social abilities in session, and social outings and homework assignments are used to generalize treatment gains to everyday settings. Conclusion: Social neuroscience has studied social functioning in isolation with simple tasks. This effort is designed to translate basic findings into complex social behaviors that occur in context. In turn, learning about complex social behavior in neuropsychological populations may inform our understanding of brain-behavior relationships for more ecologically relevant social behavior.

Keywords: social cognition, traumatic brain injury, rehabilitation

Poster B30, Friday, October 12, 1:00 – 2:30 pm
Estrogens rapidly modulate performance on a social learning task in mice

Kelsy Ervin¹, Jeffrey Friesen¹, Nicola Gallagher¹, Veronique Roussel¹, Jonathan Zicherman¹, Amy Clipperton Allen², Anna Phan¹, Elena Choleris^{1,2},¹University of Guelph, Guelph, ON, Canada, ²Scripps Research Institute, Jupiter, FL, United States

Presenter: Kelsy Ervin

The social transmission of food preferences (STFP) is a form of social learning often studied in rodents. In the STFP, an animal exhibits a preference for a novel food based on olfactory cues provided by a conspecific during a previous social interaction. Estrogens affect several social behaviours, and act through different receptors in the brain, including estrogen receptor (ER) alpha, ER-beta, and the G-protein coupled estrogen receptor (GPER). In mice, estradiol and an estrogen receptor (ER) beta agonist prolong the preference for the demonstrated food, while an ER-alpha agonist blocks learning (Clipperton et al., 2008). In these studies, STFP was tested 48 hours after drug treatment. On this time scale, the effects of estrogens on STFP are likely due to genomic effects. Estrogens are also known to affect behaviour on a rapid time scale, within hours to minutes after administration. For instance, ER-alpha and GPER agonists improve social recognition and ER-beta agonists impair social recognition in female mice 40 minutes post-administration (Gabor, unpublished data; Phan et al., 2011). The rapid effects of ER activation on the STFP are currently unknown. We therefore administered 17beta-estradiol, the ER-alpha agonist propyl pyrazole triol (PPT), the ER-beta agonist diarylpropionitrile (DPN), and the GPER agonist G-1 to female ovariectomized observer mice 15 minutes prior to a brief exposure to a recently fed ovariectomized demonstrator mouse. We used a "difficult" version of the STFP paradigm which allowed us to examine any enhancing effects of drug treatment on the acquisition phase of STFP, with particular attention to the first hour of the observer food choice test to assess rapid effects. Results show that 17-beta estradiol improves performance within the first hour. PPT had no effect on learning and mice treated with DPN showed a delayed improvement, at 2 and 4 hours post-acquisition. Experiments with G-1 are still in progress, but may help explain the early improving effects of estradiol. These results resemble those found with the long-term effects of ER-alpha and ER-beta agonists, but are distinct from the rapid effects on social recognition, which was enhanced by PPT and inhibited by DPN. These results show that estrogens can rapidly affect performance on a social learning task, and imply that these effects on the STFP are different from the effects on social recognition, possibly by acting in different brain regions.

Keywords: social learning, estradiol, estrogen receptor

Poster B31, Friday, October 12, 1:00 – 2:30 pm

Evaluation of Empathy in Williams Syndrome: The Salk Institute Sociability Questionnaire

Patricia Fillet¹, Philip Lai^{1,2,3}, Yvonne Searcy¹, Lucia Chen³, Judy Reilly¹, Ursula Bellugi¹, ¹The Salk Institute for Biological Studies, La Jolla, CA, ²San Diego State University, San Diego, CA, ³University of California San Diego, La Jolla, CA

Presenter: Patricia Fillet

Empathy is a social experience of sharing feelings or reading another's emotions. The new field of social neuroscience seeks to understand how biological systems are able to process social behaviors. Williams syndrome (WS) is a rare genetic disorder often characterized by inappropriate hyper-sociability, compared to other genetic disorders such as Down Syndrome (DS) (Jarvinen-Pasley, et al, 2008). Some have proposed that WS' social behaviors are akin to "cocktail party chatter." The aim of our present study is to investigate the degree to which social behaviors in WS reflect an emotional sensitivity to others. Our participants consisted of individuals with Williams Syndrome (WS, N= 130), Autism Spectrum Disorder (ASD, N= 43), Down Syndrome (DS, N= 35); and Normal Controls (NC, N= 109). These groups were further bifurcated into children 8-17 and adults 18-33

years. The Salk Institute Sociability Questionnaire (SISQ) is a questionnaire using a seven-point Likert scale and measures aspects of sociability, including aspects of empathy. Caregivers completed the ratings for the participants with neurodevelopmental syndromes, while NC provided self-ratings. Four items on the SISQ associated with empathy were examined. Three separate ANOVAs were conducted to examine group gender and age differences. A 4x2 (group (ASD, DS, TD, WS) by gender) multivariate ANOVA was conducted on children (ages 8-17). Group differences were found for all 4 items. Post-hoc analyses revealed higher ratings for the WS group on "how likely is your child to comment on the emotional state of other individuals" and "participant comments on others' emotional states" than the other three groups. On "accurate assessment of emotional states," the WS group scored higher than both ASD and DS groups; finally on "participants eagerness to please" revealed differences between WS and ASD: WS were rated higher. A second 3x2 (group (DS, TD, WS) by gender) multivariate ANOVA was conducted on adults (ages 18-34). For all 4 items, WS scored significantly higher than the DS group, while scoring significantly higher than the TD on 3 items. On emotion accuracy, the DS group was rated significantly lower than TD and WS groups. Finally, a 3x2 (group (DS, TD, WS) by age) ANOVA showed no differences; scores on these four measures were fairly stable across age ranges. Overall, across ages, the WS group show more empathic behaviors than the other groups, suggesting that their overfriendliness" includes significant elements of empathy.

Keywords: Williams syndrome, empathy, sociability

Poster B32, Friday, October 12, 1:00 – 2:30 pm

Personality of Williams Syndrome versus Typical Development: Insight into the Social Phenotype

Rowena Ng¹, Ursula Bellugi^{2,1}, ¹The Salk Institute for Biological Studies

Presenter: Patricia Fillet

Williams syndrome (WS) is a genetic disorder most commonly known for their hypersocial phenotype, characterized by an overly friendly disposition, positive affective state, and attention to faces individuals (Doyle et al., 2004; Jones et al., 2000). The present study examined developmental differences in personality traits in WS and TD participants to observe changes in social dimensions. A total of 63 WS and 91 TD individuals were administered a brief version of the Multidimensional Personality Questionnaire. Participants were bifurcated into subgroups: those under 18 years are younger and those over 18 years are older. Our within-group findings observed no differences in social dimensions in younger versus older WS and TD participants. However, among social traits, younger and older TD participants consistently scored higher in Social Potency and Affective Positive Emotionality relative to WS group. Alternatively, WS individuals rated higher in Communal Positive Emotionality and Social Closeness than TD participants, suggesting TD and WS obtain well-being from relationships differentially. While WS individuals enjoy relationships because it affords close social ties, TD individuals appreciated social interactions because they offer opportunities to make personal impact on others (i.e., leadership, social dominance). Our findings offer a new definition of social personality in WS and provide evidence of the stability in their sociability across development.

Keywords: Personality, Neurodevelopmental Disorder, Williams Syndrome

Poster B33, Friday, October 12, 1:00 – 2:30 pm

Introducing the Communication of Affect Receiving Ability Test: Ecologically Valid Spontaneous and Dynamic Facial Displays for Social Neuroscience

Ross Buck¹, Stacie Powers², Rebecca Derven¹; ¹University of Connecticut, ²The Ohio State University

Presenter: Ross Buck

Most attempts to measure brain response to emotional faces employ posed photographs. Such stimuli lack ecological validity, particularly as the posing sender is not experiencing emotion. Spontaneous facial displays differ in internal timing from posed expressions, and such differences could well impact brain processes in receivers. An alternative approach employs dynamic color displays of spontaneous expressions as stimuli. We describe the Communication of Affect Receiving Ability Test: Spontaneous, Posed, Regulated (CARAT-SPR). CARAT-SPR is designed to measure brain responses to spontaneous expressions, as well as posed expressions and also regulated expressions, where a sender attempts to pose an emotional expression while presented with a stimulus of opposite valence. Spontaneous expressions were filmed while senders viewed pictures of “familiar persons,” “neutral,” and “unpleasant” pictures while filmed by a hidden camera; posed expressions were filmed after the camera was revealed and senders were asked to pretend to respond to pictures they had previously seen; regulated expressions were filmed while the sender was asked to pose seeing a picture of one valence while actually exposed to a picture of opposite valence. The initial item pool comprised 1250 spontaneous, 102 posed, and 86 regulated expressions (157 senders for spontaneous, 31 for posed and regulated). Two Test Version Forms (TVFs) comprising spontaneous items with the highest communication scores were chosen with no repeats on individual senders, and balanced by sender gender and slide category. Final “familiar” items were all rated for happiness at 5.00 or higher, “unpleasant” items rated for disgust at 5.20 or higher, and the “neutral” rated at 2.60 or lower for any emotion. TVF 1 included 19 familiar, 13 neutral, 20 unpleasant sequences. TVF 2 included 23 familiar, 14 neutral, 18 unpleasant sequences. These were shown to new groups of receivers. Communication accuracy (% slides correctly categorized) averaged 92.76%. Sixty-two final items were selected from TVF 1 and TVF 2, and were examined by investigators to choose the final 34 spontaneous items for the CARAT-SPR. Twenty four of these constitute a spontaneous CARAT-SPR subtest (4X2X3: four each of female and male senders viewing familiar, neutral, and unpleasant slides); ten additional spontaneous sequences (two each of female and male senders viewing familiar and unpleasant slides, one each of a female and males viewing a neutral scene) are presented with 8 Posed and 8 Regulated sequences for the spontaneous-posed-regulated CARAT-SPR subtest. Thus, the final CARAT-SPR comprises two subtests, 24 spontaneous items designed to be easily judged (< 95%) and 26 items in which 10 easily judged spontaneous items are mixed with 8 Posed and 8 Regulated items. Items are 4 seconds long. An initial test of the spontaneous items achieved a high detection accuracy (98.33%). CARAT-SPR is recommended as an alternative or supplement to posed pictures of facial affect in fMRI and EEG studies, using spontaneous expressions in which a high level of detection accuracy is required (>.95%); as well as exploring brain responses to posed and regulated expressions.

Keywords: Emotion, communication, empathy

Poster B34, Friday, October 12, 1:00 – 2:30 pm

Effects of Reward and Interest on the Neural Bases of Feedback Processing

Catherine Cho¹, Sung-il Kim¹; ¹Korea University

Presenter: Catherine Cho

Substantial research has implicated the role of monetary reward on motivating one to exert more effort and to increase frequency of behavior (Schultz, 2006). However, a number of studies suggest extrinsic rewards contingent upon performance can cause harmful effects on cognition and motivation (Ryan & Deci, 2000). One recent study indicates that a group of participants who were rewarded for successful trials were less likely to engage in the task in subsequent sessions, and revealed decreased activations in the striatum when money was no longer provided (Murayama et al., 2010). However, these studies have shown undermining effects after performing the task, and it is unclear whether similar effects take place while processing feedback during task performance. Therefore, the current study investigated the effects of reward and nonreward contexts on feedback processing while performing a task. Moreover, we aimed to investigate whether feedback processing of reward and nonreward conditions would differ depending on interesting and noninteresting trials. Participants engaged in a working memory task in which two factors were varied: interest and reward. For interesting trials, funny images of soccer players were presented, whereas noninteresting trials displayed plain images of soccer players. These trials were grouped into reward or nonreward blocks, indicating that subjects were able to receive money for successful trials in reward conditions, and vice versa in nonreward conditions. The trial began with a reward cue followed by the encoding phase during which four images of soccer players were presented. After a delay, participants were shown an image in the probe phase, during which participants had to decide whether the image was shown or not previously. A negative or positive feedback was subsequently provided depending on performance. Results indicate that for reward contexts, no significant activation was observed in negative feedback phase for interesting trials, whereas in nonreward conditions, interesting trials revealed increased activity in regions involved in negative feedback processing including the medial prefrontal cortex, orbitofrontal cortex, and inferior parietal lobule. Compared to reward conditions, positive feedback in nonreward conditions revealed increased activations in the middle frontal gyrus, medial prefrontal cortex, parahippocampal gyrus, and insula during interesting trials. These results suggest that the effect of monetary reward only enhances cognitive functions for uninteresting trials, and further indicate that when the task is inherently interesting, reward attenuates feedback processing.

Keywords: Feedback, motivation, reward

Poster C1, Friday, October 12, 6:00 – 7:30 pm

Neural Mechanisms underlying the female prevalence of affective disturbances from adolescence

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Cognitive and Social Neuroscience, Department of Psychology, University of Chicago, Chicago, Illinois, 60637

Presenter: Jiajin Yuan

Neural Mechanisms underlying the female prevalence of affective disturbances from adolescence Jiajin Yuan^{1,2} & Hong Li³ 1 Key Laboratory of Cognition and Personality of Ministry of Education, School of Psychology, Southwest University, Chongqing 400715, China; 2Center for Cognitive and Social Neuroscience, Department of Psychology, University of Chicago, Chicago, Illinois, 60637; 3 Research Center for Psychological Development and Education, Liaoning Normal University, Dalian, 116029, China; E-mail: yuanjiajin168@126.com Background and Research purposes: Abundant epidemiological literatures showed a greater prevalence of affective disturbances in females vs. males that starts from early adolescence. The psycho-neural mechanisms underlying this phenomenon have yet to be well understood. Our studies addressed this issue by focusing on the following three aspects: 1), sex differences in neural susceptibility to emotional stimuli of varying valence strengths in adult samples; 2), sex effect in susceptibility to startling, vigilance-related stimuli whose contents are neutral, emotion-irrelevant in adult samples; 3) pubertal influences on sex difference in susceptibility to emotional stimuli of varying valence strengths. Method: Study 1 required subjects to perform a standard/deviant distinction, irrespective of the emotionality of deviant pictures. Study 2 required subjects to perform an active and a passive version of oddball task, to address possible gender effect in reaction to neutral, unpredictably rare stimuli. Study 3 asked subjects to perform two modified three-stimulus oddball tasks, to address gender effect in responding to neutral, unpredictably novel stimuli. Study 4 resembles Study 1 in methodology, except that pre-pubertal and pubertal boys and girls replaced adult samples, to clarify how puberty influences sex differences in susceptibility to emotional stimuli of diverse strengths. ERP measures & subjective reports/ behavioral measures were used for the four studies. Results: In Study 1, we observed a prominent emotion effect for mildly negative stimuli in females but not in males; whereas both genders responded similarly to highly negative and to positive stimuli of diverse strengths. In study 2, we observed a significantly larger startling response in behavioral and neurophysiological indexes to rare stimuli in females vs. males. Similarly, Study 3 observed larger, and prolonged novelty-related brain responding, and greater subjective novelty feelings in females vs. males during three-stimulus oddball tasks. Study 4 observed that pubertal transition was associated with increased neural susceptibility to negative stimuli in girls, but with decreased susceptibility to these stimuli in boys. In addition, pubertal transition resulted in decreased susceptibility to positive stimuli in both sexes, and this effect was more pronounced in girls. Conclusions: women are more susceptible to negative emotions than men. This susceptibility is not only due to the decreased threshold for reaction to unpleasant events, but may also be a result of increased vigilance response to unpredictably rare, or novel stimuli whose contents are neutral, emotion-irrelevant. Moreover, this susceptibility may be associated with psychosocial and physiological changes during pubertal transition, a period that changes girls into “females”.

Keywords: sex difference, emotion susceptibility, pubertal transition, affective disturbances, Event-Related Potential

Poster C2, Friday, October 12, 6:00 – 7:30 pm
Neural correlates of the reward value for number of choice options

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Presenter: Ryuta Aoki

A large literature has described brain regions within which BOLD-fMRI tracks the value of stimuli and outcomes, notably including the ventral striatum (VS), orbitofrontal cortex (OFC) and medial prefrontal cortex (mPFC). Here we investigated a distinct aspect of choice: the value presented by the sheer number of options available, regardless of actual outcome. Furthermore, for the first time we investigate the relative coding of this type of value when the choices offered are one's own, or those of another person. A two-person game between 22 healthy participants (SELF) and a confederate (OTHER) presented numbers of options for each player that were manipulated independently (1, 2, or 4 available options) on a trial-by-trial basis. Reward outcomes were at a fixed 50% probability regardless of the number of options. A whole-brain GLM analysis identified responses to 1) the number of options for SELF, 2) for OTHER, and 3) the level of equality of option numbers between the two players. The number of options for SELF was significantly associated with increased activation of the VS. Level of equality was significantly associated with activation in the central OFC. After the scan, participants were asked to rate their emotions toward the numbers of options for SELF and OTHER. We found significant correlations across participants in the degree of positive emotion endorsed: in response to the number of options available to oneself (correlation with the VS activation, $r = 0.47$, $P = 0.029$), and in response to the level of equality (correlation with the central OFC activation, $r = 0.45$, $P = 0.037$). Closely regions within the VS and mPFC were activated by reward outcome for SELF and equity of outcome amongst the two players. All of these regions have been found to be implicated in prior studies of reward processing. The findings suggest that similar mechanisms are recruited not only when we obtain rewarding outcomes, but also when we have a greater number of options to freely choose among; and not only on trials with greater equity of reward outcomes, but also in greater equity of options available for choice. Freedom of choice may thus itself be rewarding.

Keywords: Social comparison

Poster C3, Friday, October 12, 6:00 – 7:30 pm
Serotonin-related genotypes influence social vigilance in free-ranging primates

Karli Watson¹, Daniel Li¹, Michael Platt¹, Pate Skene¹, Lauren Brent¹, ¹Duke University

Presenter: Karli Watson

In the dynamic and complex social structures of primates, the acquisition of social information is crucial to an individual's fitness. Because appropriate social interaction depends on the relatedness, sex, and rank of the individuals involved, as well as their reproductive and behavioral states, the collection of social information is imperative for adaptive decision-making. Like foraging, social information seeking is a process of accessing a variably distributed resource, under the constraint of costs associated with the search behavior. For example, visual information seeking can demand postures or behavioral states

incompatible with activities such as sleeping, drinking, or eating, by necessitating that the animal forgo these activities in order to gather information. Despite this, there is ample behavioral evidence that non-human primates will exert effort or incur some cost in order to gather social information. Moreover, previous research with captive rhesus macaques suggests that genetic polymorphisms associated with the serotonin system (the 5-HTTLPR polymorphism within the serotonin transporter gene, SLC6A4) influence social attention and decision making. Here we observe social vigilance behavior in individual macaques on the island of Cayo Santiago, Puerto Rico. We find that polymorphisms associated with the serotonergic system influence naturalistic patterns of social information gathering in free-ranging macaques.

Keywords: Neuroethology, primates, behavioral genetics

Poster C4, Friday, October 12, 6:00 – 7:30 pm

Toward a better understanding of social reward: roles of experience, status, aggressivity, and associated neural activation in the ventral tegmental area

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Presenter: Mario Gil

Most studies investigating the rewarding properties of social interactions between conspecifics have focused on aggressive and reproductive behaviors. For example, Syrian hamsters develop a conditioned place preference (CPP) for copulation and aggression. Our current research seeks to determine whether non-aggressive interactions between male hamsters are also rewarding; what roles social experience, status, and aggression play in social reward; and whether social interactions are associated with long-term changes in neural activity. We have previously shown that both dominant male hamsters and their subordinate partners develop a CPP for social interactions. However, the rewarding effects of social interactions were greater for dominant animals relative to their submissive partners. We also found that increased c-Fos-immunoreactivity (ir) in the ventral tegmental area (VTA), elicited by a new social encounter, was positively correlated with previous aggressive experience. To expand on our previous findings, we tested whether social interactions and/or exposure to a caged stimulus animal increase c-Fos-ir in the VTA compared to controls. We also tested whether previous social experience changes c-Fos-ir in the VTA in response to novel social stimuli (i.e., a social encounter or caged stimulus male). Here we report that male hamsters that were allowed to interact with a subordinate male partner had higher levels of c-Fos-ir in the VTA compared to controls that were exposed to an empty cage and males that were exposed to a caged stimulus male. Interestingly, we also found that males with previous social experience had higher levels of c-Fos-ir in the VTA, in response to a caged stimulus male, compared to naïve males that had been isolated prior to being exposed to a caged stimulus male. Taken together, our data suggest that social interactions between male hamsters are rewarding in both aggressive and non-aggressive contexts, and that social status modulates the rewarding value of social interactions; that is, social dominance increases social reward value. Social interactions stimulate the mesolimbic reward system, and previous social experience enhances its response to novel social stimuli. In addition, previous experience expressing higher levels of social dominance and aggression is associated with increased activation of the mesolimbic reward system in response

to a new social encounter. This work was supported by NSF Grant IOS-0923301 to HEA.

Keywords: Social Reward, dominance, aggression, mesolimbic reward system, conditioned place preference

Poster C5, Friday, October 12, 6:00 – 7:30 pm

Mu Suppression, Empathy and Distraction

C. Chad Woodruff¹; ¹Northern Arizona University

Presenter: C. Chad Woodruff

Given the importance of perspective-taking, empathy and intention understanding to human sociality, it might be argued that the neural correlates of these would be engaged automatically. Indeed, some have suggested that social mirroring in the brain may be automatic and involuntary. Using a putative electroencephalographic measure of human mirror neuronal processing, mu rhythms, we tested the hypothesis that cognitive distraction would attenuate mu suppression. We also correlated mu suppression with the Empathy Quotient and the subscales of the Interpersonal Reactivity Index to determine whether previous research showing such correlations could be replicated. The first hypothesis was confirmed in that, while watching a video of hand movements, a secondary word generation distraction task eliminated evidence of mu suppression relative to a focused attention. These findings strongly indicate that mirroring processes as measured by mu suppression are not obligatory but require focused attention. Previous research indicating negative relationships between empathy and mu suppression were also replicated. A model to explain the seemingly counter-intuitive negative relationship is offered.

Keywords: Mu Suppression, Empathy

Poster C6, Friday, October 12, 6:00 – 7:30 pm

Mother's trauma modulates amygdala response to infant distress

Sohye Kim¹, Peter Fonagy^{2,1}, Jon Allen^{3,1}, Udit Iyengar¹, Sheila Martinez¹, Lane Strathearn¹; ¹Baylor College of Medicine, ²University College London, ³The Menninger Clinic

Presenter: Sohye Kim

Although empirically well demonstrated, the mechanisms by which trauma-related distress is transmitted continue to lack empirical base. Animal work suggests that long-term emotional and behavioral effects of trauma are associated with changes in the amygdala, a neurobiological substrate proposed to mediate long-term socio-emotional sequelae (e.g., abusive parenting) of early-life stress (e.g., maltreatment). In humans, functional magnetic resonance imaging (fMRI) studies documented amygdala hyperactivity in post-traumatic stress disorder; however, these studies have used standardized face stimuli as probes for amygdala activity, and could not examine the mechanisms of transgenerational effects of trauma-related distress. The present fMRI study examined 44 first-time mothers as they underwent scanning, viewing face images of their own infant, happy and sad, along with those of a matched unknown infant. We examined whether traumatic experiences, indicated by the Adult Attachment Interview as still actively influencing attachment representations (unresolved trauma), modulated mothers' amygdala blood oxygenation level-dependent (BOLD) response to their own babies' affect. Mixed-effects linear regression models were fitted separately for early and late phases of the experiment, given

evidence for differential habituation rates of the amygdala in individuals with trauma as compared to normal controls. While no effect of trauma emerged in the early phase, trauma became a significant predictor of amygdala response in interaction with the identity and affect of the baby in the late phase: whereas mothers with no trauma showed a greater amygdala response to sad than happy faces of their own infant, mothers with trauma displayed a diminished response to their own infants' sadness as compared to happiness. Happy and sad faces of unknown infants did not elicit differential amygdala response in either of the mother groups. Our results provide a neurobiological account of how mothers whose experience of trauma continues to affect attachment representations appear to be less responsive to (i.e. "turn away" from) their infants' distress, rendering their infants psychologically 'alone' in the midst of intense sadness – the phenomenon that has been proposed to epitomize the essence of attachment trauma. Maternal disengagement from infant distress, as captured in the present study in an attenuated amygdala signal, is discussed as a potential mechanism that contributes to the intergenerational transmission of trauma.

Keywords: trauma, amygdala, maternal

Poster C9, Friday, October 12, 6:00 – 7:30 pm

The role of striatal cholinergic neurons in social and object recognition, memory, and attention.

Daniel Palmer¹, Elena Choleris¹, Boyer D. Winters^{1,1} University of Guelph

Presenter: Daniel Palmer

The striatum is known to be involved in various behaviors, including learning, memory and reward. Previous work exploring the contributions of the striatum to behaviour has often focused on the role of the neurotransmitter dopamine. However another neurotransmitter released in the striatum, acetylcholine, can contribute to striatum mediated behaviours, but relatively little is known about this. Recently, a knockout mouse has been developed that has disrupted cholinergic transmission in the striatum. Transmission is disrupted through blocking the production of the Vesicular Acetylcholine Transporter (VACHT). This protein, which allows acetylcholine to enter synaptic vesicles, is critical to cholinergic transmission and its removal prevents release of acetylcholine into the synaptic cleft. The present research has focused on characterizing these VACHT knockout mice on a variety of behavioural tasks designed to assess aspects of recognition memory, social processing, and attention. These include tests for object and social recognition, social learning, and the attention-dependent 5-choice serial reaction time task. Preliminary results have revealed that in the object recognition paradigm assessing the ability for an animal to discriminate novel from familiar objects, striatal VACHT knockouts can successfully identify novel objects if tested with a three hour retention delay, but are impaired if the retention delay is five minutes, suggesting disruption of short- but not long-term memory for objects. Ongoing investigations are assessing social learning, social recognition, spatial memory, sustained attention, and working memory. This array of tests will provide insight into the cholinergic function of the striatum, and how it contributes to behavioural processes related to learning and memory.

Keywords: Acetylcholine, Striatum, Behaviour, Recognition Memory, Social Learning, Attention

Poster C10, Friday, October 12, 6:00 – 7:30 pm

fMRI activation by face and biological motion perception: Comparison of response maps and creation of probabilistic atlases

Andrew D Engell¹, Gregory McCarthy^{1,1} Yale University, Dept. of Psychology

Presenter: Andrew D Engell

Twenty years of neuroimaging have identified a core set of brain regions activated by face perception. More recent research is no longer focused on the existence of these areas but rather their role in, and relationship, to other cognitive and perceptual tasks. For instance, it has been shown that biological motion evokes a greater response than non-biological motion within 'face-specific' brain areas. The current study had two aims. First, compare the activation maps from large-sample localizers of face (N=124) and biological motion (N=100) perception. Second, create face and biological motion probabilistic atlases based on these large data sets. In separate experiments, participants viewed blocks composed of exemplars from one of two possible stimulus categories. Participants in the face localizer saw blocks composed of a series of static images depicting either faces or outdoor scenes. Participants in the biological motion localizer saw blocks composed of a series of point-light movies depicting either biological or non-biological motion. AIM 1. Comparison of the contrast maps from each localizer found substantial overlap of face and biological motion sensitive areas. The overlap was most evident in the right amygdala and 'core' regions of the face network within occipitotemporal cortex, the fusiform gyrus and superior temporal sulcus. The similarity of the activation maps suggests an expanded role of these 'face' areas in the perception of social agents, writ large. Preliminary analysis of intracranial EEG data further supported this idea. ERPs recorded from a site along the right fusiform gyrus were highly face-selective, whereas the subsequent change in gamma-band power was significantly larger to biological than non-biological motion. AIM 2. Statistical maps were created in which the values represented the probability of a voxel being category-selective for faces or biological motion. To do so we binarized each participant's contrast map based on a z-score ≥ 1.65 and then calculated the voxel-wise mean of these maps. The peak probability for faces was located along the right fusiform gyrus ($P = .70$; 44, -48, -22), whereas the peak probability for biological motion was located at the intersection of the anterior occipital and inferior temporal sulci ($P = .54$; 48, -64, -8). The complete probabilistic maps will be made freely available to the imaging community.

Keywords: social perception, face, biological motion

Poster C11, Friday, October 12, 6:00 – 7:30 pm

Social working memory recruits neurocognitive networks distinct from canonical working memory

Meghan Meyer¹, Matthew Lieberman^{1,1} UCLA

Presenter: Meghan Meyer

Leading memory researcher Gordon Bower once suggested that the purpose of working memory "is to build up and maintain an internal model of the immediate environment and what has been happening in our world." (p. 54, 1975). Importantly, much of our immediate environment and what has been 'happening' is social. In fact, on average 85% of human conversation involves the sharing of information about people (Dunbar, 1997). Successful navigation of the social world may thus require the ability to

maintain and manipulate information about people's beliefs, traits, and mental states, or social working memory (SWM). Although humans likely engage in working memory for social information frequently, the brain mechanisms supporting the maintenance and manipulation of social-cognitive information remain elusive. On the one hand, the medial frontoparietal network and tempoparietal junction ('mentalizing system') engage in simple social cognition tasks (Mitchell et al., 2005) and may therefore support SWM. On the other hand, this brain network reliably reduces activation as a function of traditional (non-social) working memory demand (McKiernan et al., 2003). The goal of our study therefore was to examine if the mentalizing system increases activation in response to SWM. Given the importance of managing social-cognitive demands to navigate the social environment, we also explored what, if any, neural activation during SWM corresponded with individual differences in social cognitive ability. Methods: To examine the neurocognitive underpinnings of SWM, we developed a novel delayed-response working memory task that varied working memory load in the social domain on a trial-by-trial basis (Meyer et al., 2012). During scanning, participants completed trials in which they encoded names of two, three, or four of their friends, mentally ranked their friends along a trait dimension during a delay period, and answered a true/false question about the rankings. After the scan, participants completed the perspective-taking subscale of the Empathy Interpersonal Reactivity Index (Davis, 1983). Results: Parametric analyses showed increases in the mentalizing system (medial frontoparietal network and TPJ) as a function of the number of friends considered along a trait dimension during the delay period. Importantly, this kind of analysis in traditional (non-social) working memory studies find deactivation of this network, suggesting that SWM may rely at least in part on a neurocognitive network distinct from canonical working memory. Moreover, results from the whole-brain regression of the delay period parametric analysis with perspective-taking scores entered as a regressor showed significant activation in mentalizing regions (medial frontoparietal network). Conclusion: Past working memory research focused on the basic building blocks that allow us to handle representations of our immediate environment but neglected to incorporate relevant social information that makes up much of our mental processing. Our results suggest that SWM is not simply using the same working memory system as canonical working memory. Echoing Bower, we suggest that the purpose of social working memory is to build up and maintain an internal model of the immediate social environment and what has been happening in our social world and that this process may rely on distinct mechanisms from canonical working memory.

Keywords: social neuroscience

Poster C13, Friday, October 12, 6:00 – 7:30 pm

Facial processing and visual attention in an emotion saccade task in schizophrenia: Symptom correlates

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Presenter: Sonia Bansal

In schizophrenia, ineffective processing of facial information has a detrimental effect on the ability to infer the emotional state of others and impairs interpersonal functioning. Aberrations in facial affect recognition and discriminating the direction of another person's gaze have been reported. Patients with schizophrenia avoid gazing at salient facial features like the eyes, thus missing important cues. In studies tracking eye movements to social

stimuli, individuals with schizophrenia tend to make longer and fewer fixations than controls and these fixations are concentrated outside of salient feature regions. The goals of this study were to examine eye movements in an emotional saccade task and examine how they relate to psychiatric symptoms in schizophrenia patients and to personality traits in controls. For this study, a novel saccade task with neutral and fearful faces was used to assess eye movement and visual attention. Participants were instructed to generate saccades towards (pro-saccade) or in the opposite direction (anti-saccade) of eye gaze displayed on faces presented in the center of the screen. Using an eye-tracking system, point of gaze data was derived and mapped onto representations of the facial stimulus, with the eye region demarcated. Gaze avoidance was quantitatively measured by obtaining displacement of point of gaze from the eye region. Measures of frequency and duration of fixations were used to assess visual attention. Psychiatric symptoms in patients were evaluated using the Positive and Negative Syndrome Scale (PANSS), which assesses the severity of positive symptoms (e.g., hallucinations) and negative symptoms (e.g., flat affect, social withdrawal). Traits of anxiety (State-Trait Anxiety Inventory) and impulsivity (Barratt Impulsiveness Scale) were assessed in controls. Gaze avoidance to fearful and neutral faces, as measured by displacement, was significantly higher in both pro-saccade and anti-saccade conditions in patients relative to controls, ($p=0.002$). In the patient group, a higher frequency of fixations in both fear and neutral faces was associated with PANSS items of hallucinations ($r=0.76$, $p=0.01$) and active social avoidance ($r=0.57$, $p=0.05$) irrespective of saccade condition. Fixation duration for neutral faces correlated significantly with the PANSS item of conceptual disorganization in the pro-saccade condition ($r=0.67$, $p=0.02$). There was also a significant correlation between avoidance of eye contact in neutral faces (measured by displacement from point of gaze) and blunted affect ($r=0.57$, $p=0.05$). In the control group, fixation frequency for fearful faces was correlated with total score on the impulsivity ($p=0.01$). Trait anxiety correlated with fixation duration when responding to neutral faces in the anti-saccade condition ($r=0.57$, $p=0.05$). These results suggest that eye movements to social stimuli in schizophrenia patients reflect visual attention disturbances associated with psychiatric symptoms. Data also show that personality traits such as impulsivity and anxiety can predict eye movements and gaze control to social stimuli in healthy controls. The study of eye movements to social stimuli may help us better identify the neural networks involved in processing facial expressions and gaze direction in both healthy individuals as well as clinical populations with social functioning deficits.

Keywords: visual attention, eye tracking, face processing, schizophrenia

Poster C15, Friday, October 12, 6:00 – 7:30 pm

Sex differences in the effects of social context on acquisition of nicotine self-administration in adolescent rats.

Kayla N. Chandler¹, Natalie A. Peartree¹, Julianna Goenaga², Colter Whillock¹, Nora Dado¹, Timothy H.C. Cheung², Heather A. Bimonte-Nelson¹, Janet L. Neisewander^{2,1} Psychology Department, Arizona State University, ²School of Life Sciences, Arizona State University

Presenter: Janet L. Neisewander

Social context plays a critical role in the initiation of smoking in adolescents. We examined the influence of a social partner during initiation of nicotine self-administration in male and female Sprague-Dawley rats during the transition from adolescence to young adulthood (postnatal days 60-70). We constructed self-

administration chambers that were conjoined with a removable middle partition that was either a solid wall or a wall containing a wire mesh portion that allowed some social contact. Rats first received 2, 30-min habituation sessions per day over 2 consecutive days with the solid partition in place for one session, and the mesh partition in place for the other. Self-administration training consisted of 9, 2-h sessions that took place over a 10-day period with the solid partition in place for half of the rats (Isolated) and the mesh partition in place for the others (Social). During training, each response resulted in simultaneous delivery of nicotine (0.015 mg/kg, IV) followed by lever retraction for a 20-sec time out. The results demonstrated that during the first session only, Social males received more nicotine infusions than Isolated males. In contrast, in females there was no difference between groups initially; however, Isolated females received more nicotine infusions than Social females during the last 2 sessions. The findings suggest that a social context may enhance the initial reinforcing effects of nicotine in males, whereas social isolation in females may contribute to escalation of nicotine intake. In both cases, these social influences may contribute to vulnerability to smoke. These findings highlight sex differences in the influence of social factors on nicotine self-administration at a vulnerable developmental stage of life.

Keywords: nicotine self-administration

Poster C16, Friday, October 12, 6:00 – 7:30 pm

Is altruistic punishment automatic? Electrophysiologic and neuroimaging evidence of the effects of cognitive load and psychopathy in the rejection of unfair offers in the Ultimatum Game

Joana B. Vieira^{1,2}, Pedro R. Almeida¹, Fernando Ferreira-Santos¹, Fernando Barbosa¹, Abigail Marsh², João Marques-Teixeira¹; ¹University of Porto, ²Georgetown University

Presenter: Joana B. Vieira

It has been demonstrated that in the Ultimatum Game (UG) subjects reject unfair offers about half the times (Camerer, 2003). This response, commonly referred to as altruistic punishment, is considered to be a prosocial behavior, since the subject foregoes monetary gain to punish the other player for his unfairness (Frith & Frith, 2008). There is evidence that refusing unfair offers is driven by an automatic emotional reaction to unfairness (associated with insula and amygdala activation), while acceptance requires cognitive effort (associated with dorsolateral prefrontal cortex activation) (Sanfey et al., 2003; Gaspic et al., 2011). A consistent activation of the anterior cingulate cortex (ACC) to unfair offers has also been shown (Sanfey et al., 2003), reflecting the conflict between cognitive and emotional motivations in the UG. The ACC is believed to be the neural generator of the Medial Frontal Negativity (MFN) event-related potential (ERP) component, which is sensitive to the fairness of offers (Boksem & DeCremer, 2010). We explored the automaticity of altruistic punishment by manipulating the cognitive load during the UG and analyzing its effect on responses to unfairness. We also examined the potential modulatory effect of psychopathic traits in the rejection of unfair offers. Results of two ongoing studies will be reported. In study 1, participants were assessed using the Triarchic Psychopathy Measure (TriPM; Patrick, 2010) and performed the UG under load and no-load conditions, while EEG was recorded (32 channels). Fair offers were accepted more often than unfair ones by participants in both high and low psychopathy groups ($p < .001$). An effect of cognitive load ($p = .036$) and a fairness*cognitive load interaction ($p = .021$) emerged, with subjects accepting more unfair offers in the load than in the no-load condition. We observed a

trend for higher acceptance rates in the high psychopathy group ($p = .1$) and a correlation ($r = .51$) between psychopathy and acceptance of unfair offers only in the load condition ($p = .05$). ERP analyses revealed a trend for lower MFN amplitudes in the load condition ($p = .059$). These preliminary results question the idea that altruistic punishment is purely automatic – individuals accept more unfair offers under cognitively demanding conditions; increasing the cognitive load decreased MFN amplitude, suggesting less sensitivity to fairness in this condition. The association between psychopathy and acceptance rates only in the load condition suggests a greater interference of cognitive load in high scorers, which points to the use of more deliberative processes in making social decisions. In study 2, we are investigating the neural responses to UG offers via functional magnetic resonance imaging (fMRI), under load and no-load conditions, in subjects varying in psychopathy. In line with previous findings, preliminary neuroimaging results reveal increased activation in predicted regions (left amygdala, insula and right ACC) for unfair versus fair offers. Patterns of activation in response to unfair offers in the load versus no-load condition (including increased activation in inferior and medial frontal gyrus), suggest the cognitive load manipulation is effective and provide a basis for further exploration of the effects of psychopathy and psychopathy*cognitive load interactions.

Keywords: social decision-making; psychopathy

Poster C17, Friday, October 12, 6:00 – 7:30 pm

Brain systems involved in making utilitarian judgments in moral decision-making

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Presenter: So Young Choe

The affective/intuitive system of moral judgment has been more emphasized than the reasoning/deliberative system recently. Although recent research has emphasized emotion's role in utilitarian judgments, the neural basis of the trait of individuals that contribute to those judgments has not been focused on. Two functional magnetic resonance imaging (fMRI) studies were conducted to examine the differences in the neurobiological mechanisms for between subjects who are either high in utilitarian judgment ("High Utilitarian"), who tend to endorse more harmful actions for the greater good, or low in utilitarian judgments ("Low Utilitarian"), who do not endorse harmful actions, even when such actions would serve the greater good. Previous research found that ventromedial prefrontal cortex (vmPFC) damage increased utilitarian judgment (Koenigs, Young, Adolphs, Tranel, Cushman, Hauser, et al., 2007). In our studies using personal moral utilitarian judgment scenarios (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), groups pre-selected from a larger sample to be High Utilitarian vs. Low Utilitarian make judgments about whether to opt-in to harm another for the greater good in three types of scenarios: High-conflict scenarios involve a difficult decision between the 'greater good' and the emotional aversiveness of the action (e.g., pushing a man off a bridge) that must be taken to obtain it. Low-conflict decisions involve a similar aversive action, but without a clear 'greater good.' Non-conflict scenarios do not involve any aversive action that must be endorsed. We found that High Utilitarian participants (relative to Low Utilitarian participants) show decreased activity at low conflict scenarios and increased activity at high conflict scenarios in vmPFC/ACC. This finding

suggests that vmPFC activity is not necessarily related to the emotional impact of the scenario, as the greatest activation is shown by those who are most resistant to the emotional impact. Rather, it may be a marker for the difficulty of decisions involving approach/avoid conflicts in the social domain. Consistent with this view, Low Utilitarian participants show more activation in mPFC/dIPFC in low conflict scenarios. These results suggest that Low and High Utilitarians approach utilitarian moral judgment in markedly different ways.

Keywords: utilitarian judgment, moral decision making, emotion, disposition, fMRI

Poster C18, Friday, October 12, 6:00 – 7:30 pm
Social Support Predicts Basal Cortisol Levels

Melissa Warner¹, Amber Allison¹, Elizabeth A Shirtcliff¹; ¹University of New Orleans

Presenter: Melissa Warner

Introduction Basal cortisol refers to the relatively stable levels of cortisol present naturally throughout the day. Cortisol is constantly released, following a distinct pattern, with high levels expected in the morning, a peak within 30 minutes of awakening, and a steady decline throughout the afternoon. This rhythm provides the necessary resources to cope with moment-to-moment changes in the environment; research suggests that abnormal patterns of basal functioning have important implications for an individual's risk for negative health outcomes (Fries et al., 2008). Importantly, perceptions of social support availability may provide a physiological buffer by influencing appropriate levels of basal cortisol. **Methods** As part of a larger study conducted at UNO, nine pilot individuals (age 18-25; 6 male) provided saliva during a laboratory stress paradigm and a basal comparison day. Basal hormones were averaged across the six samples to provide a composite basal hormone score. These individuals also completed the Social Support Questionnaire Short Report (SSQSR), which asks about global perceptions of support availability. Support was quantified by summing the number of supportive individuals endorsed for each item; item one was of particular interest because it probes the availability of dependable support providers. **Results** Regression analysis revealed that SSQSR item 1 ($M=6.64$, $SD=2.83$) significantly predicts basal hormone levels ($t=-6.503$, $p=.003$), with 94% of the variance in basal hormone levels being predicted by this perception of dependable social support. Basal cortisol levels were lower in individuals endorsing more support availability. **Conclusions** Research consistently indicates that social support serves as a protective shield against the detrimental effects of both acute and chronic stress (Cohen & McKay, 1984); however, the mechanism underlying the ability of social support to alter health outcomes is not well understood. Considering that basal cortisol levels may powerfully influence an individual's susceptibility to moment-to-moment changes in the environment, including stressors, factors that alter basal functioning are especially important to identify and understand. Findings here suggest that perceptions of social support availability, particularly presence of dependable support, are predictive of lower basal cortisol levels, which may be protective against negative physical and psychological health outcomes.

Keywords: Psychology

Poster C19, Friday, October 12, 6:00 – 7:30 pm
Stress and Empathy in children aged 10 to 13 years.

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Presenter: GONZALEZ BURGOS ADRIANA

Some of the most important advances in the study of stress lie in the recognition of the importance of a person's interaction with the environment and the ability to relate empathically. It is in childhood when we develop patterns to face stressful factors and when a child learns to control his environment with these. The aim of this research was to study some of the processes that regulate psychoemotional stress in school children, and their relationship with empathic processes. Participants of this exploratory study were 150 children (10-13 years old; 60 boys and 90 girls) selected randomly. The discriminant analysis results indicate that participants with high levels of stress, also show lower empathic positive emotionality. The ANOVAs analysis of variance showed gender differences: girls obtained significantly higher scores compared to boys.

Keywords: STRESS - EMPATHY - CHILDHOOD

Poster C20, Friday, October 12, 6:00 – 7:30 pm
Acute physiological stress reactivity in novice and experienced skydivers across multiple physiological systems

Gem Scott¹, Amber Allison¹, Elizabeth Shirtcliff¹; ¹University of New Orleans

Presenter: Gem Scott

A large body of research illustrates the utility of the laboratory setting for stimulating acute stress, notably acute physiological stress reactivity. These tools are limited, however, insofar as they (a) fail to stimulate reactivity reliably in a large minority of participants (30-50%), and (b) may not have direct applicability to a real-world setting in quality and magnitude of the ensuing stress response. Skydiving represents an effective real world stressor that still permits experimental control over timing, duration and setting of the stressor. The present study examined autonomic nervous system (ANS) and cortisol responses to skydiving in novice and experienced skydivers. An acute stressor generally elicits the "fight or flight" response, which includes ANS activation. This increases vigilance and arousal through the release of epinephrine and norepinephrine. To document the effects of the ANS, participants wore small ambulatory devices to record measures of sympathetic and parasympathetic nervous system activity, such as heart rate (HR). The hypothalamic-pituitary-adrenal (HPA) axis is a slower, longer lasting component of the stress response that culminates in the release of cortisol from the adrenal gland. Cortisol release is an allostatic mediator that is used by the body in an effort to maximize the effectiveness of the physical and the mental until after a threat has been neutralized. The HPA axis is activated to manage situations that are novel, unpredictable, and/or uncontrollable. HPA axis activity was captured through a series of salivary cortisol measures. We hypothesized that (a) skydiving would stimulate a robust stress response; (b) the stress response would be attenuated in experienced jumpers compared to novice jumpers as they experience a lack of novelty associated with skydiving. Data was analyzed using two-level Hierarchical Linear Models in order to capture between and within-individual changes in the repeated-measures psychophysiological outcome variables (HR and cortisol). HR increased significantly during the jump ($B=25.96$, $t=8.97$, $p<.0001$); however, there were no group differences in HR,

suggesting that the ANS system aspect of the body's stress response does not habituate, allowing an effective response to even an oft repeated stressor. Activation of the ANS system is less costly to the body than activation of the HPA axis. Interestingly, we found that while both groups exhibited a HPA response, the novices displayed a more robust cortisol reaction to the jump than did experienced jumpers ($B=-.049$, $t=2.36$, $p=.019$), with novices experiencing a higher peak in cortisol and maintaining increased cortisol levels for longer. First, most participants experienced reactivity to skydiving, suggesting that many non-responders in acute laboratory challenges would become stress responders in more extreme challenging contexts. Second, the HPA axis may be more responsive to the elements of novelty and control than perceived risk or danger. Evidence for habituation in one physiological system and not another is a powerful demonstration that the components of the stress response are not identical, but are coordinated in an intricate balance.

Keywords: stress reactivity; stress response; cortisol

Poster C21, Friday, October 12, 6:00 – 7:30 pm
Human Flashmobs: An Evolutionary Construct

Gayil Nalls^{1,1} SMARTlab, University College Dublin

Presenter: Gayil Nalls

Explorations of the similarities between animal and human behavior often result in fascinating findings that advance understandings of one or more species. This research explores a behavioral aspect of living North American Robins (*Turdus migratorius*), large brown migratory thrushes, as they occupy a localized natural summer habitat, in order to better understand a dramatic and fastly evolving type of human behavior known as flash mobbing, a coordinated act of collective behavior mediated by social media with characteristics of rapid assembly and dispersement of scores of individuals. The primary objective is the development of theories that integrate field observations of robins with similar behavioral activities of humans to form a statement about what underlies the human collective behavior of flash mobbing. Field observations provide data on how robins signal and communicate with one another to coordinate acts of collective behavior to access their food source and escape their predators. The research looks at innate, genetic and evolutionary mechanisms that support collective behavior related to survival in order to discover similarities and differences between the behaviors of the two species. In conclusion, with social media especially twitter, humans can act on genetic patterning and evolutionary directives to exercise social, political, and survival agendas. As evolution has favored a flash mobbing like behavior in animals such as robins, human populations may be genetically inclined to use a modified version of flash mobbing as a tool of resilience and adaptation.

Keywords: collective behavior, evolutionary behavior, social media, flashmob, Twitter, North American Robins (*Turdus migratorius*), animal behavior

Poster C22, Friday, October 12, 6:00 – 7:30 pm
Aberrant basal ganglia morphology in Williams syndrome: Implications for dysregulated motor and social behavior

Andrew J. Arnold¹, Tim T. Brown², Matt J. Erhart², Ursula Bellugi¹, Eric Halgren^{2,1} Salk Institute for Biological Studies, La Jolla, California, ²University of California San Diego, La Jolla, California

Presenter: Andrew J. Arnold

Williams syndrome (WS) is a rare neurodevelopmental genetic disorder associated with a hemizygous microdeletion of approximately 25 contiguous genes on the long arm of chromosome 7q11.23 (Korenberg et al., 2000). This definitive genetic etiology underlies a host of neurobiological, cognitive, and behavioral aberrations (Bellugi et al., 2000). For example, individuals with WS portray specific cognitive deficits yet exhibit uniquely gregarious social behavior (Järvinen-Pasley et al., 2008) and apparent heightened emotional sensitivity (Zitzer-Comfort et al., 2007). In contrast, individuals with high-functioning autism (HFA) exhibit largely opposite social tendencies and serve as a salient comparison group. Specifically, WS individuals are significantly more likely to approach strangers in a social situation than typically-developing (TD) controls (Järvinen-Pasley et al., 2010). Intriguingly, this type of disinhibited social approach behavior in WS may be supported in part by neural structures that underlie motor function such as the basal ganglia (Baxter, 2003). The WS brain is known to be smaller than that of controls and there are structural and functional abnormalities in socially-relevant regions such as the amygdala, orbitofrontal cortex, and parietal cortex including fusiform face-processing area (Meyer-Lindenberg, Mervis, & Berman, 2006; Haas et al., 2009; Golarai et al., 2010). However, motor-related structures also known to have an important role in cognition have been relatively ignored in the WS literature. Thus, the current investigation represents a fresh approach to how aberrant brain structure relates to motor and social behavior in WS, and promises to yield further insight into the role of fronto-striatal circuits in social behavior. Here we present novel structural MRI findings showing neuroanatomical differences between WS, HFA, and TD groups while correcting for overall brain size fluctuations (Brown et al., in progress). Specifically, we compared volumetric measures of the putamen, caudate, and pallidum in school-age children with WS ($n = 6$), with HFA ($n = 14$), and TD controls ($n = 20$). A multivariate ANOVA revealed a trend for between-group differences amongst these subcortical structures. A series of univariate ANOVAs further demonstrated there are no group differences in caudate or pallidum, but there is a significant reduction in bilateral putamen size in the WS group, and this effect is strongest in the right structure. These represent our main results and are highly significant given our low WS sample size. In addition, data on two motor tasks, finger-tapping (FT) and the grooved pegboard (GP), are presented for these groups. There was a significant group difference in performance for left-hand FT, such that the WS group exhibited reduced motor output, but no group difference in right-hand FT performance. The WS group was drastically impaired in both hands on GP performance, yet there were no differences between the TD and HFA groups on this assay of fine motor control. How these motor results may systematically relate to basal ganglia morphology are considered, as well as their putative contribution to divergent social behavior across these three groups.

Keywords: Williams syndrome basal ganglia

Poster C23, Friday, October 12, 6:00 – 7:30 pm
Mimicking authentic smiles – an EMG study

Sebastian Korb¹, Stéphane With², Susanne Kaiser², Didier Grandjean^{2,1} University of Wisconsin, Madison, ²Geneva University

Presenter: Sebastian Korb

Smiling is one of the most ubiquitous signals in human interactions and it occurs in a wide range of social contexts. Despite smiles

being frequently perceived in every-day life, the perceptual processes leading to the interpretation of a smile as being “authentic”, i.e. expressing happiness or enjoyment, remain unclear. The literature generally favors the interpretation that smiles with orbicularis oculi contraction (producing “crow’s feet” wrinkles around the eyes) are perceived as more joyful and thus authentic than other types of smiles. Therefore, the orbicularis oculi has been suggested as a marker of enjoyment. However, less is known about how judges use smile intensity as a marker of authenticity, and how smile intensity interacts with orbicularis oculi contraction to create the percept of an authentic smile. Finally, the link between facial mimicry (FM) and ratings of authenticity remains unclear. Here, dynamic stimuli of avatars displaying 19 types of smiling with various degrees of mouth opening, smile amplitude, and orbicularis oculi activation, were created based on the Facial Action Coding System (FACS). 31 participants watched and rated the authenticity of the smiles, while FM was assessed by recording electromyography (EMG) from 4 facial muscles. Results showed that the orbicularis oculi is not a marker of authentic smiles per se, but does so in combination with strong zygomaticus activation. In fact, weak smiles displaying an orbicularis oculi contraction were judged as less authentic than strong smiles with orbicularis oculi. When ordering trials by rating of authenticity, we found that activation of the zygomaticus and orbicularis oculi correlated with ratings of authenticity for smiles of weak and medium intensity, but not for the strongest smiles. This supports recent models of embodiment, postulating that FM may be more relevant for emotion perception when the facial expression is somewhat ambiguous.

Keywords: facial expression; smile; EMG; facial mimicry; authenticity

Poster C25, Friday, October 12, 6:00 – 7:30 pm
X-ray microscopy imaging of neurons

Russell Hanson^{1,†}; Children’s Hospital Boston

Presenter: Russell Hanson

X-ray scanning microscopy has advanced to the point where 15 nm resolution can be resolved in tissue through advances in X-ray optics technology. When doing deep tissue imaging using light microscopy or electron microscopy it is necessary to slice tissue into ultra-thin slices. This is obviously a destructive task and makes it impossible to study dynamic cellular features such as synaptic plasticity. The potential to perform non-destructive imaging using soft X-ray microscopy has the potential to image synapses and other structural components in new ways. X-ray diffraction microscopy has been the domain of physicists, but new applications are in using this tool for biology, neurology, and to aid in the reconstruction of the connectome. Using an X-ray beam with an energy of 12.4 keV (0.1 nm) and imaging on an X-ray CCD camera effective pixel sizes of approximately 230 nm can be achieved. Inherently X-ray imaging has a higher resolution than light microscopy because of the much shorter wavelength. Determining the effective energy levels for in vivo imaging can be determined using DNA microarray tools or sequencing and scanning at incremental energy levels. While MR is also a useful non-destructive imaging method we show how X-ray diffraction microscopy and X-ray microscopy have marked advantages for some imaging modalities of complex and deep brain tissues.

Keywords: X-ray microscopy, MR, fMRI, imaging

Poster C26, Friday, October 12, 6:00 – 7:30 pm
Social networks: The neural decoding of social closeness to others

Rebecca J. Von Der Heide¹, Ingrid R. Olson^{1,†}; Temple University

Presenter: Rebecca J. Von Der Heide

Two important dimensions of a social network are (a) the size or number of individuals in a network and (b) the quality and complexity of one’s relationships to others. In humans, a number of recent studies have reported volumetric associations between specific brain regions and social network size. The volume of the amygdala, the ventromedial prefrontal cortex, and the density of grey matter in the right superior temporal sulcus, amygdala, left middle temporal gyrus and entorhinal cortex have all been correlated with individual differences in social network size (Bickart et al., 2011; Kanai et al., 2011; Lewis et al., 2011). By comparison, less is known about the neural correlates of the quality and complexity of social networks. The present study investigates whether brain regions that play an important role in person perception (the fusiform face area) and person knowledge (anterior temporal lobe) also play a role in processing social closeness, a variable that would, for example, allow a person to classify an individual in one’s social network as a “best friend” or an “acquaintance”. During the first testing session, participants rank ordered photos of their best friends, close friends, and acquaintances by their social proximity (i.e. best friend to most distant acquaintance) and then based on the geographic proximity of the home of each peer to their home (i.e., closest to most distant). During the second testing session, fMRI was used to assess functional brain activity. On each trial, participants were simultaneously presented with photos of two peers. During half of the blocks in a run participants indicated which of the two peers was socially closest to them and during the other half, they indicated which peer lived geographically closest to them. Photos of ‘best friends’, ‘close friends’ and ‘acquaintances’ were presented in separate blocks during the social proximity condition and photos of the same peers that lived ‘closest’, ‘medium-distance’, and ‘far’ were presented in separate blocks during the geographical proximity condition. We predicted that activity in brain regions associated with high-level social information processing (e.g., ATL, amygdala, medial PFC) would parametrically increase with levels of social closeness but not with levels of geographical closeness. We also predicted regions associated with spatial information processing (e.g., PPA and/or retrosplenial cortex) would parametrically increase with levels of geographical closeness. Preliminary results revealed significantly greater activation in areas of the brain (PPA, retrosplenial cortex) when participants made judgments about the geographical proximity of peers compared to their social proximity. The results also showed greater activation in areas of the brain (ATL, medial PFC) associated with social information processing when participants judged the social proximity to peers in their social networks compared to their geographical distance.

Keywords: social cognitive neuroscience, social memory, fMRI, social cognition

Poster C27, Friday, October 12, 6:00 – 7:30 pm
Belief reasoning: Reasoning about the knowledge and ignorance of others

Samantha S. M. Drover¹, Adriana Mejia-French¹, Mark A. Sabbagh^{1,†}; Queen’s University

Presenter: Samantha S. M. Drover

Theory of mind refers to the everyday understanding that human behavior is motivated, at least in part, by internal representational mental states such as beliefs, desires, and intentions. Belief reasoning, in particular judging whether others hold true or false beliefs, is complex because it depends on our own beliefs about a given state of affairs. By classifying others' beliefs as true, we are attributing to them the same knowledge that we have about a particular state of affairs. In contrast, classifying others' beliefs as false is tantamount to judging that they are ignorant of something that we know. To date, judgments about true and false beliefs have been treated equivalently when characterizing the neurocognitive bases of belief reasoning. Yet, there are several reasons to think that there may be differences in the kinds of expectations we generate on the basis of others' true and false beliefs. The goal of the current study is to use brain electrophysiological measures to assess: 1) whether we are equally confident in our predictions about action based on true versus false beliefs, and 2) whether we are equally surprised when people act unexpectedly given their true or false beliefs. Two components of the event-related potential (ERP) are responsive to unexpected events: the N2 component, which is elicited in response to an event that contradicts an individual's expectations and the P3b, an ERP that may reflect memory-updating processes in the association cortex in response to task-relevant unexpected events. With this in mind, we recorded ERPs from 18 adults as they viewed a series of animations that were designed to induce reasoning about others' true versus false beliefs. In each animation, a protagonist watched as two characters each hid in one of three possible boxes, and then left the room. During the protagonist's absence, one character changed boxes while another character remained in the same place. Thus, the protagonist had a true belief about the location of one of the characters and a false belief about the other. Participants were then told that the protagonist wanted to find one of the characters and then looked in a place that was either consistent or inconsistent with the protagonist's true or false belief. Results showed that the P3b component was similar when protagonists acted in ways that were consistent with their true or false beliefs. However, the P3b component was stronger when the protagonists looked in ways that were inconsistent with true beliefs as compared to false beliefs. A similar pattern was found for the N2 component. The distributions of the effects were consistent with neural generators in regions that are associated with false belief reasoning in adults and children. These findings suggest that although participants were equally confident in their expectations that others act in accordance with their knowledge or ignorance, participants were more surprised when others' actions did not comport with their true or false beliefs. Such findings thus indicate that there may be an asymmetry in the neurocognitive processes supporting true versus false belief reasoning.

Keywords: Belief reasoning, theory of mind, ERP

Poster C28, Friday, October 12, 6:00 – 7:30 pm
Therapeutic Approach in the Different levels of neurotransmitters in Post Traumatic Stress Disorder in a Traumatized Population

Fuad Lechin^{UCV}, Bertha Van der dijs^{UCV}, Marcel Lechin^{Bayllor}, Gustavo JL Bruzual Massabie^{UCV/USB},¹ Instituto de Medicina Experimental UCV Venezuela, ² Instituto de Medicina Experimental UCV Venezuela, ³ School of Medicine at Texas, ⁴ Instituto de Medicina Experimental UCV Venezuela

Presenter: Gustavo JL Bruzual Massabie

During an acute stress situation, a population was measured, the people had an extraction of blood and after that in the lab we obtained the differences of all neurotransmitters that we study for, but lets begin. During an acute stress situation, all NA noradrenaline, DA dopamine, 5HTP free and platelet, Ach Acetylcholine and AD adrenaline are activated. All except for the DR dorsal raphe nuclei and the RO Raphe obscurus serotonergic nuclei show an increased firing rate. Activation of the PVN paraventricular nuclei is responsible for the enhanced release of CRF, VASOPRESSIN AND OXYTOCYN HORMONES, Noradrenergic, serotonergic, and CRF mechanisms converge to trigger the ACTH>CORTISOL CASCADE. On the contrary, the GHRH>GH cascade is inhibited at the hypothalamic-hypophysis level whereas somatostatin secretion is increased. Gonadotropin secretion is inhibited whereas prolactin secretion is enhanced. Both neural (sympathetic nerves) and adrenomedullary glands are activated. Rise of NA noradrenaline, DA, and Ad plasma levels is registered. Increased Ad plasma levels are response for platelet aggregation and the rise of 5HT or free serotonin in the plasma. Circulating serotonin is normally shared by platelets (98-99%)=5HT and plasma (1-2%)=f5HT. Neural sympathetic nerves release NA noradrenaline (90%)+DA (10%) which are verted to the bloodstream. These NA nerves are postsynaptic axons arising from sympathetic ganglia. At this level, preganglionic Ach axons establish synaptic contact with NA postsynaptic neurons. Preganglionic Ach neurons have their cell bodies at the intermediolateral spinal column. These preganglionic spinal cells receive polysynaptic activation from the LC-NA Locus CERULEOUS NUCLEUS, in such a way that stimulation of this NA nucleus provokes neural sympathetic activation and a rise of NA plasma levels. Other preganglionic neurons located at the thoracic segment of the intermediolateral spinal column receive excitatory axons from the C1-medullary Ad nucleus. These preganglionic sympathetic neurons send axons to the adrenomedullary glands where they trigger catecholamine secretion Ad 80 % + NA 10%+DA10% According to the above the NA/Ad plasma ratio reflects the participation of the neural/adrenomedullary sympathetic activity. In normal subjects during supine-resting conditions, the NA/Ad ratio =3 to 5. This ratio will increase when LC-NA activity predominates over C1-Ad activity conversely, the NA/Ad ratio will decrease in the opposite situation. Normally, several physiologic stimuli such as orthostasis, moderate exercise and glucose ingestion raise the NA/Ad ratio. This response is also registered after administration of various central acting drugs, such for instance Buspirone. 5HT, which shows no change during short-lived acute stress situations, falls during prolonged acute stress. At this time, parasympathetic activity is lowered and both the 5HT/5HTP ratio and tryptophan are positively correlated with this activity. Blood serotonin arises from the small bowel enterochromaffin cells, which release serotonin when stimulated by vagal nerve endings. At this time we show how modulate all previous events, nuclei, zones, neurotransmitters and actions, and effects in the people and the response to the stress.

Keywords: Clinical/Therapeutic approach/treatments/

Poster C29, Friday, October 12, 6:00 – 7:30 pm
Nicotine self-administration with an aversive olfactory-gustatory cue in a permissive social environment in adolescent rats

Hao Chen^{1,1} University of Tennessee Health Science Center

Presenter: Hao Chen

Despite the fact that most adolescents had unpleasant initial experience with cigarettes (coughing, dizziness, etc.), many of them continued to smoke and eventually became addicted. The

critical role of social environment in acquiring smoking has been repeatedly documented. We recently established a rodent model of adolescent nicotine self-administration (SA) that allows the effects of social environments to be studied. Stable nicotine SA with a contingent olfactogustatory (OG) cue was only observed with the presence of a conspecific who also had access to the same OG cue (i.e. the 'demonstrator' rats provided a permissive social environment). In contrast, nicotine SA was not acquired when the odor cue was withheld from the demonstrator rat (i.e. in a neutral social environment). Thus, socially transmitted odor cue is critical for the acquisition. One issue of this original model resides with the OG cue, which was composed of saccharin (20mM) and unsweetened KoolAid Grape (0.05%). Although the grape odor was neutral, saccharin was appetitive. Thus, the saline group self-administered more infusions than the nicotine group, making it difficult to identify the rewarding effect of nicotine from that of the OG cue. Here, we tested the hypothesis that a permissive social environment will support the acquisition of nicotine SA with an aversive OG cue. Adolescent female Sprague-Dawley rats fitted with jugular catheters were subjected to i.v. nicotine SA in operant chambers contained two (active v. inactive) lickometers. Contingent i.v. infusion (0.03mg/kg nicotine or saline) and oral OG cue (60ul 0.005% quinine + 0.05% unsweetened KoolAid Grape to the active spout) were delivered using fixed ratio 10 schedule. Demonstrator rats had free access to an OG cue containing 10mM saccharin (to ensure sufficient consumption) and 0.05% KoolAid grape, and were allowed to have orofacial contact with the SA rats. A total of 10 daily 3 h sessions were conducted. The nicotine group (n=8) emitted significantly more licks on the active spout ($p < 0.05$) and thus self-administered more infusions ($p < 0.001$) than the saline group (n=7). The number of nicotine infusions was not significantly different from the previous data where the OG cue contained saccharin ($p > 0.05$). These data demonstrated that nicotine SA with OG cue requires a permissive social environment, is driven by nicotine, and does not depend on the quality of the taste cue.

Keywords: addition nicotine motivation

Poster C30, Friday, October 12, 6:00 – 7:30 pm
Vasopressin eliminates orienting bias in female C57BL/6J neonates through V1aR

Elizabeth A.D. Hammock¹, Caitlin S. Law¹, Pat Levitt²,¹Vanderbilt University, ²University of Southern California

Presenter: Elizabeth A.D. Hammock

Arginine vasopressin (AVP) and the vasopressin 1a receptor (V1aR) influence adult learning and memory and species-typical social behaviors. Less is known about their roles in the developmental emergence of behavior. We tested a potential role for AVP and V1aR in an odor based orienting task reflecting primordial social behavior in neonatal rodents. Male and female post-natal day 8 C57BL/6J neonates were trained with one of two odor exposure conditions. In the control ("not-contingent") condition, mice were exposed to a novel odor for 1 hour when their mom was absent from the home cage. In the "contingent" condition, neonates were exposed to the same odor for one hour while their mom was in the home cage with the neonates. Two hours after the odor exposure ended, neonates were tested in a preference chamber where they could move freely over two odors: the exposed odor and a novel odor. Surprisingly, males showed no orienting bias toward either odor after either not-contingent (n=12, $p > 0.05$) or contingent (n=8, $p > 0.05$) odor exposure as measured by the amount of time spent over each odor. In contrast,

female neonates showed a selective preference for the familiar odor, but only when they had previously experienced that odor contingent with the presence of the mom in the home cage (n=11, $P < 0.05$), and not in the not-contingent condition (n=10, $p > 0.05$). We then assessed the ability of V1aR KO animals to perform in this task. As with WT, male KO did not show any evidence of odor bias after odor exposure with either the not-contingent (n=12, $p > 0.05$) or contingent (n=8, $p > 0.05$) condition. Female KO, however, showed a very strong odor bias for the familiar odor after both the contingent (n=9, $p < 0.05$) and the not-contingent odor exposure (n=15, $p < 0.05$). This indicates that in females, blocking V1aR activity (as in the KO) enhances orienting bias for familiar odors. We then tested the possibility that activating the receptors would have the opposite effect, thus removing the observed orienting bias in WT females after contingent odor exposure. Intracerebroventricular application of 20ng of AVP in WT females (n=6) blocked the odor bias we observed in control females injected with vehicle (n=7). The effect of AVP appears to act through V1aR, as injection of AVP into V1aR KO females (n=4) failed to block odor bias. Overall, these studies indicate early sex differences in orienting bias in neonatal mice. The data also suggest that AVP signaling through V1aR may modulate the tendency for orienting in the direction of familiar odors in particular social contexts. This may contribute to the neurobiological mechanisms of known sex differences in natal dispersal as development proceeds.

Keywords: vasopressin, odor preference, social orienting

Poster C31, Friday, October 12, 6:00 – 7:30 pm
Social impressions from voice: perceptual and neuroimaging evidence

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Presenter: Pascal Belin

The human voice carries speech but also a wealth of socially-relevant information on the speakers biological characteristics, affective state and personality. Although much research has focused the cerebral bases of speech perception, much less is known on how listeners extract and process socially-relevant cues from the voice. We will present recent evidence on the psychological and cerebral mechanisms involved in the perception of vocal attractiveness and on the underlying acoustical cues. We will also show that personality impressions from voice are robust across listeners even from a brief utterance, and can be summarized in a two-dimensional space reflecting perceived trustworthiness and perceived dominance, in striking analogy with results from face perception.

Keywords: voice perception; face perception; attractiveness; personality impressions

Poster C32, Friday, October 12, 6:00 – 7:30 pm
Amygdala response to positive or negative affect is context specific

Lane Strathearn^{1,2,3}, Sohye Kim^{1,3},¹Baylor College of Medicine, ²Texas Children's Hospital, ³Children's Nutrition Research Center

Presenter: Lane Strathearn

Originally characterized as the fear center of the brain, the amygdala is also activated in response to positive affective cues. Human faces, both positive and negative, are particularly potent triggers of amygdala activation. This study examined the potential effect of interpersonal context on amygdala response, by showing mothers faces of their own and an unknown infant. We hypothesized that mothers amygdala response to happy and sad infant face cues would vary depending on infant identity. We used functional MRI to measure amygdala activation in 39 first-time mothers, while viewing happy and sad infant faces of both their own and a matched unknown infant. Emotional arousal to each face was rated using the Self Assessment Manikin Scales. Mixed-effects linear regression models were used to examine significant predictors of amygdala response. Overall, arousal ratings and amygdala activation were greater when mothers viewed their own infants face compared with unknown infant faces, and sad infant faces elicited greater emotional arousal than happy faces, regardless of infant identity. However, for own-infant faces, amygdala activation was greater for happy compared to sad faces, whereas the reverse was true for unknown-infant faces. Arousal ratings were not significantly associated with amygdala response, after controlling for infant affect and identity. These results suggest that amygdala response to positive and negative affective cues is context dependent, and not driven by arousal. Amygdala activation may reflect the perceived value of a particular stimulus in a specified context and aid in decision-making processes, determining the likelihood of approach or withdrawal behavior.

Keywords: amygdala, maternal care, attachment, infant, neuroimaging, face

Poster C33, Friday, October 12, 6:00 – 7:30 pm

Fixed interests in childhood autism: A randomized controlled trial of intranasal oxytocin on visual fixation preferences

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Presenter: Lane Strathearn

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by severe social/communication deficits, repetitive behaviors and fixated interests (DSM-5 criteria). Recently, studies have shown that the neuropeptide oxytocin enhances social communication while reducing repetitive behaviors in ASD patients (Hollander et al., 2003; Andari et al., 2010; Guastella et al., 2010). This study is the first to examine the effect of intranasal oxytocin on fixated interests in children and adolescents with ASD. We hypothesized that ASD subjects would show a visual preference for more highly organized or structured (systemized) real-life photographs, compared with matched control subjects, and that this preference would be reversed after administration of intranasal oxytocin. As part of a randomized double blind placebo-controlled crossover study, 30 subjects (15 ASD and 15 control males ranging from age 8 to 18 years) were administered either intranasal oxytocin (25 IU) or placebo on their first study visit and the alternate solution on a subsequent visit two weeks later. Oxytocin administration was counterbalanced across study visits. On each occasion, participants then viewed 14 slides, each containing four related pictures that differed on the degree of

systemization (i.e. different arrangements of people, animals, objects or scenes). Picture position on each slide was pseudo-randomized across study participants. Visual preference was determined using an automated eye tracker which calculated fixation times and counts within each of the four regions of interest. Mixed-effects linear regression models were used to determine the relationship between oxytocin administration and visual fixation preferences in ASD and control subjects, adjusting for visit order and picture position. Significant 3-way interactions were found for both fixation time and count; oxytocin significantly reduced the tendency for ASD subjects to view more highly systemized pictures after receiving placebo, where the opposite pattern was seen for control subjects. This study provides additional evidence for the potential benefits of oxytocin in ASD to diminish fixated interests, in addition to reducing repetitive behaviors and enhancing social communication.

Keywords: autism, ASD, oxytocin, fixation, eye tracking

Poster C34, Friday, October 12, 6:00 – 7:30 pm

Brain Signature of Williams Syndrome Revealed by Transcriptome Analysis

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Presenter: Julie Korenberg

Understanding the neurobiology of disorders of human social behavior is one of the greatest challenges facing modern biomedicine. One of the most powerful approaches for solving psychiatric disorders of unknown neural and genetic origin such as anxiety, autism and schizophrenia, is the use of genetic syndromes with high risk comorbidity for these. Williams syndrome (WS) is caused by a de novo hemizygous deletion of 25-28 genes on Chr7q11.23 and is characterized by a pattern of cognitive deficits associated with striking hyper sociality, gregarious social style, tendency to approach strangers, coupled with anxiety. WS therefore provides a unique opportunity to link genes with the brain substrates and neurobiological systems that underlie disorders of social interaction. To understand how the decreased copy number of deleted genes alter the developmental and functional neural systems, and their effects through interactions of these genes with the remaining 99.9% of genes in the genome, we determined the transcriptional networks disturbed in 34 persons with WS and 18 controls using RNA isolated from lymphoblastoid cells using exon microarrays combined with RNA-Seq and quantitative RT-PCR for measuring subtle (< 2 fold) cis and trans dosage effects at genome-wide levels. Gene set analyses suggest that the WS deletion initiates a transcript level perturbation of a proximal gene network comprised of physically interacting gene products and their associated pathways. This network-level perturbation involves multiple genes that regulate actin cytoskeleton and MAPK signaling pathways most closely related to functional pathways defined in the dendritic spine. In order to determine whether the brain network in WS also revealed a consistent transcriptional disturbance that differed between WS and normal brain, we determined the mRNA expression levels of the WS deleted genes and the downstream altered genes revealed by the genome-wide transcriptomic analysis in LB cells. The results of post-mortem brain tissue samples from four regions (cortex, hypothalamus, amygdala, cerebellum) from WS and controls using quantitative RT-PCR demonstrated the consistently disturbed transcriptome pattern in WS brain and decreased expression. These results

provide evidence of a molecular neuropathological basis of the neurocognitive and social emotional behavioral deficits in WS, and establish WS as a brain model for human psychiatric disorders of social behavior.

Keywords: Williams syndrome, transcriptomic analysis, lymphoblastoid cell

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