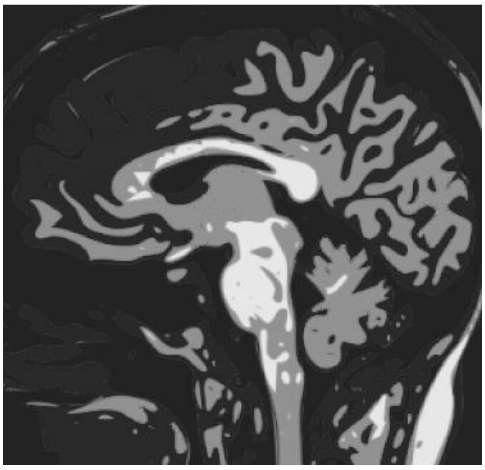
The Neuroscience of Emotion:

From Reaction to Regulation

June 4 – 6, 2009



Hosted by the Department of Psychology
Tufts University, Medford, MA

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The Neuroscience of Emotion:
From Reaction to Regulation

Schedule at a Glance

Thursday, June 4

3:00 – 8:00 pm	Registration
5:00 – 6:15 pm	Session A: Keynote Address
6:30 – 8:00 pm	Session B: Poster Session I and Welcome Reception

Friday, June 5

8:00 am – 5:30 pm	Registration
8:00 – 9:00 am	Continental Breakfast
9:00 – 10:45 am	Session C: The Role of the Amygdala in Human Emotion
10:45 – 11:15 am	Coffee Break
11:15 am – 1:00 pm	Session D: Translating Between Animal and Human Models of Emotion
1:00 – 2:30 pm	Lunch
2:30 – 3:40 pm	Session E: Cognition and Emotion
4:00 – 5:30 pm	Session F: Poster Session II and Light Refreshments

Saturday, June 6

8:00 am – 5:05 pm	Registration
8:00 – 9:00 am	Continental Breakfast
9:00 – 10:45 am	Session G: Emotion in Psychopathology
10:45 – 11:15 am	Coffee Break
11:15 am – 12:25 pm	Session H: Emotion Regulation
12:25 – 2:00 pm	Lunch
2:00 – 3:45 pm	Session I: Emotion in Development
3:45 – 5:00 pm	Session J: Informational Session with Representatives from NIH
5:00 – 5:05 pm	Closing Remarks and Conference Adjourned

Conference events will take place in the Aidekman Arts Center, 40 Talbot Ave, Tufts University, Medford, MA, 02155.

Oral Presentations

Thursday, June 4

Registration (Alumnae Lounge)
Thursday, June 4, 2009
3:00 – 8:00 pm

Session A **Keynote Address** (Cohen Auditorium)
Chair: Heather L. Urry, Tufts University
Thursday, June 4, 2009
5:00 – 6:15 pm

Michael Davis, Emory University
"Neural Systems Involved in Extinction of Fear: Relevance to Psychotherapy"

Anxiety disorders are the most common type of psychiatric illness, afflicting an estimated 19 million children and adults in the US alone. Although medications have been extremely helpful in treating many of these individuals, they can have unpleasant side effects, can be addictive, and do not work for all patients. Cognitive behavioral therapy has also proven to be very helpful in treating many of these disorders and is based on the well-researched phenomenon known as fear extinction, in which a fearful situation is confronted repeatedly in the absence of any aversive event. Extensive empirical work by psychologists has revealed the basic behavioral characteristics of extinction, and theoretical accounts have emphasized extinction as a form of inhibitory learning as opposed to an erasure of acquired fear. Much of this work has been done using a paradigm known as fear conditioning, in which an initially neutral stimulus, such as a tone, is paired with an aversive event, such as footshock (in rats) or an air blast to the throat (in people). Following this conditioning procedure, the tone produces a variety of behavioral effects (freezing, increased startle, increased blood pressure, sweating) that serve as an objective measure of conditioned fear. If the tone is then presented repeatedly in the absence of the aversive shock or air blast (extinction training), it is much less likely to elicit these conditioned fear responses. Guided by this work, neuroscientists have begun to dissect the neural mechanisms involved in extinction, including the brain regions where extinction-related plasticity occurs and the cellular and molecular processes that are engaged. I will review key experiments demonstrating the behavioral characteristics of extinction, and briefly review what is currently known about the neurotransmitters involved. Finally, I will describe the role of NMDA receptors in extinction has that has led to new ways to combine drugs, such as D-cycloserine, with cognitive behavioral therapy to produce clinical benefits.

Session B **Poster Session I and Welcome Reception** (Alumnae Lounge and Balch Lobby)
Thurs, June 4, 2009
6:30 – 8:00 pm

Abstracts are available in the latter half of this program.

Friday, June 5

Registration (Alumnae Lounge)
Friday, June 5, 2009
8:00 am – 5:30 pm

Continental Breakfast (Balch Lobby)
Friday, June 5, 2009
8:00 – 9:00 am

Session C The Role of the Amygdala in Human Emotion (Cohen Auditorium)

Chair: Lisa M. Shin, Tufts University
Friday, June 5, 2009
9:00 – 10:45 am

Paul J. Whalen, Dartmouth College
"The Fundamental Role of the Human Amygdala in Biologically Relevant Learning"

My research seeks to demonstrate that the amygdala, part of a circuitry originally designed for fear and fear-related learning (in an evolutionary sense), now supports subtle fluctuations in state more appropriately referred to as vigilance. These fluctuations, observed in response to stimuli that predict biologically relevant outcomes, then give rise to a host of central and peripheral responses that facilitate the processing of biologically relevant information. We have answered questions about the fundamental role of the amygdala in humans using expressions on the faces of others, which produce robust activation of the amygdala. We suggest that this activation is related to the fact that facial expressions are, in essence, conditioned stimuli; that is, they have predicted biologically relevant outcomes for you in the past, thus, upon their presentation in an experimental study, they will command the respect of this system (at least initially). While these signals will often be comparable across a group of subjects, we can also find evidence of individual differences between subjects.

Elizabeth A. Phelps, New York University
"Changing Fear: Cognitive Regulation to Reconsolidation"

I will explore how animal models of fear learning extend to humans in a social context. Specifically, I will demonstrate how the neural circuitry of fear conditioning forms the basis to fears learned through social communication and changing fears in humans through social and non-social means relies on overlapping neural mechanisms. Social means of fear learning and their alteration in humans take advantage of phylogenetically shared systems of simple fear conditioning and this flexibility of fear learning in humans may also present unique challenges.

Ahmad R. Hariri, Duke University
"The Neurobiology of Individual Differences in Complex Behavioral Traits"

Neuroimaging, especially BOLD fMRI, has begun to identify how variability in brain function contributes to individual differences in complex behavioral traits. In parallel, pharmacological fMRI and multimodal PET/fMRI is identifying how variability in molecular signaling pathways influences individual differences in brain function. Against this background, functional genetic polymorphisms are being utilized to understand the origins of variability in signaling pathways as well as to efficiently model how such emergent variability impacts behaviorally relevant brain function. My talk will provide an overview of a research strategy seeking to integrate these complimentary technologies and utilize existing empirical data to illustrate its effectiveness in illuminating the neurobiology of individual differences in complex behavioral traits. I will

also discusses how such efforts can contribute to the identification of predictive disease risk markers as well as the development of more effective and individually tailored treatment regimes.

Coffee Break (Balch Lobby)
Friday, June 5, 2009
10:45 – 11:15 am

Session D **Translating Between Animal and Human Models of Emotion** (Cohen Auditorium)

Chair: Heather L. Urry, Tufts University
Friday, June 5, 2009
11:15 am – 1:00 pm

Gregory J. Quirk, University of Puerto Rico School of Medicine
"Prefrontal Regulation of Fear Responses in Rodents"

Decades of psychological research have taught us that extinction of classical conditioning reduces the expression of the conditioned response, but does not eliminate the conditioning memory, suggesting that extinction is inhibitory learning. Recent advances in rodent research have delineated the neural circuits involved in the acquisition and expression of extinction. While the basolateral amygdala (BLA) is a site of inhibitory learning in extinction, the medial prefrontal cortex modulates the expression of extinction memory, via projections to the amygdala. Converging lines of evidence indicate that the infralimbic (IL) prefrontal cortex inhibits the expression of conditioned fear by inhibiting amygdala output. Extinction induced plasticity in IL occurs via both synaptic and intrinsic mechanisms. Furthermore electrical stimulation of IL reduces fear and strengthens extinction. Manipulations of the prelimbic (PL) prefrontal cortex have the opposite effect, suggesting that this area works with the amygdala to activate fear. Thus, PL and IL serve as "on" and "off" switches for fear expression. Extinction failure is associated with over and under activity in PL and IL respectively, suggesting that the ability to retrieve extinction is governed by prefrontal cortex, in conjunction with hippocampal and amygdala inputs. Human homologues of rodent IL and PL show predicted changes in activity levels in people undergoing extinction, as well as extinction failure in PTSD patients. Strategies to ameliorate prefrontal deficits could facilitate extinction-based therapies for anxiety disorders.

Klaus A. Miczek, Tufts University
"Anxiety and Aggression: Translating Preclinical Data on GABA and Serotonin to the Clinic"

Serotonin and GABA, more than any other neurotransmitters, and their receptors have been the focus of molecular pharmacology and genetics studies of anxiety and aggression. They are evolutionary old molecules, the former characterized by discrete low concentration. The most successful translation of preclinical data with models in rodents and primates to the clinic pertain to the positive allosteric modulation of $GABA_A$ receptors. For example, molecular and behavioral biology studies have begun to differentiate the anxiety-relieving, sedative, anticonvulsant, amnesic and aggression-modulating effects of benzodiazepines and alcohol and link them to very specific subunits of the $GABA_A$ receptors in discrete mesocorticolimbic pathways. Similarly, at least half a dozen serotonin receptor subtypes and transporter molecules at somatodendritic, pre- and post-synaptic sites in the mesocorticolimbic pathways have emerged as critical for the modulation of escalated aggression. These anatomical and receptor-selective mechanisms begin to match the clinical complexity of different anxiety disorders and different types of escalated aggressive behavior.

Lisa Feldman Barrett, Boston College & Massachusetts General Hospital/Harvard Medical School
"Is a Growling Dog Angry?"

Scientists who emphasize that humans are animals focus on one set of facts when defining and studying emotion. Scientists who emphasize human uniqueness focus on a different set. What the field needs is a model that can account for all the facts, where species-general and species-specific aspects of emotion are incorporated within one unifying framework. I will suggest one possible framework, and illustrate how it is consistent with a broad array of observations about the human brain.

Lunch (Balch Lobby and Alumnae Lounge)
Friday, June 5, 2009
1:00 – 2:30 pm

Session E **Cognition and Emotion** (Cohen Auditorium)

Chair: Sarah R. Cavanagh, Tufts University
Friday, June 5
2:30 – 3:40 pm

Patricia J. Deldin, University of Michigan
"The Psychophysiology of Rose-colored Lenses"

Memory biases for negative information have been theorized to play an etiological role in major depression. Event-related brain potentials provide a unique window into the processes underlying this phenomenon. In this talk I will provide neurophysiological evidence for memory biases in both healthy and major depressive research participants, delineating the specific affected processes and the contexts in which they occur.

Margaret M. Bradley, University of Florida
"Neural Processes in Affective Perception"

Visual cues depicting unpleasant and pleasant objects and events elicit measurable neural and peripheral activity in human observers. Using dense sensor EEG arrays, the timing and topography of neural processes associated with perceptual, attentional, and attentional engagement can be investigated. Studies are described that explore perceptual (e.g., complexity, repetition) and attentional manipulations (e.g., startle probe, task-relevance) on event-related potentials during affective picture perception. The resulting data suggest a cascade of neural processes from sensory detection to stimulus identification to motivational activation, with different processes modulated by perceptual, attentional, and affective variables. The data are consistent with the view that cues that activate fundamental defensive and appetitive neural systems naturally engage attention in the service of determining appropriate action and that this activation serves as the basis of affective experience.

Session F **Poster Session II and Light Refreshments** (Remis Sculpture Court)

Friday, June 5
4:00 – 5:30 pm

Abstracts are available in the latter half of this program.

Saturday, June 6

Registration (Alumnae Lounge)
Saturday, June 6, 2009
8:00 am – 5:05 pm

Continental Breakfast (Balch Lobby)
Saturday, June 6, 2009
8:00 – 9:00 am

Session G **Emotion in Psychopathology** (Cohen Auditorium)

Chair: Daphne Holt, Massachusetts General Hospital
Saturday, June 6
9:00 – 10:45 am

Lisa M. Shin, Tufts University
"Neuroimaging Studies of Posttraumatic Stress Disorder (PTSD): Moving Beyond the Identification of Functional Abnormalities"

Recent neuroimaging studies have reported functional abnormalities in several limbic and paralimbic brain regions in PTSD. Specifically, the amygdala and dorsal anterior cingulate cortex (dACC) appear to be hyperresponsive in PTSD, whereas the rostral anterior cingulate cortex (rACC) and adjacent medial prefrontal cortex (mPFC) appear to be hyporesponsive in this disorder. These findings are consistent with fear conditioning models of PTSD as well as the role of these brain regions in the assessment of emotional stimuli and emotion regulation. New research will be presented to help determine whether these functional abnormalities can predict response to treatment. In addition, the results of a new study of monozygotic twins discordant for trauma exposure will be presented to help determine whether the functional abnormalities in PTSD are acquired signs of the disorder or familial vulnerability factors that increase the risk of PTSD after exposure to psychological trauma.

Mary L. Phillips, University of Pittsburgh
"Neuroimaging Emotion in Mood Disordered Populations"

My long-term research goal is to identify specific abnormalities in neural systems underlying different subprocesses supporting emotion processing and emotion regulation in individuals with major psychiatric disorders, including bipolar disorder and unipolar depression. Identifying neural system abnormalities that may represent objective biomarkers of psychiatric disorders is a crucially important step toward the long-term goal of improving diagnostic accuracy of these disorders, and informing management in individuals presenting in the early stages of psychiatric illness. My research has also focused on examination of the extent to which neuroimaging can help identify as early as possible neural system abnormalities in those individuals at genetic risk of psychiatric disorder that in turn can be used as predictors of subsequent development of the disorder.

I will present findings from several neuroimaging studies from my group in which we have employed different neuroimaging techniques, including functional Magnetic Resonance Imaging (fMRI), diffusion tensor imaging (DTI), functional connectivity and dynamic causal modeling (DCM), to examine structural and functional connectivity in neural systems underlying emotion regulation in healthy, bipolar and unipolar depressed adults. I will also present findings from studies in which we have begun to examine the extent to which these neuroimaging techniques are beginning to identify abnormalities in neural systems supporting emotion processing and emotion regulation in individuals at high genetic risk of subsequently developing bipolar disorder and unipolar depression, that in turn will facilitate identification of potential risk markers of disorder development.

Diego A. Pizzagalli, Harvard University
"Toward an Objective Characterization of Anhedonic Phenotypes: Behavioral and Neuroimaging Approaches"

Anhedonia, the lack of reactivity to pleasurable stimuli, plays an important role in a variety of psychiatric disorders, and is a cardinal symptom of depression. Although anhedonia confers increased vulnerability to psychopathology, few studies have employed laboratory-based measures to objectively characterize this important phenotype. In addition, the neurobiological underpinnings of anhedonia remain largely unknown. To address these issues we have developed a probabilistic reward task based on a differential reinforcement schedule that allows us to objectively assess participants' propensity to modulate behavior as a function of reward history. Our findings indicate that depression is characterized by an impaired tendency to modulate behavior in response to prior reinforcements, and provide initial clues about which aspects of hedonic processing might be dysfunctional in depression. In addition, recent functional magnetic resonance imaging (fMRI) findings suggest that blunted hedonic responses are associated with dysfunction within basal ganglia regions previously implicated in reward processing. We are currently investigating the effects of genetic vulnerability and stress on hedonic deficits and associated neurobiological dysfunctions.

Coffee Break (Balch Lobby)
Saturday, June 6, 2009
10:45 – 11:15 am

Session H **Emotion Regulation** (Cohen Auditorium)

Chair: Greg Hajcak, Stony Brook University
Saturday, June 6
11:15 am – 12:25 pm

Kevin N. Ochsner, Columbia University
"Reappraisal: From Basic Mechanisms to Mechanistic Breakdowns"

The ability to effectively manage our emotions is essential to the maintenance of both mental and physical well-being. One of the most flexible and powerful regulatory strategies is reappraisal, which involves cognitively changing our interpretation of the meaning of an event in order to change our emotional response to it. In this talk I will present a series of studies designed to unpack the basic psychological and neural mechanisms underlying reappraisal, and how they function differently in clinical groups. The first part of the talk seeks to establish a model of basic reappraisal mechanisms by comparing and contrasting different forms reappraisal to each other and to related regulatory strategies. The second part translates this model to help clarify how emotion dysregulation plays a role in both substance abuse and borderline personality disorder.

Heather L. Urry, Tufts University
"Neural Correlates of Emotion Regulation in Older Age"

Functional neuroimaging studies indicate that regions of prefrontal cortex (PFC) and the amygdala are implicated in using cognitive reappraisal to regulate negative affect. Interestingly, older people exhibit decrements in performance on cognitive tasks associated with regions of PFC that are implicated in reappraisal processes, including poorer visual working memory performance, and decreased ability to ignore task-irrelevant information. Yet, at the same time, there is substantial evidence to suggest that older people actually experience higher levels of affective functioning than younger adults on a daily basis. This raises important questions as to the emotion regulatory processes that underlie such salutary functioning. This talk will review evidence to suggest that functioning in PFC and amygdala regions during reappraisal is related to affective functioning in older adults, and that older adults choose emotion regulatory strategies that provide the best fit with the cognitive, social, and neural systems at their disposal.

Lunch (Balch Lobby and Alumnae Lounge)
Saturday, June 6, 2009
12:25 – 2:00 pm

Session I **Emotion in Development** (Cohen Auditorium)

Chair: Jennifer A. DiCorcia, Tufts University
Saturday, June 6
2:00 – 3:45 pm

Charles A. Nelson III, Harvard University Medical School
"Tuning the Developing Brain to Social Signals of Emotions"

Humans in different cultures develop a similar capacity to recognize the emotional signals of diverse facial expressions. This capacity is mediated by a brain network that involves emotion-related brain circuits and higher-level visual-representation areas. Recent studies suggest that the key components of this network begin to emerge early in life. The studies also suggest that initial biases in emotion-related brain circuits and the early coupling of these circuits and cortical perceptual areas provide a foundation for a rapid acquisition of representations of those facial features that denote specific emotions.

Nim Tottenham, University of California, Los Angeles
"Infant Institutionalization and Subsequent Socio-Affective Neurodevelopment"

Early adversity, for example poor caregiving, can have profound effects on emotional development. Orphanage rearing, even in the best circumstances, lies outside of the bounds of a species-typical caregiving environment and is often followed by difficulty in the socio-emotional domain. This talk will describe the developmental trajectory of socio-emotional behaviors (self regulation in the context of highly arousing social information) and associated neuro-development in a population of previously institutionalized children using behavioral data as well as structural and functional neuroimaging. The individual differences in neural phenotypes we observed co-occur with behavioral atypicalities, including peer relationship difficulties. These findings are consistent with previous reports describing negative socio-affective effects of prolonged orphanage care and with animal models that show long term changes in the amygdala and emotional behavior following early postnatal stress. Thus, stress-related changes in limbic circuitry may be the mediating factor between early adversity and residual emotional and social problems experienced by children who have been internationally adopted.

John D. E. Gabrieli, Massachusetts Institute of Technology
"Neurodiversity in Emotion and the Brain"

Functional neuroimaging is revealing how brain mechanisms mediate diversity and individuality in emotion processing. I will review evidence that variation in personality, gender, and age relates to variation in emotion processing in the human brain.

Session J **NIMH Session with Janine Simmons, Program Officer** (Cohen Auditorium)

Chair: Heather L. Urry, Tufts University
Saturday, June 6
3:45 – 5:00 pm

Closing Remarks and Conference Adjourned
Saturday, June 6
5:00 – 5:05 pm

Poster Presentations

Session B Poster Session I (Alumnae Lounge)
Thursday, June 4, 2009
6:30 – 8:00 pm

B1

Sex-Dependent Effects Of Creatine Supplementation In The Forced Swim Test, PATRICIA J. ALLEN, KRISTEN E. D'ANCI, ROBIN B. KANAREK, AND PERRY F. RENSHAW, *Tufts University, University of Utah School of Medicine.* Antidepressant drugs produce physiological effects within hours, but clinical relief requires weeks of treatment. This discrepancy suggests that the true nature of antidepressant action remains to be elucidated. Recent evidence indicates that impairments in bioenergetic function, cellular resiliency, and structural plasticity are associated with the pathogenesis of depressive disorders. A novel therapeutic strategy is to focus on agents that alter energy parameters and improve neuronal survival. Preliminary evidence suggests that creatine, an ergogenic compound known to promote cell survival and influence brain bioenergetics, can improve mood in treatment resistant patients. The present study investigated the effects of creatine supplementation using the forced swim test (FST), an animal model selectively sensitive to antidepressants with clinical efficacy in humans. Thirty male (study 1) and thirty-six female (study 2) Sprague-Dawley rats were maintained on either chow alone or chow blended with either 2% w/w or 4% w/w creatine monohydrate for 5 weeks prior to behavioral testing. Male rats maintained on 4% creatine displayed increased immobility in the FST as compared to controls, while female rats maintained on 4% creatine displayed decreased immobility in the FST. Open field and wire suspension tests confirmed the behavioral specificity of these observations, with no differences in performance as a function of diet. The present findings suggest creatine supplementation alters depression-like behavior in the FST in a sex-dependent manner in rodents, with female rats displaying an antidepressant-like response. While the mechanisms of action are unclear, sex-differences in creatine metabolism and the hormonal milieu are likely involved.

B2

Mineralocorticoid Receptor Genotype (rs5522), Stress and Reward Learning, RYAN BOGDAN, ROY H. PERLIS , JESEN FAGERNESS, AND DIEGO A. PIZZAGALLI, *Harvard University, Psychiatric and Neurodevelopmental Genetics Unit, Center for Human Genetic Research, Massachusetts General Hospital*. Anhedonia has been identified as a candidate depressive endophenotype. Prior animal and human studies suggest that stress might reduce hedonic capacity, raising the possibility that stress-induced anhedonia might explain links between stress and depression. The mineralocorticoid receptor (MR) is involved in the regulation of the onset and threshold of the physiological stress response. The val allele of the MR Iso/Val polymorphism (rs5522) has been associated with an enhanced endocrine and autonomic response to psychological stress. Two studies using an empirically based probabilistic reward learning task evaluated whether MR Iso/Val genotype and stress independently and interactively influenced reward learning. We hypothesized that val carriers would show stress-induced deficits in reward learning. In Study 1 (n = 174) we examined whether MR Iso/Val genotype influenced reward learning, and found that Val carriers had elevated reward learning relative to Iso homozygotes. In Study 2 (n = 51) we evaluated if MR Iso/Val genotype and stress interacted to influence reward learning.. As hypothesized, val carriers – but not Iso homozygotes – showed reduced reward learning under the acute stressor. In sum MR val carriers have heightened reward learning under basal conditions but are susceptible to stress-induced reward learning deficits. The MR val allele may leave individuals vulnerable to depression under stress via stress-induced anhedonia.

B3

Sustained prelimbic responses correlate with fear expression and extinction failure, ANTHONY BURGOS-ROBLES, IVAN VIDAL-GONZALEZ, AND GREGORY J. QUIRK, *University of Puerto Rico School of Medicine, Massachusetts Institute of Technology.* During auditory fear conditioning, it is well established that lateral amygdala (LA) neurons potentiate their response to the tone conditioned stimulus (CS), and that this potentiation is required for conditioned fear behavior. Conditioned tone responses in LA, however, last only a few hundred milliseconds and cannot be responsible for sustained fear responses to a tone lasting tens of seconds. Recent evidence from inactivation and stimulation studies suggests that the prelimbic (PL) prefrontal cortex is necessary for expression of learned fears, but the timing of PL tone responses and correlations with fear behavior have not been studied. Using multi-channel unit recording techniques in behaving rats, we observed sustained conditioned tone responses in PL that were correlated with freezing behavior on a second-to-second basis during the presentation of a 30-sec tone. These tone responses were also correlated with conditioned freezing across different experimental phases (habituation, conditioning, extinction). Moreover, the persistence of PL responses after extinction training was associated with failure to express extinction memory. Together with prior findings, the present results suggest that PL transforms transient amygdala inputs to a sustained output that drives conditioned fear responses and gates the expression of extinction. Given the relatively long latency of conditioned responses we observed in PL (~100 ms after tone onset), we propose that PL integrates inputs from the amygdala, hippocampus, and other cortical sources to optimally regulate the expression of fear memories.

B4

Variations in Stress Reactivity Influence Social Buffering in Rhesus Macaques, K.N. HERMAN, S.M. MCLAUGHLIN, A. CUMMINS, D. DELANEY, K. CHISHOLM, P. NOBLE, S.J. SUOMI, J.T. WINSLOW, E.E. NELSON, *National Institute of Mental Health, University of Maryland, Eunice Kennedy Shriver National Institute of Child Health and Human Development*. Highly social species including humans tend to display better recovery from stress in the presence of familiar social partners. Our lab has previously demonstrated a reduced capacity for social buffering in rhesus monkeys subjected to early adversity. We investigated whether differences in stress reactivity (cortisol) influenced durations of social behavior, tension, and arousal. Subjects were 24 juvenile male rhesus monkeys (Macaca mulatta) reared either in indoor social groups with mothers and peers (MR) or without mothers in the continuous presence of peers (PR). Testing was carried out in a novel cage both alone and with a homecage partner, or blood samples were collected immediately after testing and were later assayed for cortisol. Subjects were classified into high or low stress reactivity groups based on a cluster analysis. An ANCOVA controlling for homecage cortisol levels with rearing and alone cortisol values as between-subjects factors revealed a rearing X cortisol interaction on social behavior ($F(1,20)=7.518$, $p=.013$). A planned contrast revealed higher levels of social behavior for PR subjects with low versus high cortisol ($p<.05$). Higher levels of social behavior were found for low versus high cortisol ($F(1,20)=12.242$,$p=.002$). A similar rearing X cortisol interaction was found for tension ($F(1,20)=4.211$, $p=.053$). A planned contrast revealed that PR subjects with high versus low cortisol levels displayed more tension ($p<.05$). These findings indicate that high stress reactivity may compromise an individual's capacity for social buffering. High reactive subjects with a history of early adversity appear to be particularly vulnerable to the effects of stress.

B5

TESTOSTERONE AFFECTS ATTENTION TO SOCIAL STIMULI IN MALE MACAQUES, HANNA M KING, LAURA B KURDZIEL, KAELYN M CALDWELL, MARGARET R CHIAVETTA, SARAH R PARTAN, JERROLD S MEYER, DANIEL R GROW AGNÈS LACREUSE, UNIVERSITY OF MASSACHUSETTS, HAMPSHIRE COLLEGE, BAYSTATE MEDICAL CENTER. Studies in human females suggest higher levels of exogenous testosterone (T) are related to greater attention to certain types of social stimuli. However, due to risks associated with T manipulations in males, research in this population is limited. Studies in nonhuman primates may help resolve this issue. We investigated the activational effects of T on emotions in male rhesus macaques. The emotional tasks included the Approach-Avoidance Task, which tested responses to familiar, novel and negative objects and the Video Task which tested responses to scenes of unfamiliar conspecifics in neutral, positive and negative social contexts. Following a 4-week baseline period, six monkeys were treated with a gonadotropin releasing hormone agonist (Lupron, 200µg/kg) before being randomly assigned to one of 2 treatment groups: Lupron + T Enanthate (TE, 20mg/kg) or Lupron + oil. In each treatment group, 3 monkeys received Lupron + TE or Lupron + oil for 4 weeks and then received the alternate treatment for 4 additional weeks. TE treatment was associated with increased watching time for negative videos. T levels resulting from exogenous administration of TE were significantly correlated with mean time per watching bout, proportion of and total watching time for neutral videos with similar trends for negative videos. No significant correlations were found between T levels and behavior in the Approach-Avoidance Task. These data suggest that T may enhance attention to specific social stimuli. Further studies are needed to understand the mechanisms by which T may mediate responsiveness to social stimuli of different emotional valence.

B6

Context-independent Extinction of Fear in Rats, ELIZABETH LIU, KI ANN GOOSENS, *M.I.T., McGovern Institute for Brain Research.* In previous experiments, we were able to overcome context-based fear renewal in rats by matching the predictability of the auditory conditional stimulus (CS) and inter-stimulus interval (ISI) presentations across training and extinction days; mismatch produced context-dependent extinction. Further experiments demonstrate that context-dependent extinction can be overcome by retraining rats with a new, predictable CS. First, rats received fear conditioning (Day 1; Context A) with 5 predictable tone (CS1)-footshock pairings. They were then fear conditioned (Day 2; Context B) with 5 predictable white noise (CS2)-footshock pairings. Rats were extinguished in Context C (Day 3) to CS1 or CS2 and tested the following day (Day 4) in either Context C (consistent; CON) or Context D (Inconsistent; INCON); the CS presentation matched exactly CS presentation from both training days. Rats received CS1 or CS2 extinction training in both the CON and INCON groups exhibited significantly lower freezing behavior on Day 4 compared to Day 3. Thus, rats in the INCON group demonstrated robust context-independent extinction to both CS1 and CS2. In a second experiment, rats received the initial auditory fear conditioning with unpredictable CS1s, consisting of 5 tone-footshock pairings at pseudorandom intervals. Rats were fear conditioned again on Day 2 with predictable CS2-footshock pairings and extinguished on both Day 3 (Context C) and Day 4 (Context C or D) to predictable CS1 or CS2. Rats extinguished in both consistent contexts (CC) and inconsistent contexts (CD) exhibited significantly higher expression of extinction on Day 4 compared to Day 3, resulting in context-independent extinction.

B7

Ghrelin signaling modulates amygdala-dependent learning, RETSINA M. MEYER, ANITA Y. LIN, AND KI A. GOOSENS, *Massachusetts Institute of Technology*. Previous research has shown that the orexigenic hormone ghrelin regulates synapse formation and synaptic plasticity (Diano et al, 2006). The receptor for ghrelin, also known as the growth hormone secretagogue receptor (GHSR1a), is found throughout the brain including the basolateral nucleus of the amygdala (BLA). In the current studies, we examine how chronic activation of this receptor either with its endogenous ligand, acylated-ghrelin, or a synthetic ligand, ibutamoren mesylate (MK-0677), affects fear learning. Long-Evans rats received bilateral BLA cannulae implants through which drug (0.5mg/ml), ghrelin (3nMol), or vehicle (NaCl, 0.9%) was infused either a single time or chronically (once daily for 5 days). 24 hours after the last infusion, animals were trained on an auditory fear conditioning task. Fear conditioning (FC) consisted of three tone-shock trials in context A. One day later, animals were returned to context A for 10 minutes to test contextual fear memory. The next day, animals were placed in a new context (context B) to test auditory fear memory. After two minutes of exploration, an eight minute tone was presented. Freezing was used as the measure of long-term memory. Initial results show that ghrelin receptor signaling enhances fear associations when activated chronically but not after a single dose.

B8

Propranolol acts centrally to reduce fear without impairing extinction, JOSE RODRIGUEZ-ROMAGUERA, FRANCISCO SOTRES-BAYON, DEVIN MUELLER, AND GREGORY J. QUIRK, *University of Puerto Rico.* Previous work has implicated noradrenergic β-receptors in the consolidation and reconsolidation of conditioned fear. Less is known, however, about their role in fear expression and extinction. The β -receptor blocker propranolol has been used clinically to reduce anxiety. With an auditory fear conditioning task in rats, we assessed the effects of systemic propranolol on the expression and extinction of two measures of conditioned fear: freezing and suppression of bar-pressing. One day after receiving auditory fear conditioning, rats were injected with saline, propranolol, or peripheral β -receptor blocker sotalol (both 10 mg/kg, IP). Twenty minutes after injection, rats were given either 6 or 12 extinction trials and were tested for extinction retention the following day. The effect of propranolol on the firing rate of neurons in prelimbic (PL) prefrontal cortex was also assessed. Propranolol reduced freezing by more than 50%, an effect that was evident from the first extinction trial. Suppression was also significantly reduced. Despite this, propranolol had no effect on the acquisition or retention of extinction. Unlike propranolol, sotalol did not affect fear expression, although both drugs significantly reduced heart rate. This suggests that propranolol acts centrally to reduce fear. Consistent with this, propranolol reduced the firing rate of PL neurons. Propranolol reduced the expression of conditioned fear, without interfering with extinction learning. Reduced fear with intact extinction suggests a possible use for propranolol in reducing anxiety during extinction-based exposure therapies, without interfering with long-term clinical response. (Note: Poster withdrawn.)

B9

Sex Differences and the Role of Gonadal Hormones in Conditioned Fear Acquisition and Extinction: Rat Studies, S. IGOE, K. LEBRON-MILAD, J.E. NOVALES, A. CONTERO, AND M.R. MILAD*, Massachusetts General Hospital, Harvard Medical School*. Previous studies in both rats and humans have revealed sex differences in fear learning, implicating gonadal hormones as possible regulators of fear-related behavior. We expanded on this notion using a three-day fear conditioning paradigm for rats that looked at not only acquisition of conditioned fear, but also extinction and extinction recall. In order to investigate the effects of natural hormone variance, we separated females into two groups: those who were in the proestrus phase of the estrus cycle (high progesterone and estrogen expression) on the day of extinction learning, and those who were in metestrus (low progesterone and estrogen). The proestrus group showed significantly stronger extinction learning and recall than the metestrus group. To further explore the regulatory role of gonadal hormones, we administered estrogen or progesterone to females in the metestrus phase prior to extinction learning, and both of these groups showed enhanced recall. Those receiving vehicle continued to exhibit the high fear associated with the metestrus phase. To corroborate these findings, we also administered Fulvestrant, a non-specific estrogen antagonist or Mifepristone, a progesterone antagonist, to females in the proestrus phase, and both groups displayed reduced extinction learning and recall compared to those receiving vehicle. These results provide strong evidence that gonadal hormones play a role in the degree to which rats learn and extinguish fear behavior, and that this regulatory action may be subject to pharmacological manipulation.

B10

Links Between State Anxiety and Error-Monitoring Functions, KRISTIEN AARTS AND GILLES POURTOIS, *University of Ghent.* It was previously shown that early error detection is increased in high, relative to low (trait) anxious subjects, consistent with the notion that errors are aversive events. However, it remains to be determined if errors may actually enhance levels of (state) anxiety or not, and whether this effect is similar for low vs. high trait anxious participants. In this study, we addressed this question using a simple go/nogo task, which was previously designed to promote the frequent commission of errors, while preserving the perceived accuracy for performance. We selected a sample of healthy adult participants based on their trait anxiety scores. Results showed that high (trait) anxious participants made a similar amount of errors than low (trait) anxious participants in this task. Nonetheless, we found that for high anxious participants only, their level of state anxiety reliably increased after completing the go/nogo task, relative to their baseline (state) anxiety level before the task. Noteworthy, we failed to find any reliable relationship between the number of errors during the go/nogo task and this increase of state anxiety following it. These results suggest that errors, although aversive, may not have a causal effect and merely augment levels of state anxiety. We surmise that different self-regulatory systems may be associated with high vs. low (trait) anxious individuals during the go/nogo task, eventually leading to concomitant changes of state anxiety in these participants.

B11

Anxiety modulates the effects of emotion on spatial attention, CAROLINE CRUMP, AAKASH KISHORE, ANYA MEZINA, AND ERAN ZAIDEL, *University of California, Los Angeles, University of Pennsylvania.* People with high levels of trait anxiety attend selectively to negatively-valenced stimuli, and this effect is mediated by the right hemisphere (MacLeod, 1986). We tested this effect in 87 UCLA undergraduates using a modified Posner paradigm of covert orienting of spatial attention called the Lateralized Attention Network Task. This task used emotional (i.e. angry and happy) faces as automatic spatial cues, and measured Orienting Benefit (OB; difference in response latency to targets preceded by a valid cue relative to targets preceded by a neutral, central cue). We assessed anxiety with the State-Trait Anxiety Inventory (Spielberger, 1971). We predicted that participants with high anxiety would show a selectively large OB to angry faces presented in the left visual field. Consistent with our prediction, participants with high anxiety showed a selective increase in OB toward angry faces presented in the left visual field. By contrast, participants with low anxiety showed a selective increase in OB toward angry faces in the right visual field. Happy faces showed unexpected effects. There was a selective effect of OB in the left visual field for participants with low anxiety, and a selective effect OB in the right visual field for participants with high anxiety. Together, these results show that valence of an emotional cues affects orienting. This effect differs between the two hemispheres. This nonverbal test can be used as a probe for the effects of anxiety on cognition.

B12

Emotional prosody uses musical intervals to communicate emotion, MEAGAN E. CURTIS & JAMSHED J. BHARUCHA, *Tufts University.* Musical intervals are associated with emotions, but the origin of these associations is a topic of debate. For instance, the minor third is strongly associated with sadness in Western cultures, but evidence of an ecological basis for this association was previously lacking. We explored the intriguing possibility that the associations between intervals and emotions are also present in the prosody of human vocal expressions. Bi-syllabic speech samples conveying anger, happiness, pleasantness, and sadness were obtained from nine actresses who spoke American English. The speech samples were rated for perceived emotion. Acoustic analyses were conducted on the speech samples, and the prosodic contours of the sad speech samples revealed that the relationship between the two salient pitches tended to approximate a downward minor third, which is consistent with the emotional associations in the domain of music. The upward minor second was the most common prosodic interval of the angry speech samples, also mirroring musical associations. The patterns observed for happiness and pleasantness had a high degree of variability and were not typified by specific interval categories. Regression analysis of the speech sample emotional ratings revealed that the minor third was the most reliable acoustic cue for identifying sadness, and the minor second was a significant predictor of perceived anger. The results suggest that there are correspondences across domains in the use of pitch contours to encode and decode emotion, supporting the theory that these disparate systems of communication may have common evolutionary roots.

B13

Differential effects of fearful and angry facial expressions on memory. F.C DAVIS, L.H. SOMERVILLE, L.M. SHIN, & P.J. WHALEN*, Dartmouth College & Tufts University.* Research suggests that the amygdala is sensitive to both the valence and information value conveyed by facial expressions. For example, the human amygdala is more responsive to facial expressions of fear than anger, even though both expressions communicate negative valence. In non-human animals, amygdala responses to stimuli predicting negative events are enhanced when those stimuli have uncertain predictive value. We have proposed that the human amygdala is more responsive to fearful faces because of their uncertain predictive value: angry faces embody a direct threat and call for focused attention, while fearful faces call for diffuse attention because they offer less information about the source of threat. This hypothesis predicts that fearful faces should lead the viewer to learn more about the context, while angry faces should lead the viewer to learn more about the angry faces. We tested this hypothesis by measuring the effects of fearful and angry facial expressions on memory. In study 1, participants viewed fearful, angry, or neutral faces alternating with neutral words. Results show that when compared to neutral face blocks, fearful faces augmented memory for words, whereas angry faces impaired memory for words. In study 2, participants viewed blocks of fearful or angry faces alternating with neutral words. Results show that subjects remembered more words from the fearful face condition and more faces from the angry face condition. These data support the idea that although they communicate a similar message in terms of negativity, fearful and angry facial expressions call for different kinds of attention.

B14

Facial Expression: Identification and Recognition. Empirical Study with Portuguese. FREITAS-MAGALHÃES & ERICO CASTRO *University Fernando Pessoa Health Sciences School*. The faces who present facial expressions are more easily identified than the neutral. This is one of the conclusions of scientific study with 612 Portuguese (306 women and 306 men) of aged between 18 and 70 years. The procedure consisted in sample of images of the neutral faces and exhibiting different facial expressions from the F-M Portuguese Face Database (Freitas-Magalhães, 2003). The results suggest that the expressive face of men is more easily identified by women and men, although women identify and recognize with more precision. Also the faces of women and men of the 25 to 50 years are more effectively identified.

B15

Effortful Control, Cognitive Control, and Emotionality in Chinese American Children. ALEXANDRA MAIN & QING ZHOU, *University of California, Berkeley.* It is becoming well-known that several factors besides intelligence play a key role in children's academic success. Effortful Control, which consists of Attention Focusing and Inhibitory Control, has been found to predict children's academic achievement over time and in non-Western cultures. Additionally, Cognitive Control, or the ability to focus goal-directed thought and action, is also expected to be associated with positive academic outcomes. Not only are these constructs conceptually different, neuroscience literature points to different brain areas as being activated during tasks tapping these skills (e.g. anterior cingulate cortex v. dorsolateral prefrontal cortex).The present study seeks to understand how different components of these global constructs uniquely predict academic outcomes, and whether they are moderated by Negative Emotionality. The data represent the first wave of a 2-year longitudinal study of 1st and 2nd generation Chinese American children. Effortful Control was measured with the Child Behavior Questionnaire (CBQ) a behavioral task, and a computer task, Cognitive Control was measured with a computer task, and Negative Emotionality was measured with the CBQ and a behavioral task. We found that the interaction between Attention Focusing and Negative Emotionality uniquely related to math skills, while overall accuracy during the Cognitive Control task directly related to reading skills. Accuracy during trials of the Cognitive Control task that required rule switching uniquely related to both math and reading skills. These results suggest that Effortful Control and Cognitive Control each contribute uniquely to children's academic outcomes in a Chinese American sample.

B16

Adaptation Aftereffects Reveal the Malleability of Unambiguous Facial Expressions. PHILIP PELL & ANNE RICHARDS , *Birkbeck College, University of London.* According to traditional theories of facial expression perception, recognition of facial expressions (or at least a set of so called 'basic expressions') requires only the extraction of a fixed unambiguous signal. The work described here examines the effects of context in shaping perception using an adaptation paradigm. Morphs with seemingly unambiguous emotional expressions were created by combining two emotions (i.e., disgust and joy, and disgust and fear). These morphs were categorized twice; once after adaptation to one of the faces used to create them and once after adaptation to the other. Morphs (e.g., a disgust-joy face categorised without a context as 'disgust') viewed after adaptation to the face on the same side of the categorical boundary (i.e., disgust) tended to be perceived as the expression on the other side of the boundary (i.e., 'joy'). Conversely, after adaptation to the face on the other side of the boundary (i.e., joy), the same morphs were reliably perceived as the expression on the original side of the boundary (i.e., 'disgust'). We conclude that perception of supposedly unambiguous expressions is strongly influenced by context. These findings challenge the 'basic emotions' theory of facial expression perception.

B17

Emotion Enhances the Subjective Recollective Experience Despite Lower Objective Memory Accuracy. ULRIKE RIMMELE, LILA DAVACHI, RADOSLAV PETROV, SONYA DOUGAL, ELIZABETH A. PHELPS, *New York University*. Emotion strengthens the subjective experience of recollection. However, these vivid and confidently remembered emotional memories may not necessarily be more accurate. We investigated whether the subjective sense of recollection for emotional stimuli converges with enhanced memory accuracy for contextual details using the remember/ know paradigm. Our results indicate a double-dissociation between the subjective feeling of remembering, and the objective memory accuracy for emotional and neutral pictures. "Remember" judgments were boosted for emotional pictures, but less coupled with accurate recollection of contextual details and accurate associative memory between the emotional picture and a contextual detail. In contrast, neutral pictures given a "remember" response were associated with better recollection of contextual details and stronger associative memory between a contextual detail and the neutral picture. These findings show that the strong subjective recollective experience for emotional stimuli does not reliably indicate greater recollection of contextual details and may thus be based on another mechanism than is the subjective recollective experience for neutral stimuli.

B18

Fleeting Emotion Detection and Expression Discrimination, TIMOTHY D. SWEENY, SATORU SUZUKI, MARCIA GRABOWECKY, & KEN A. PALLER, *Northwestern University*. Affective encounters are typically brief, often affording only a fleeting glance from which to base emotional judgments. We investigated what information is available for detection of emotion and discrimination of briefly presented expressions, and if these processes dissociate. Observers viewed two sequentially-presented and backward-masked facial expressions, one neutral and the other emotional (fearful, angry, or happy), in a two-interval forced-choice task with stimulus duration varied (10, 20, 30, 40, or 50 ms). On each trial, observers attempted to detect the face with the emotional expression — emotion detection, and classify the expression — expression discrimination. Emotion detection was above chance at all durations and most accurate for happy expressions. Emotional expressions showing teeth yielded the highest accuracy. We evaluated expression discrimination with a novel calculation of d' that allowed comparisons between expression pairs, finding above-chance performance for angry/happy and fearful/happy at all durations except 10 ms, and poor performance of fearful/angry at all durations. Discrimination between fearful and angry expressions was also poor in an experiment in which all emotional faces were negative in valence (fearful, angry, or disgusted), suggesting that poor fearful/angry discrimination is not a deficit incurred from simultaneously discriminating expressions with negative and positive valence. Inverting the faces impaired happy/angry discrimination, but not emotion detection, suggesting that configural information contributes to expression discrimination but not emotion detection. Emotion detection and expression discrimination appear to rely on different information from a face, and detection often occurred without successful expression discrimination, suggesting a dissociation between these two processes.

B19

Emotional arousal enhances the vividness of perceptual experience and memory, REBECCA M. TODD, DEBBIE TALMI, & ADAM K. ANDERSON, UNIVERSITY OF TORONTO, ROTMAN RESEARCH INSTITUTE, WELLCOME DEPARTMENT OF COGNITIVE NEUROLOGY. An often-quoted quality of highly emotional memories is their unique vividness. We examined whether this vividness may in part reflect an enhancement in the quality of perceptual experience during emotional events. Using a psychophysical magnitude estimation procedure, we embedded images in varying low levels of gaussian noise and participants (26 undergraduate students from the University of Toronto) estimated the perceived magnitude of noise relative to a standard of equivalent luminance and contrast ratio. Images were complex scenes from the international affective image set (IAPs) and were positive and arousing, negative and arousing, or neutral. One week later, memory for images was tested and participants subsequently rated the arousal level of each image. Noise magnitude judgments made at encoding varied linearly with increasing objective noise levels. Emotionally arousing images of both negative and positive valence were judged as significantly less noisy/more vivid compared to neutral images of objectively equal noise. Noise estimation was highly correlated with individual differences in self-reported arousal. Moreover, although both noise ratings and arousal ratings predicted memory vividness, the effect of noise ratings of relative perceptual vividness on memory vividness was mediated by arousal. These findings suggest that emotional arousal interacts with stimulus encoding to alter the quality of perceptual experience, which may be a contributing factor to the vivid character central to highly emotional memories. (Note: Poster withdrawn.)

B20

The Influence of Emotion Regulation on Social Interactive Decision-Making, *Mascha van 't Wout, Luke J. Chang, & Alan G. Sanfey, University of Arizona, Brown University.* Although adequate emotion regulation is considered to be essential in everyday life, it is especially important in social interactions. However, the question of whether emotion regulation strategies are effective in a socially interactive context in which decisions made have actual consequences remains unanswered. We investigated the effect of expressive suppression and emotional reappraisal on strategic decision-making in a social interactive environment, i.e. the Ultimatum Game. As hypothesized, participants in the emotional reappraisal condition accepted unfair offers more often than participants in the suppression and no-regulation condition. Additionally, the effect of emotional reappraisal even influenced the amount of money participants proposed during a second interaction with partners that had treated them unfair previously. These results support and extend previous findings that emotional reappraisal is a powerful emotion regulation strategy that influences and changes how we interact with others even in the face of inequity.

B21

Sleep Deprivation Disrupts the Ability to Recognize Human Emotions, ELS VAN DER HELM, NINAD GUJAR, MATTHEW P. WALKER, *University of California, Berkeley.* While the effect of sleep-deprivation on cognition has received considerable interest, the impact of sleep loss on emotional processing remains surprisingly understudied. Here we demonstrate that sleep-deprivation markedly impairs the ability to identify specific human emotions. Participants rated different affective face categories: Sad, Happy and Angry, which ranged in a gradient from neutral to emotional. Prior to the task participants were sleep-deprived. To control for repeatability, a second group was tested twice under sleep rested conditions. Only under conditions of sleep-deprivation we observed a significant impairment in the recognition of Anger and Happy expressions, especially as the emotional intensity increased, yet the recognition of Sad expressions was preserved. These selective deficits were, however, ameliorated following recovery sleep. Such findings suggest that sleep loss impairs discrete affective neural systems, disrupting the ability to identify salient emotional cues—a critical function that directs optimal social and complex motivational behavior—and may offer clinically relevant insights into the co-occurrence of sleep disruption in psychiatric disorders.

B22

The Angry Spotlight: Selective Visual Attention to Rewards in Anger, WILLIAM R. SHIRER, BRETT Q. FORD, TAD T. BRUNYE, CAROLINE R. MAHONEY, HOLLY A. TAYLOR , & MAYA TAMIR*, Boston College & Tufts University.* According to Mogg and Bradley (1999), the attentional system provides a mechanism for detecting and monitoring visual stimuli that are relevant to the motivational state of the organism. Research on selective visual attention has found that both trait affect and state affect are associated with unique patterns of attentional biases (MacLeod & Mathews, 1986; Mathews & MacLeod, 1994). Particularly, emotions influence to what items in the environments we attend, how quickly we attend to them, and how quickly we are able to disengage from them. In this study, we induced participants with anger, happiness or fear and then used eye tracking to examine selective visual attention to threatening versus rewarding images. We found that people induced to feel angry attend more to rewarding images than threatening images, consistent with the theory that anger supports the motivational state of reward-seeking. People induced to feel happy, an emotion also consistent with reward-seeking, were also found to attend more to rewarding than threatening images. Conversely, people induced to feel fear, an emotion consistent with threat-avoidance, attended more to threatening than rewarding images, relative to people in the happy or angry conditions.

B23

Subliminal Emotional Priming and Decision Making in a Simulated Hiring Situation, INÈS SKANDRANI-MARZOUKI & YOUSRI MARZOUKI, *Tufts University & Aix-Marseille University*. The present study was designed to examine the unconscious influence of emotion on decision making in a simulated hiring situation. To do so, we used a subliminal masked priming paradigm with varying faces as primes. The primes were presented with a duration of 50ms with two levels of emotional factor: positive emotion (happiness) versus negative emotion (anger). These primes were followed by emotionally neutral target faces for which primes were congruent (same faces) or incongruent (different faces). Two dependant measures were analysed: number of choices and reaction time (RT). Results revealed a strong effect of emotional priming. Participants tended to choose more target faces preceded by positive prime faces. Moreover, they reacted faster in the presence of target faces preceded by negative primes.

B24

Cognitive and Affective Processing in Moral Reasoning: Relationships Among Alexithymia, Psychopathy, and Executive Functions, ALLISON EARON & NANCY S. KOVEN, *Bates College*. A recently proposed "dual-process theory" posits that utilitarian moral reasoning style is the result of cognitive control of emotion. This hypothesis suggests that deficits in affective processing will contribute to increased utilitarianism. As such, the relationship between alexithymia, psychopathy, moral reasoning style, and executive function was investigated by administering a series of self-report surveys to both a college and community sample. Results revealed that as alexithymia scores increase, rates of utilitarian moral decision-making increase. However, while alexithymia was associated with impaired executive function, utilitarianism and executive function had no significant relationship, suggesting the existence of a different cognitive factor in alexithymia to account for increased utilitarianism. A significant correlation between alexithymia and psychopathy was also observed, and psychopathy was similarly associated with deficits in executive function.

B25

The Late Positive Potential Varies with Trait Anxiety, JENNIFER AUGELLO, LAURA O'TOOLE, GREG HAJCAK, GEORGE BONANNO, & TRACY DENNIS, *The City University of New York, Stony Brook University, Teachers College, Columbia University, Hunter College.* The late positive potential (LPP), an event-related potential, reflects increased processing of, and attention to emotional stimuli (Cuthbert et. al, 2000). Previous research has demonstrated that LPP amplitudes are greater for pleasant and unpleasant compared to neural stimuli (Hajcak, Moser, & Simons, 2006). The LPP may therefore serve as a marker for disruptions in affective processing in anxious individuals, who show greater vigilance for and avoidance of threat-relevant stimuli (Mathews & Mackintosh, 1998). Presently studies have not examined associations between trait anxiety and the LPP in light of these attention biases. The present study (N=22) examined these associations in two tasks: a passive view and an affective regulation task, involving unpleasant stimuli. During the passive view there was a positive correlation between LPP amplitudes in an early window (350-500 ms) and trait anxiety ($r = .44$, $p = .04$), suggesting increased processing of unpleasant stimuli as trait anxiety increased. Conversely, there was a negative correlation between LPP amplitudes in a late window (1000-2000 ms) and trait anxiety ($r = -.42$, $p = .04$), suggesting subsequent withdrawal of attention during later stages of processing the unpleasant stimuli. During the affective regulation task, LPP amplitudes were greater in the suppress versus enhance condition for low trait anxious individuals ($t(10) = 2.39$, $p = .04$); however, there was no significant difference between these conditions for high trait anxious individuals, suggesting disrupted ability to regulate emotional responses to unpleasant stimuli. Taken together, findings support the hypothesis that the LPP reflects anxiety-related attention biases, specifically early vigilance followed by attentional avoidance, and regulatory disruptions.

B26

EEG Asymmetry, Temperament, and Socio-Emotional Outcomes in Children, JENNIFER MARTIN MCDERMOTT, EVA KWONGE , & NATHAN A. FOX, *University of Wisconsin, University of Maryland*. The Behavioral Inhibition System (BIS) is characterized by avoidant behaviors and sensitivity to negative experiences whereas the Behavioral Approach System (BAS) is associated with approach behaviors and sensitivity to positive experiences (Gray, 1987). These systems are linked to hemispheric variations in brain activity (EEG asymmetry) and personality traits. Evidence suggests that abnormalities in these systems may increase susceptibility to mood disorders (e.g. Harmon-Jones & Allen, 1997, Kasch, et al., 2002). Although somewhat similar patterns have emerged in children (e.g. Possel et al., 2008), less is known about these associations within the context of children's temperament traits. Therefore, the current study was designed to examine associations among EEG asymmetry, temperament traits, and socio-emotional outcomes in children. Temperament and socio-emotional outcomes were assessed via maternal report on CBQ, Child BIS/BAS, and CBCL measures. Alpha band scores were calculated at frontal and parietal sites and used to create asymmetry groups. The data reveal links between EEG asymmetry and temperament traits at the parietal region. Specifically, children with greater right versus left activation were less soothable and displayed greater sadness, negative affect and anxiety/depression ($t's > -2.16$, $p's < .05$). Temperament and asymmetry groupings predicted ratings of total socio-emotional problems on the CBCL ($F's(1,61) \geq 6.24$, $p's \leq .01$). Specifically, children high in right EEG activation and temperamental inhibition had the highest rates of total problems. This interaction suggests a potential additive effect for temperament and EEG asymmetry in relation to children's socio-emotional outcomes and highlights the need for further study of these constructs within a developmental context.

B27

Emotion-related modulation of high-frequency EEG power, JULIE ONTON & SCOTT MAKEIG, *University of California San Diego*. Discovering the EEG correlates of different emotional states would be useful in many clinical settings, for example to monitor or possibly practice emotion self-regulation through EEG biofeedback. In this study, we show that orderly fluctuations in broadband high-frequency power can be isolated from high-density scalp electroencephalographic (EEG) data and are sensitive to mental and/or emotional state. EEG data from an eyes-closed emotion imagination task were linearly decomposed using independent component analysis (ICA) into maximally independent component (IC) processes to eliminate the confounding effects of mixed EEG signals summed at each scalp electrode. Joint decomposition of IC log spectrograms into source- and frequency-independent modulator (IM) processes revealed two classes of IMs that separately modulated broadband high-frequency (~15-200 Hz) power of brain and muscle IC sources. Multi-dimensional scaling revealed orderly but spatially complex relationships between mean broadband IM effects and the valence of the imagined emotions. Thus, contrary to previous assumption, coherent broadband spectral modulation patterns encompassing the beta, gamma, and high gamma frequency ranges can be isolated from scalp-recorded EEG data and differentially associated with cognitive activities.

B28

Prefrontal Asymmetry Moderates Relationships between Self-Reported Empathy and Depression, AMANDA R. W. STEINER, ELIZABETH A. BENDYCKI, & JAMES A. COAN, *University of Virginia.* Individuals with depression have been shown to report normal or even elevated levels of empathy (e.g., O'Connor et al., 2007), but this relationship is not completely understood. Aspects of empathic responding have been theorized to be more strongly related to depression when an individual lacks the resources necessary to regulate emotions (e.g., Schieman & Turner, 2001). Additionally, research in our lab suggests that relatively greater left prefrontal activity indexes approach-related emotion regulation strategies that protect people against withdrawal-related negative affect. In this study, we used prefrontal asymmetry (pFA) and self-reported depressive symptoms to predict an individual's rating of their ability to be empathic (e.g., by being sensitive, providing emotional support, etc.). Based on previous findings, we expected that individuals who reported being depressed would be less likely to report being empathic if they demonstrated relatively greater left prefrontal activity during experimental tasks. Participants completed a battery of questionnaires before their prefrontal activity was recorded using EEG. Results indicated that pFA interacted with depressive symptoms to predict empathy ratings. Decomposition of this interaction effect revealed that relatively greater left pFA was associated with lower levels of self-reported empathy in individuals with depression. By contrast, individuals reporting low levels of depressive symptoms showed no significant relationship between pFA and empathy. These findings will be discussed in the context of understanding vulnerabilities to depression within a biopsychosocial framework.

B29

Prefrontal Asymmetry Moderates the Negative Effects of Insecure Attachment Styles, AMANDA R. W. STEINER, MARGARET T. DAVIS, & JAMES A. COAN, *University of Virginia*. Securely attached individuals demonstrate a greater sense of well-being than insecurely attached individuals (e.g., Hazan & Shaver, 1987), but the underlying neural mechanisms supporting these differences remain unclear. For this study, we used self-reported attachment styles and prefrontal asymmetry (pFA), a putative neurophysiological measure of affective vulnerability, to predict homesickness in college freshmen. We hypothesized that pFA would moderate the relationship between attachment style and subsequent homesickness reports, such that individuals who reported insecure attachment styles would be buffered from feelings of homesickness if they demonstrated greater left prefrontal activity during experimental tasks. Participants completed the Relationship Scales Questionnaire (Griffin & Bartholomew, 1994) to assess attachment patterns across four categories: secure, anxious, preoccupied, and dismissing. EEG was obtained at rest, as well as during and following two video clips designed to elicit negative affect. Participants returned six weeks later to complete questionnaires on their adjustment to college, including level of homesickness. Results indicated that pFA interacted with self-reported attachment style to predict homesickness six weeks after brain measurements and self-reports were obtained. Decomposition of this effect revealed that relatively greater left pFA was associated with lower levels of homesickness in individuals who reported having insecure attachment styles. By contrast, individuals reporting a secure attachment style showed no relationship between pFA and homesickness. An approach-related emotion regulation style (i.e., relatively greater left pFA) may buffer individuals from risks associated with difficulty forming and maintaining social relationships.

B30

Emotion Regulation And Cognitive Control Preserve Learning Under Stereotype Threat, RONALD C. WHITEMAN, CATHERINE GOOD, & CAROL DWECK, *The City College of New York, CUNY, Baruch College, CUNY, Stanford University*. Research on stereotype threat (ST) reveals that women's math performance may suffer when tasks are presented as diagnostic and gender is made salient because worry about fulfilling the stereotype absorbs working memory resources. Less is known, however, about how these affective responses influence learning processes that could support remediation of performance errors. Here, we took advantage of the neuromonitoring afforded by ERPs to assess females' affective appraisal of negative performance feedback on a challenging math test and their engagement with tutorial opportunities that could support error correction on a later surprise retest. We divided our subjects into better and poorer learners based on a post-hoc median split of error correction to determine if different processes supported effective learning under ST and non-threat (NT) conditions. Overall, better learners exhibited reduced affective processing of negative feedback, as indexed by the Late Positive Potential (LPP), a waveform associated with attention to arousing stimuli. However, the LPP of better learners under ST was reduced further compared to better learners under NT, suggesting additional down-regulation of the affective response. During preparation to receive the math tutor, better learners exhibited posterior slow wave activity indicative of a reorienting of attention toward the learning opportunity. Under ST, this was coupled with greater anterior activity suggesting engagement was more effortful compared to NT. Taken together, these data suggest that when exposed to ST, down-regulating negative emotional responses to error and up-regulating cognitive processing of learning opportunities may be even more critical for rebound from failure than under NT.

B31

Neurophysiological And Cardiovascular Correlates Of Emotion Regulation, S. WOLTERING, H. CHAPMAN, & M.D. LEWIS, *University of Toronto*. Emotional reactions involve changes in both cognitive and bodily processes. Therefore, effective emotion regulation may also involve modulation of responses in both of these systems. The present study investigated the relationship between regulation of cognition and regulation of the body in children and adolescents, using a go/nogo task in combination with the induction of negative emotions. Behavioural, temperamental and event-related brain potential (ERP) indicators of cognitive control were collected, as was a measure of parasympathetic control of the heart (respiratory sinus arrhythmia, RSA). RSA, during and after the emotion-induction procedure, was significantly correlated with the no-go N2 amplitudes in the emotion induction phase, independently of age. Resting RSA was correlated with individual differences in the capacity for effortful cognitive control, as measured by questionnaire. The results suggest that regulation of emotional responses in seemingly distinct domains may indeed be carried out in an integrated manner during childhood.

Session F Poster Session II (Alumnae Lounge)
Friday, June 5, 2009
4:00 – 5:30 pm

F1

Amygdala Activity Predicts Expectancy Effects On Pain-Processing Regions, LAUREN Y. ATLAS, NIALL BOLGER, MARTIN A. LINDQUIST, & TOR D. WAGER, *Columbia University.* A central question in cognitive neuroscience over the last fifty years concerns processes affected by expectancy. Expectations about pain intensity can strongly influence self-reported pain in experimental and clinical settings, but whether and how expectancy-related changes in the brain contribute to the subjective experience of pain is largely unknown. In addition, limbic and striatal regions such as the amygdala and ventral striatum are implicated in hundreds of studies of emotion and affect, but they have an ambiguous relationship with pain. In this study, we provide evidence that pain expectancies influence both core pain-processing regions and interconnected limbic regions, including the amygdala. We used a novel multi-level mediation analysis in fMRI to identify regions that 1) respond to expectancy, 2) predict trial-to-trial variations in pain reports, and 3) formally mediate the relationship between experimentally manipulated expectancy and reported pain. Several canonical pain-processing regions emerged as mediators, including anterior cingulate cortex, anterior insula, thalamus, and pons. In addition to these pain-processing mediators, we identified mediators not typically associated with pain but with cognitive control and affective value, including the left dorsal amygdala. In this presentation, we focus on interactions between expectancy effects on dorsal amygdala and pain-processing mediators. We show that expectancy-related increases in the amgydala predict increases in core pain-processing regions, which in turn predict pain experience. These results directly link amygdala activity to perceived pain, and begin to outline how multiple brain pathways interact to generate the subjective experience of pain.

F2

Neural Underpinnings of Attachment Security Enhancement, MELANIE CANTERBERRY, OMRI GILLATH, REBECCA CHAMBERS, LAURA E. MARTIN, & CARY R. SAVAGE, *University of Kansas.* Attachment security is the perception that one is worthy of being loved and has close others who will provide support, comfort, and protection when needed. The presence of attachment security is associated with better emotion regulation, higher positive mood, higher self-esteem, lower defensiveness, and higher tolerance for people who are different from oneself. A sense of attachment security can be experimentally enhanced using various subliminal or supraliminal methods, and has been shown to have beneficial effects such as reducing distress and maintaining or restoring well-being and self-esteem (Gillath, Selcuk, & Shaver, 2008). This enhancement is thought to temporarily activate mental representations of attachment figures and the support and comfort associated with them, while augmenting a person's sense of security in a rewarding way. The current research was designed to provide insight into the underlying neural mechanisms of security enhancement using fMRI. Ten participants (4 males; Mdn age = 26.5) were scanned in a pilot study. Participants were presented with either positive or negative attachment primes while completing a cognitive task. Analysis revealed that security enhancement was associated with higher brain activation in the inferior frontal and fusiform gyri, which are known to be related to processing of emotional and social information (e.g., Ortigue, et al., 2007). The moderating role of attachment style as well as the implications of our findings to attachment theory and the broader field will be discussed.

F3

Amygdalo-Insular Anticipatory Response to an Aversive Sound: Association with Anxiety, JOSHUA M. CARLSON, TSAFRIR GREENBERG, & LILIANNE R. MUJICA-PARODI, *State University of New York, Stony Brook School of Medicine*. Anticipation of negative outcomes is a central component of anxiety and the insula appears to be an important neural substrate in which this process is mediated. However, the extent to which individual differences in trait anxiety are associated with anticipation-related insula reactivity to aversive sounds is unknown. Based on previous findings in other sensory modalities, we hypothesized that the insula, amygdala, and anterior cingulate would be activated during the anticipation of an aversive sound and that this activity would be positively associated with an individual's level of trait anxiety. Twelve participants completed the Spielberger trait anxiety inventory (1970) and an fMRI auditory anticipation paradigm that included a cue (X: aversive or O: neutral; 1 sec) plus countdown period (16 sec), which preceded either an aversive (100 dB burst of white noise) or neutral auditory event (1 sec). An ROI analysis revealed increased aversive anticipation-related activity in bilateral amygdala and insula. Within this ROI, a cluster in the right anterior insula was positively associated with individual differences in trait anxiety. An exploratory whole brain analysis revealed additional activation in the auditory and visual cortex, superior temporal gyrus, thalamus and inferior colliculus. These findings provide evidence for an amygdalo-insular system involved in a preparatory modulation of cortical and subcortical sensory processing in anticipation of an aversive sound. The sensitivity of the right anterior insula to individual differences in trait anxiety suggests that individuals with high trait anxiety may experience greater worry and somatic arousal while anticipating undesirable events.

F4

The Neural Substrates of Person-knowledge and Face Familiarity, J. CLOUTIER, W.M. KELLEY, & T.F. HEATHERTON, MIT, TUFTS UNIVERSITY, DARTMOUTH COLLEGE. This study examines the impact of person-knowledge on the neural substrates of facial familiarity. Based on current neural models of face perception, it was hypothesized that distinct extended networks of brain regions differentiate the perception of (a) novel faces, (b) novel faces associated with person-knowledge, (c) perceptually familiar faces and (d) familiar faces for which person-knowledge was learned. To test this hypothesis, we conducted an event-related fMRI experiment during which participants viewed faces that were experimentally manipulated to represent these different levels of familiarity. Results confirmed the involvement of the medial prefrontal cortex (MPFC) when person-knowledge about a social target is available.

F5

fMRI Investigation of Emotional Responses for High and Low Sensation Seekers, H.R. COLLINS, S. KISER, C. R. CORBLY, Y. JIANG, T.H. KELLY, & J. E. JOSEPH, *University of Kentucky.* High sensation seeking has been associated with risky behaviors and negative behavioral outcomes, and high sensation seekers (HSS) are more sensitive to arousal than low sensation seekers (LSS). However, little is known about the neural systems involved in emotional reactivity among HSS and LSS. Based on the Zuckerman-Kuhlman Personality Questionnaire, we obtained a group of HSS and a group of LSS. Using fMRI, HSS and LSS participants viewed images that were characterized as positive or negative in valence and high or low on arousal. These participants differed in regions that were active during picture viewing, suggesting differences in emotional processing due to sensation seeking type. When contrasting high arousal negative to high arousal positive images, HSS showed a stronger response than LSS in the right insula. The insula is known to be involved in arousal, sympathetic stress responses, and may be involved in addictive cravings. When contrasting high arousal positive to high arousal negative images, LSS showed activation in the anterior cingulate whereas HSS showed no such activation. The cingulate has been implicated in emotion regulation and cognitive control, suggesting LSS attempt to regulate their emotional reactivity when presented with intense images. When processing high arousal emotional stimuli, HSS recruit regions associated with arousal while LSS recruit regions associated with emotion regulation. Along with previous findings, this research suggests that HSS show dysfunctional emotion regulation and are sensitive to arousal. This study elucidates the differential brain regions involved in processing emotional materials for high and low sensation seekers.

F6

Neural Response to Emotional Stimuli with Phylogenetic and Ontogenetic Significance, JOAQUIN DE ROJAS & ELIZABETH KENSINGER, *Boston College*. Neural and behavioral responses to emotional stimuli often are discussed within an evolutionary framework. Although some of the information that elicits an emotional response is likely to have had evolutionary significance (e.g., snakes, spiders), many other stimuli would not have been evolutionarily relevant (e.g., guns, grenades). The present study re-analyzed data from two fMRI studies (Kensinger et al., 2007; Kensinger & Schacter, 2008) to examine whether the neural systems that respond to fear-evoking stimuli differ depending upon whether those stimuli are of phylogenetic or ontogenetic significance. The results revealed that when stimuli were ontogenetic, activity was increased in regions of the anterior cingulate and orbitofrontal cortices. By contrast, when stimuli were phylogenetic, activity was increased in a region spanning the lingual and fusiform gyri. These results suggest that there can be differences in how particular fear-evoking stimuli are processed, and those differences can depend upon the stimuli's evolutionary significance.

F7

Brain Activation in Emotional Interference: The Role of Serotonin Transporter Polymorphisms, Kathryn Handwerger, Christopher I. Wright, Joshua L. Roffman, Reid Offringa, Sonali Paul, Katherine McMullin, Michelle M. Wedig, Frank Diaz, George Bush, Jordan W. Smoller, Ahmad R. Hariri, & Lisa M. Shin, *Tufts University, Massachusetts General Hospital and Harvard Medical School, Brigham and Women's Hospital, Harvard University, Duke University, Tufts University School of Medicine.* Anxiety disorders are typically marked by enhanced attention toward emotional information and abnormal patterns of anterior cingulate activation during the performance of emotional interference tasks. Whether these differences reflect acquired characteristics of anxiety disorders or premorbid risk factors is unknown. A common serotonin transporter promoter region polymorphism (5-HTTLPR) has been implicated in the mediation of anxiety-related behaviors. However, to date, fMRI research has not directly examined the role of the 5-HTTLPR on emotional interference in a healthy population. We used functional magnetic resonance imaging (fMRI) in 17 healthy participants during an emotional Face Stroop task. Subjects saw fearful and happy expressions with superimposed words that either matched (Congruent) or did not match (Incongruent) the facial expression. All subjects were genotyped for the 5-HTTLPR and rs25531, which may modulate the impact of the 5-HTTLPR, and separated into two groups: L' homozygotes (5-HTTLPR L/L and rs25531 A/A) or S' carriers (5-HTTLPR S/+ or rs25531 G/+). Behavioral results revealed no significant differences in degree of interference (response times or error rates) between L' homozygotes and S' carriers. Functional MRI analyses revealed significantly greater dorsal anterior cingulate (dACC), rostral anterior cingulate, and right amygdala activation in the Incongruent>Congruent comparison in all subjects. Assessment of genotype status revealed significantly greater dACC and amygdala activity in S' carriers compared to L' homozygotes in the Incongruent>Congruent comparison. These preliminary results indicate that healthy S' carriers, who presumably have relatively increased serotonin signaling, display neural patterns similar to those found in patients with anxiety disorders; suggesting that such neural patterns may represent premorbid markers of risk.

F8

Gender Specific Activations For Perceiving Threatening Dynamic Faces And Bodies. M.E. KRET, J. GRÈZES, S. PICHON, & B.DE GELDER, *Tilburg University, Ecole Normale Supérieure, Massachusetts General Hospital.* We express and communicate our emotional states and action tendencies with our whole body, the face included. Are faces better signal bearers than bodies or does each contribute in its own complementary way? Taking together the many studies on facial expressions and the few available on bodily expressions does not provide an answer to this question. We undertook a systematic comparison of the neurofunctional network dedicated to processing facial and bodily expressions using short video clips. We also added the factors gender of the observer and of the observed faces and bodies. Two event-related functional magnetic resonance imaging (fMRI) experiments using oddball task were realized, the first used short video fragments of anger and neutral facial and bodily expressions, the second experiment used fearful and neutral expressions. There are three major sets of results. As concerns stimulus category, our results show that the amygdala (AMG) is sensitive to expressions of faces and bodies, but significantly more to faces. The cuneus, fusiform gyrus (FG), middle temporal gyrus (MT/V5/EBA area), superior temporal sulcus (STS) and temporo-parietal junction (TPJ), superior parietal lobule (SPL), primary somatosensory cortex (SI) and at subcortical level, the thalamus, were involved in processing bodies more than faces. Threatening body expressions, whether fearful or angry, modulated activity in MT/V5/EBA area, right TPJ and SI. One final major finding is that emotions expressed by male and female actors were equally recognized, but activation of emotion processing areas only appeared when one is perceiving threat from male actors.

F9

Disambiguation of Social Cues in Working Memory, LOPRESTI, ROBERT ROSS, MATTHEW GRACE, & CHANTAL STERN, *Boston University, Massachusetts General Hospital, Harvard Medical School.* Social interactions require us to continuously monitor the changing facial expressions of multiple individuals. This ability relies on a working memory system that can maintain information about the identity and emotional expressions of individuals across time. One possible mechanism for this would require separate systems for the maintenance of identity and expression. Another mechanism would involve flexibly binding emotion and identity together during working memory. A recent imaging study from our lab supports this second hypothesis. We demonstrated that the orbitofrontal cortex, amygdala, and hippocampus are involved in binding identity and emotion together during the delay period of a working memory task (LoPresti et al., 2008). The goal of the current study was to examine how overlapping representations of individuals with multiple facial expressions are disambiguated in working memory. We designed a delayed match-to-sample task for fMRI with two sample faces that were either from the same individual with different emotional expressions (overlapping), or from two different individuals with different expressions (non-overlapping). We isolated fMRI activity related to the disambiguation of overlapping social cues during working memory by comparing the overlapping and non-overlapping conditions. This analysis revealed changes in the orbitofrontal cortex during encoding and in the hippocampus during the delay period. In addition, we found changes in the superior temporal sulcus and inferior temporal gyrus during the delay period. These results suggest that the orbitofrontal cortex and hippocampus are important for distinguishing between social cues with common features, and for maintaining those distinctions during social interactions.

F10

Mindfulness During Pain and Negative Emotion: An fMRI Study, PETER MENDE-SIEDLECKI, HEDY KOBER, JASON BUHLE, BRENT HUGHES, ETHAN KROSS, TOR D. WAGER, & KEVIN N. OCHSNER, *Columbia University, University of Texas, University of Michigan*. Recent research has examined various mechanisms supporting effortful emotion regulation. Concurrently, acceptance-based meditation practices have emerged as a potential means of treatment for disorders ranging from depression to chronic pain. Though the two disciplines may share functional goals, an understanding of the behavioral efficacy and neural substrates of acceptance as an emotion-regulation strategy is lacking. This study used fMRI to examine the use of acceptance-based mindfulness strategies to regulate responses to both physically and emotionally aversive stimuli. Sixteen healthy subjects were scanned while viewing neutral and aversive images and while experiencing warm or painful heat. While experiencing these stimuli, participants were instructed to either (a) react naturally to the stimuli and to allow themselves to feel their full emotional response ("react") or (b) accept the sensations they experienced and to recognize that these feelings would pass ("accept"). Subjective ratings indicated that participants displayed statistically significant drops in negative affect when maintaining an accepting mindset rather than a reactive mindset. Maintaining the "accept" mindset produced activity in right rostrolateral prefrontal cortex and posterior cingulate cortex, as compared to the "react" mindset. This is consistent with literature on the maintenance of abstract mindsets. In addition, overall acceptance success scores (collapsed across stimuli) correlated with overall "accept" state activity in right rostrolateral prefrontal cortex and left dorsolateral prefrontal cortex, consistent with prior work on emotion regulation.

F11

Functional Connectivity During a Facial Expression vs. Identity N-Back Task, MAITAL NETA, ERIKA RUBERRY, & PAUL WHALEN, *Dartmouth College, Cornell University*. Facial expressions of emotion are a critical aspect of our social interactions as human beings. Just as important is the identity of the individuals, as this creates the context in which these expressions will be interpreted. Therefore, it is crucial that we monitor both identity as well as expression information and maintain this information in memory. Participants performed an N-back task in which they either tracked the expression or the identity of the same set of face stimuli. During both the expression and identity tasks, we found a significant increase in activity in dorsolateral prefrontal cortex (DLPFC), an area that has been shown to be critical for working memory. Functional connectivity analyses revealed that activity within this region of the DLPFC was coupled with regions that have been shown to support the processing of emotional expressions and identity during the respective task. Finally, across subjects, activity in the DLPFC correlated with the amygdala during the facial expression N-back, and with the fusiform gyrus during the face identity N-back. The correlated level of activity in these regions was also significantly correlated with performance on the respective tasks. Based on these findings, there is evidence for two separate neural circuitries, both involving the DLPFC, supporting working memory for two distinct aspects of face processing/memory.

F12

Active Coping – Role of Amygdala-Striatal Circuitry in Humans, DANIELA SCHILLER, CHRISTOPHER K. CAIN, KATE R. KUHLMAN, JOSEPH E. LEDOUX & ELIZABETH A. PHELPS, *New York University.* Adaptive performance under adverse conditions critically relies on the ability to regulate emotions. Emotion regulation can be implemented through cognitive strategies or instrumental responses (active coping). Although the latter is more common in everyday life, research to date focused on the cognitive domain, and surprisingly little is known about coping through instrumental actions. We developed a novel active coping paradigm in which subjects were cued to press a button during aversive or neutral stimuli presentation. In the active coping condition, image termination was contingent upon this response, whereas in the non-coping condition, the button press failed to terminate the image. Using neuroimaging, we found increased amygdala responses when subjects were unsuccessful in terminating the aversive stimuli, but these responses decreased when actions were successful. In parallel, the striatum and dorsomedial prefrontal cortex (PFC) showed increased and correlated responding during successful coping. These results provide evidence for the involvement of amygdala-striatal-PFC circuitry in active coping with aversive events. Thus, different regulation strategies engage separable cortico-amygdala paths to modulate emotional responses: A cognitive strategy recruits amygdala-ventromedial-dorsolateral PFC circuitry, potentially due to the high-order cognitive functions involved; Whereas, an instrumental strategy, as shown here, engages amygdala-striatal-dorsomedial PFC circuitry when motor-emotion interface is required.

F13

The Influence of Context on Emotional Face Processing, C.B.A. SINKE & B. DE GELDER, *University of Tilburg, University of Maastricht, Massachusetts General Hospital, Harvard Medical School.* Humans rapidly recognize and understand facial expressions of others, as shown by numerous behavioral and neuroimaging studies. An important factor that may influence this recognition process is the context in which the face is perceived. Affective scenes have already shown to influence an ERP component (the N170) of facial expressions, indicating that the face is already at an early stage encoded differently in an affective context. We wanted to further explore these context effects using functional magnetic resonance imaging. We tried to investigate the influence of either a congruent or incongruent scene on the neuronal processing of fearful and neutral faces. Fourteen participants were being scanned while they were shown photographs (248 trials) of either a fearful or a neutral face in a fearful, neutral or scrambled scene. To stay focused, they had to respond to an oddball, being an inverted stimulus. All bodies were replaced with the same black body-like shape for all identities and emotions, so no information could be extracted from this. The experiment consisted of four runs of 31 blocks. Eight stimuli were presented per block for 800 ms with an interval of 350 ms. Also, a functional localizer for the perception of faces, bodies, houses and tools was used. Our results show that activity in brain areas that are associated with perception of faces or perception of scenes, are influenced by the emotional information conveyed by the respective stimuli.

F14

The Neural Bases of Empathic Accuracy and Affective Expressivity, JAMIL ZAKI, JOCHEN WEBER, NIALL BOLGER, & KEVIN OCHSNER, *Columbia University.* How do people understand the thoughts and feelings of others, and effectively communicate their own internal states? While much research in cognitive neuroscience has addressed the mechanisms involved in sharing the sensory and emotional states of others, the mechanisms underlying accurate understanding those states have remained largely unexplored. We used a novel empathic accuracy (EA) paradigm to address this gap in extant knowledge. Brain activity was recorded from 16 perceivers using fMRI while they watched videos of social targets describing emotional autobiographical events, and continuously rated how positive or negative they believed targets felt. Correlations between these ratings and targets' own affect ratings served as measures of EA, and were used as predictors in subsequent fMRI analyses. This allowed us to explore brain activity tracking with perceivers' accuracy in understanding target affect. We found that periods of accurate – as opposed to inaccurate – inferences were supported by frontal and parietal activity associated with mental state attribution, and sensorimotor structures within the mirror neuron system. Furthermore, targets who scored high on a trait measure of emotional expressivity were more affectively "readable" – that is, they produced higher levels of EA across perceivers – and this was in part because target expressivity predicted the magnitude of perceivers' neural activity in several brain regions related to mental state attribution. Overall, these data demonstrate that multiple social cognitive processes are employed in concert to understand the emotions of others, and that the characteristics of social targets affect perceivers' neural and cognitive processes.

F15

A Bias Towards 'Looming' Human Faces in a Frontoparietal Network and its Potential Role in Social Behavior, BRITTANY S. CASSIDY, XIAOMIN YUE, JEREMY YOUNG, ROGER B.H. TOOTELL, & DAPHNE J. HOLT, *Harvard University*. Functional neuroimaging studies of social cognition and behavior have focused on regions of the medial temporal and prefrontal lobes that are known to be involved in emotional learning, memory and regulation. However, emerging evidence suggests that some prioritization of emotionally or socially –salient information occurs at early, perceptual stages of information processing. For example, studies in non-human primates have identified a network of polymodal regions (including the macaque ventral intraparietal area (VIP), or putative human homologues in the dorsal intraparietal sulcus (DIPS) and ventral intraparietal sulcus (VIPS), ventral premotor cortex (PMv) and putamen) that responds preferentially to objects and movements near the body. This near-space network is proposed to protect the body surface from harm, and to facilitate contact with rewarding stimuli (e.g. food or a mate). Some neurons within this network in the monkey respond selectively to 'looming' stimuli (e.g. expanding greater than contracting), but the frequency and distribution of such responses in the human brain are unknown. Using fMRI, we tested for regions in the human brain that exhibit a looming bias. Eight healthy subjects underwent functional MRI scanning while viewing three types of approaching and receding stimuli in a block-design experiment: computer-generated human faces with neutral expressions, cars and spheres. To ensure that attention was evenly distributed across Approach and Withdrawal conditions, subjects pressed a button when a dot appeared on screen while maintaining fixation. Also, the size of peripersonal space and 'time spent alone' was assessed in each subject. FMRI responses during the Approach versus Withdrawal condition were compared using a spherical coordinate system. In the voxel-wise analysis, a looming bias could be detected in: PMv, DIPS, VIPS, MT+, V1, amygdala, putamen. The ROI analyses revealed that the most robust effects were found in DIPS and PMv. Overall, the looming bias was larger for faces compared to car stimuli, and was not present for sphere stimuli. Finally, we also found significant correlations between the magnitude of: 1) the looming bias to faces and 'time spent alone' and 2) the approach response and size of peripersonal space, suggesting that variation in the function of the near-space monitoring network may contribute to individual differences in social behavior. Overall, tHemHHhese findings suggest that within a near-space network, there is a perceptual bias for symmetrically expanding stimuli, that is particularly strong for human faces, allowing socially-salient objects approaching the body to be automatically prioritized for further processing.

F16

Brain Response to Negative Facial Expressions Among Smokers in Withdrawal, URAINA CLARK, LAWRENCE H. SWEET, RICHARD C. MULLIGAN, COLLEEN E. FINNERTY, BETH A. JERSKEY, JASON HASSENSTAB, RONALD A.COHEN, & RAYMOND S. NIAURA*, Brown University***.** Emotional factors contribute to addiction behaviors. Negative emotion is frequently reported among persons in nicotine withdrawal and is a known antecedent of relapse. Functional magnetic resonance imaging (FMRI) offers a direct and objective method to examine the neural mechanisms associated with withdrawal. We sampled FMRI brain response to images of negative facial expressions among 16 cigarette smokers (8 male, 23-64 years) under 2 conditions: at regular nicotine levels and following a 15-hour overnight abstinence. Participants viewed 3 blocks of negative expressions (anger and fear) alternating with 2 blocks of resting baseline. Task-related activity was quantified individually using voxel-wise multiple regression. Regions of interest (ROI) were defined by significant task-related response compared to baseline (voxel p<.005, clusters >200mm3). Comparisons of individual task-related effects under nicotine and withdrawal conditions in each of the resulting 12 ROIs revealed significant differences in 6 ROIs known to be involved in emotion and visual processing. Under withdrawal participants demonstrated reduced activation in regions involved in visual attention (inferior parietal) and emotional processing (amygdala). Greater activation was observed in regions involved in interoception (insula; anterior cingulate) and down-regulation of emotion (inferior frontal). This pattern suggests smokers in withdrawal experience reduced efficiency to attend to and process negative visual stimuli. These findings provide evidence of abnormalities in emotional reactivity associated with the withdrawal state, which may underlie risk for relapse.

F17

FMRI Response to Negative Emotional Images Among Smokers in Withdrawal, C. E. FINNERTY, L. H. SWEET, R. C. MULLIGAN, U.S. CLARK, S. D. VANDERHILL, R. A. COHEN, & R. S. NIAURA, *Brown University*. Negative emotion is frequently reported among smokers in nicotine withdrawal and is a known antecedent of relapse. Subjective reports of emotional experience are susceptible to response bias. Functional magnetic resonance imaging (FMRI) offers a more direct and potentially more sensitive method to understand the neural mechanisms of withdrawal. Nine 15-hour abstinent right-handed cigarette smokers (>8 cigarettes/day; 7 female, mean age=34.3) viewed neutral, negative, and positive images from the International Affective Picture System during FMRI. Each condition included 28 images presented in two blocks at a rate of 3 seconds each and two 28 second resting baseline blocks. Task-related activity was quantified individually using voxel-wise multiple regression. Task-related effects were averaged in each region of each participant for use as the dependent variable in tests of hypotheses. Hypothesis testing was conducted in regions of interest defined by significant (p<.005) task-related activity compared to the resting baseline. The paradigm elicited changes in brain activity in 14 regions associated with visual processing, attention, and emotion. These regions were further examined for specific effects of negative emotion and relationships between this response and smoking severity as measured by cigarettes smoked per day. Two of these regions demonstrated a significant positive correlation between the response to negative emotional stimuli and smoking severity. These included regions comprising a large cortical fronto-parietal attentional network (r=.73, p<.05), including subcortical nuclei (r=.68, p<.05; caudate and thalamus). Findings suggest that in smokers experiencing withdrawal smoking severity is associated with a greater FMRI attentional response to negatively valenced stimuli.

F18

Regulation of craving in cigarette smokers: An fMRI study, HEDY KOBER, ETHAN KROSS, WALTER MISCHEL, CARL L. HART, & KEVIN OCHSNER, *Columbia University, University of Michigan***.** A failure to regulate craving has been implicated in substance abuse disorders and in post-treatment relapse. However, while the neural correlates of craving have been explored, the neural correlates associated with the regulation of craving have received little attention. Therefore, this study used fMRI to examine the neural bases of the regulation of craving for cigarettes and food in a nicotine-dependent population. Twenty-one cigarette smokers viewed images of cigarettes and of delicious-looking, unhealthy foods, and were instructed to think about either the (a) immediate sensory experience (e.g. increase craving), or (b) the long-term negative consequences associated with consuming each item (e.g. regulate craving). Subjective ratings indicated that participants experienced significantly less craving for both cigarettes and food when considering the long-term consequences associated with eating or smoking, suggesting that cognitive strategies can be used to effectively regulate craving for both food and cigarettes (consistent with clinical data). On "increase craving" compared to "regulate craving" trials, we observed activation in "reward" regions including subgenual cingulate, ventral striatum, and ventral tegmental area. This pattern was stronger for cigarettes compared to food, consistent with participants' reports of greater craving for cigarettes compared to food. Conversely, on "regulate craving" trials we observed activity in "control" regions including the dorsomedial prefrontal cortex and inferior frontal gyrus. Lastly, we report an interaction between strategy and stimulus type in the ventral striatum. Taken together, these data suggest a possible mechanism for the pattern of increased cigarette craving (compared to food) exhibited by cigarette smokers in everyday life.

F19

Age-Related Differences in the Neural Mechanisms of Emotion Regulation, CHRISTINA M. LECLERC & ELIZABETH A. KENSINGER, *Boston College***.** The ability to regulate emotion has many important implications in daily life. Recent research has begun to outline the neural mechanisms of the cognitive regulation of emotional stimuli in younger adults, however, less is known about the neural mechanisms of these processes in the older adult population. The current work used functional magnetic resonance imaging (fMRI) to investigate the neural systems associated with the cognitive reappraisal of emotional images. Participants were asked to up or down regulate their emotional reactions to positive and negative photographs. Behavioral evidence revealed that both younger and older adults were equally effective in regulating their emotional responses, with both age groups being more successful in regulating their emotional responses in hedonic (i.e., decreasing negative and increasing positive affect) versus non-hedonic directions (i.e., increasing negative and decreasing positive affect). Functional MRI results indicated differing patterns of neural activation as the two age groups regulated their emotions. For younger adults, a more diffuse network of activation, including in prefrontal and parietal regions, was observed for regulation in hedonic directions compared to non-hedonic directions. For older adults, in contrast, activity was similarly strong whenever participants were asked to cognitively reappraise their emotional response, regardless of whether the regulation was in a hedonic or non-hedonic direction. These results suggest that young adults may differentiate hedonic from non-hedonic regulation more than older adults.

F20

Neural Correlates of Gaze-Directed Reappraisal in Younger And Older Adults, PHILIPP C. OPITZ, HEATHER L. URRY, & LINDSAY C. RAUCH, *Tufts University*. Recent evidence suggests that, in studies of visually-evoked emotion, brain activation during cognitive reappraisal used to regulate emotion may be accounted for in part by eye gaze shifts. In addition, there is evidence that younger and older adults may exhibit differences in cognitive control and emotional functioning. The purpose of this study was to examine brain activation while independently manipulating reappraisal and gaze, as well as to examine possible age differences. Sixteen college aged and 15 older adults (55-65 years) increased and decreased their emotional responses to unpleasant photos using reappraisal, or simply viewed unpleasant and neutral photos in a randomized, event-related fMRI study. On each trial, gaze was directed to a square portion of the photo that was either relevant or irrelevant to the emotional meaning of the image. In preliminary analyses, we found no modulation of amygdala activation due to reappraisal. Dorsolateral prefrontal cortex (dlPFC) activation was only evident in the decrease condition, with no corresponding decrease in subjective ratings of intensity. Reappraisals focused on increasing and decreasing yielded anterior cingulate and ventrolateral PFC (vlPFC) activation. Older adults tended to show less activation in vlPFC, and they rated trials as more intense. This evidence suggests that dlPFC and amygdala reappraisal effects may depend on ad lib gaze behavior. In addition, older adults use vlPFC less during gaze-directed reappraisal, and may display heightened reactivity to visual stimuli as a consequence.

F21

An fMRI Investigation of the Rewards of Family Assistance, EVA H. TELZER, CARRIE L. MASTEN, ELLIOT T. BERKMAN, MATTHEW D. LIEBERMAN, & ANDREW J. FULIGNI, *University of California, Los Angeles.* Family assistance is an important aspect of relationships among youth from Latin American backgrounds. Although helping the family can be difficult at times, providing such assistance also can be a meaningful activity as it provides a sense of purpose and role fulfillment, particularly for youth from Latin American backgrounds who place a strong value on family assistance. In the current project, we wished to explore this dynamic activity by using fMRI to examine whether the act of providing assistance to the family engaged well-known reward systems in the brain. Twenty-six participants (12 White, 14 Latino) completed a task modified from Moll and colleagues (2006) in which they allocated money to themselves and their family. Results indicate that Latino participants show greater activation in the ventral and dorsal striatum and ventral tegmental area as compared to White participants while contributing money to their family compared to gaining money, even when it costs them money in order to contribute. In contrast, White participants show greater activation in the striatum when gaining money compared to giving money. The extent to which participants felt a sense of family identity and family assistance fulfillment in high school correlated with their reward system processing while contributing to their family compared to gaining a reward. These findings highlight the reward of providing support to the family, especially for Latinos who more strongly endorse such values and for those who feel more connected to their family during high school.

F22

Amygdala Reactivity And Anxiety Predict The Structural Integrity Of An Amygdala-Prefrontal Pathway, M. JUSTIN KIM & PAUL J. WHALEN, *Dartmouth College*. Here we combined functional magnetic resonance (fMRI) and diffusion tensor imaging (DTI) to show that individual differences in amygdala reactivity to fearful faces were associated with the structural integrity of an amygdala-prefrontal pathway. Twenty healthy subjects viewed 18-sec blocks of alternating fearful and neutral faces interleaved with a baseline fixation condition during two fMRI scans. From the DTI scans, fractional anisotropy (FA) values were calculated for each voxel to evaluate the structural integrity of white matter pathways. Voxelwise correlation analysis was performed on FA maps, with amygdala reactivity to fearful vs. neutral faces entered as the regressor. Results showed that amygdala reactivity to fearful vs. neutral faces was positively correlated with the structural integrity of an amygdala-prefrontal pathway. Spatial location of these voxels was consistent with a pathway shown in DTI tractography studies, which originated from the lateral and dorsal amygdala/substantia innominata region, then extended in a rostral and medial direction to the ventral striatum/nucleus accumbens and terminated at the medial orbitofrontal cortex. Furthermore, the strength of this pathway was inversely correlated with trait anxiety, showing compromised structural integrity in highly anxious subjects. Taken together, our data provide evidence that the strength of an amygdala-prefrontal pathway that was identified based upon the variability in functional activations of the amygdala was associated with lower levels of normal trait anxiety.

F23

Stress Response Circuitry Deficits and Hormonal Dysregulation in Women With Depression, SARAH B. SPAETH, LAURA M. HOLSEN, LAUREN A. OGDEN, JONG-HWAN LEE, ANNE KLIBANSKI, SUSAN WHITFIELD-GABRIELI, & JILL M. GOLDSTEIN, *Brigham and Women's Hospital, Massachusetts General Hospital, Massachusetts Institute of Technology*. Major depressive disorder (MDD) is a leading contributor to overall disease burden and occurs more often among women than men. Gender differences have been consistently observed, yet remain largely unexplained. Previous research on MDD suggests high rates of endocrine dysfunction and deficits in brain activation in the stress response circuitry [amygdala, hypothalamus, hippocampus, anterior cingulate cortex (ACC), orbitofrontal cortex (OFC)]. This study was designed to investigate the relationship between HPA- and HPG-axis hormones and stress response circuitry function in MDD. During two points in their menstrual cycle [early follicular (EF), ovulation (OV)], female participants (10 with recurrent MDD, 10 controls) were scanned while viewing IAPS pictures on a 3T GE MR scanner. Baseline hormone measures included pituitary (ACTH), gonadal (estradiol, testosterone), and adrenal (cortisol) hormones.
At EF, the estradiol-to-testosterone ratio was greater in controls vs. MDD. While adrenal and pituitary hormone levels were similar between groups at EF and OV, the MDD group showed a greater suppression of ACTH at OV compared to EF. Neuroimaging results suggest greater activation in the hypothalamus and ACC at EF, and the hypothalamus, ACC, and OFC in controls compared to MDD at OV. These results suggest dysregulation of the HPA- and HPG-axes in MDD, with deficits in stress response regions involved in HPA-axis feedback mechanisms and which also demonstrate high localization of steroid hormones. With additional data on DHEAS (produced by the adrenal cortex), future analyses will provide insights into where in the HPA-axis these deficits occur.

F24

Meditation Practice Leads to Changes in Brain Gray Matter Concentration, BRITTA K. HOELZEL, JAMES CARMODY, KARLEYTON C. EVANS, ELIZABETH A. HOGE, JEFFERY A. DUSEK, LUCAS MORGAN, ROGER K. PITMAN,& SARA W. LAZAR, *Massachusetts General Hospital, University of Massachusetts Medical School, Abbott Northwestern.* Previous studies demonstrated that highly experienced mindfulness meditators exhibit a different cortical structure (concentration or thickness of gray matter) in multiple brain regions when compared to non-meditating controls. However, those cross-sectional studies cannot establish whether the gray matter differences resulted from the meditation practice or were pre-existing. We report the first longitudinal study to investigate the effects of meditation training on gray matter concentration in meditation-naïve individuals. Healthy but highly stressed participants underwent an eight week mindfulness based stress reduction (MBSR) course. Anatomical MR images were acquired before and after the course and analyzed for differences in gray matter concentration in SPM5. We predicted gray matter concentration increases in the hippocampus, left inferior temporal lobe (ITL) and right insula. A paired t-test confirmed significant increases in the left hippocampus and ITL, but did not support effects in the insula. Exploratory analyses showed significant increases in the left temporo-parietal junction, posterior cingulate cortex, and cerebellum. This study demonstrates that mindfulness training leads to changes in gray matter concentration in several brain regions. Furthermore, we investigated the relationship between changes in self-reported stress (assessed with the perceived stress scale) and changes in amygdaloid gray matter concentration. While the amygdala is central to models of acute and chronic stress, the impact of stress reduction on amygdaloid structure in humans is unknown. Following the intervention, participants showed reduced self-reported stress. Decreases in stress positively correlated with concentration decreases in the right basolateral amygdala. This finding suggests neuroplastic changes associated with improvements in psychological well-being.

F25

The Brain Basis of Emotion: Meta-Analysis of the Neuroimaging Literature, KRISTEN A. LINDQUIST, TOR D. WAGER, ELIZA BLISS-MOREAU, HEDY KOBER, & LISA FELDMAN BARRETT, *Boston College, Columbia University, University of California, Davis, Harvard Medical School/Massachusetts General Hospital.* Scientists have disagreed about the brain basis of emotion since the time that psychology was synonymous with philosophy. Some researchers propose that emotions are natural kind categories represented by fixed, dedicated brain circuits (e.g., Cannon, 1921; Panksepp, 1998). Others suggest that emotions are psychologically constructed mental states represented as broadly distributed neural networks that are not, themselves, specific to emotion (e.g., James, 1890; Barrett et al, 2007). In an attempt to understand the brain basis of emotion, we statistically summarized findings from 234 neuroimaging studies (656 contrasts) of emotion published from 1990-2007. We used the multilevel kernel density analysis method (see Wager et al, 2007; Kober et al, 2008) to assess brain regions consistently and specifically involved in the experience and perception of anger, disgust, fear, happiness and sadness. Overall, we found some consistency but no specificity in brain activation, calling into question the idea that discrete emotions are represented as dedicated circuits in the brain. Commensurate with psychological constructionist views of emotion (e.g., Barrett, 2006; Barrett, Mesquita et al, 2007; Barrett, Lindquist, et al, 2007; Russell, 2003) and recent network approaches to understanding brain function (e.g., Büchel & Friston, 2001; Fuster, 2006; Mesulam, 1998; Raichle & Snyder, 2007; Seeley et al, 2007), our findings suggest that researchers may best consider emotions psychologically constructed events produced by distributed neural networks that are not themselves, specific to emotion.

F26

Ventromedial Prefrontal NK1 Receptor Alterations in Chronic Pain and Fear of Movement. CLAS LINNMAN, LIEUWE APPEL, TOMAS FURMARK, ANNE SÖDERLUND, TORSTEN GORDH, BENGT LÅNGSTRÖM, & MATS FREDRIKSON, *Uppsala University, Uppsala Imanet AB, GE Healthcare, Mass. General Hospital.* Neurokinin 1 receptors (NK1r) are involved in pain and anxiety behaviors in animals. Less is known about central alterations in this receptor system in humans, and if NK1r characteristics map onto behavioural and emotional aspects of pain. With multiple tracer positron emission tomography, using both [15]-Oxygen labelled water and an [11]-Carbon labeled NK1r antagonist radioligand, we demonstrate attenuated NK1r availability throughout the medial pain matrix in patients with chronic pain after a whiplash injury. The lowered receptor availability was most pronounced in the ventromedial prefrontal cortex (vmPFC), where attenuations were linearly related to patients' pain related fear and avoidance of movement. The NK1r availability in the vmPFC was positively correlated to regional cerebral blood flow (rCBF) in the subgenual anterior cingulate in the control group, and negatively correlated in patients. In the insula, the opposite relation was observed, with a positive correlation between insular rCBF and vmPFC NK1 availability in patients, and a negative correlation in controls. Further, rCBF measurements revealed a lower functional coupling between vmPFC and the basal ganliga (thalamus and globus pallidus) in the patient group as compared to controls, and a higher functional coupling to the insula. We conclude that the central NK1r system is altered in human chronic pain. NK1rs in the vmPFC may, in concert with the anterior cingulate and the insula, modulate the motor control output of the basal ganglia, suggesting that NK1 deficits can contribute to fear and avoidance of movement in chronic pain.

F27

White Matter Properties of Emotion Related Connections in Schizophrenia, D.P. TERRY, A.C. RAUSCH, J.L. ALVARADO, E.D. MELONAKOS, D. MARKANT, , C.F. WESTIN, R. KIKINIS, J. VON SIEBENTHAL, M.E. SHENTON, & M. KUBICKI, *Brigham & Women's Hospital, Harvard Medical School, VA Boston Healthcare System.* Schizophrenia is associated with abnormal emotional responses. We used Diffusion Tensor Imaging (DTI) and a new probabilistic method called stochastic tractography to evaluate white matter (WM) connections in regions known for emotional processing, including the anterior cingulate cortex (ACC), amygdala, and orbital frontal cortex (OFC). Sixteen schizophrenic patients and 16 normal controls, group-matched on age, gender, and parental socioeconomic status (all right-handed), were scanned. We registered Freesurfer labelmaps to DTI space to define regions-of-interest and WM masks to guide tractography. Tracts were seeded from the OFC, then filtered for connections with ACC or amygdala. Probability maps were generated for each subject based on the number of tracts passing through each voxel, which were analyzed for thresholded mean Fractional Anisotropy (FA). There was a group decrease in WM connectivity (defined as mean FA thresholded above 10%) in

patients compared to controls in the right OFC-ACC connection (p=0.024). This tract significantly correlated with right ACC volume (r=-0.71, p=0.002) in patients but not controls. Findings suggest that WM abnormalities are present in connections involving emotional processing in patients, and that WM and gray matter abnormalities might be related. Reduced FA in patients implies a loss of axonal and/or myelin integrity. It has been proposed that asynchronous neural activity is associated with synaptic pruning during development (Purves, 1998). Since WM plays a role in modulating neural synchrony, observed WM abnormalities may be related to the gray matter volumes. Further investigation is required to see how these abnormalities are related to emotional deficits in schizophrenia.

F28

The Influence of Gonadal Hormones in Conditioned Fear Extinction in Humans, M.A. Zeidan, A. Contero, R.K. Pitman, A. Klibanski, S.L. Rauch, J.M. Goldstein, & M.R. Milad, *Massachusetts General Hospital and Harvard Medical School, McLean Hospital, Brigham and Women's Hospital, Beth Israel Deaconess Medical Center, Division of Public Psychiatry, Massachusetts Mental Health Center*. It has been estimated that women are twice as likely as men to develop anxiety disorders such as PTSD. These statistics along with previously reported sex differences in fear acquisition suggest a possible role of gonadal hormones in fear circuitry. Few studies, however, have examined the role of hormones in fear extinction or extinction recall—mechanisms with clinical applications in patients with anxiety disorders including PTSD. Using an established, two-day fear conditioning paradigm, this study examines the possible role of naturally varying gonadal hormones in healthy women (n=36) on extinction recall. Conditioning and extinction learning occur on day 1, followed by recall on day 2. Blood samples were collected prior to testing on day 1 to measure gonadal hormones, and skin conductance was used to measure fear. Our results indicate that women in the follicular phase (n=18) of the menstrual cycle—when estrogen and progesterone levels are lowest—acquire higher levels of fear relative to women in the luteal phase (n=18)—peak estrogen and progesterone levels—supporting previous findings. With respect to extinction, females in the luteal phase showed greater extinction learning and recall relative to women in the follicular phase, with a positive correlation between estrogen and extinction recall. These data suggest a role of gonadal hormones in regulating the acquisition and extinction of fear, along with extinction recall. Thus, we provide a possible mechanism by which sex differences in fear responses may be explained, and open a window into possible treatments.

F29

Differential Autonomic Responsiveness to Social-affective information in Autism and Williams Syndrome, Marie-Christine André, Olufemi Olu-Lafe, Daniela Plesa-Skwerer, & Helen Tager-Flusberg,, *Boston University School of Medicine, Boston University*. In earlier social cognitive literature, people with Autism Spectrum disorders (ASD) and people with Williams Syndrome (WS) were considered to have strikingly contrasting profiles of social behavior; ASD is defined by impairments in social interaction and difficulty with communication whereas WS is characterized by extreme friendliness, empathy and social disinhibition. Recent work has demonstrated that both disorders share some abnormalities in social perceptual abilities. The purpose of the present study was to compare autonomic arousal, as measured by magnitude and frequency of skin conductance responses, to social-affective information in people with ASD and WS. Adolescents and adults with ASD were compared to age-matched individuals with WS and normal controls (NC). Participants passively viewed pictures from the International Affective Picture System (IAPS) selected based on their content – social, non-social and faces – while skin conductance responses were collected. The WS group was overall less electrodermally responsive compared to both comparison groups. The ASD group, however, was more electrodermally responsive than both the WS and NC groups for face stimuli only. These results support the view that social perceptual abnormalities underlie both ASD and WS. The ASD group's hyperarousal is consistent with findings of hyperactivation of the amygdala and social aversion, especially to direct gaze, in ASD. These findings of differential autonomic responsiveness to emotionally laden images in ASD and WS underscore the need for further studies of the neural circuitry underlying social-affective processing in neurodevelopmental disorders.

F30

Genetic Contributions to the Retention of Fear Extinction in Humans, Catherine A. Hartley, Rabia Salman, & Elizabeth A. Phelps, *New York University*. The ability to modify or control emotional responses as circumstances change is critical for our psychological well-being. One important mechanism for changing learned emotional associations is extinction. During Pavlovian fear conditioning, a previously neutral stimulus acquires emotional significance through pairing with a negatively-valenced reinforcer. Extinction refers to the gradual decrease in the expression of conditioned fear that occurs when the conditioned stimulus is presented repeatedly without reinforcement. The capacity to acquire and retain fear extinction learning over time is thought to confer resilience against anxiety-related clinical disorders. However, factors underlying individual differences in extinction retention are not presently well understood. A recent study reported that mice lacking the serotonin transporter (5-HTT) gene show marked deficits in extinction retention (Wellman et al., 2007). In our study, we investigated whether humans carrying the low-expressing short allele variant of the 5-HTT gene similarly exhibit a reduction in the ability to retain extinction learning. We utilized a two-day aversive conditioning paradigm, probabilistically pairing visual stimuli with electric shock. Day one consisted of the acquisition and the initial extinction phase. Day two consisted of the extinction retention test phase, allowing us to determine whether participants were able to retain extinction learning from the first day. Results revealed that participants carrying the short allele variant of the 5-HTT gene showed reduced extinction retention, suggesting that genetic variation may contribute to individual differences in the ability to successfully extinguish conditioned fear responses.

F31

Emotional and Cognitive Behaviors Correlate Differentially with Anterior Cingulate Volumes, M. Karpel, T. Susmaras, D. Gansler, & M. Jerram, *Suffolk University*. The anterior cingulate cortex (ACC) is central in processing information relating to executive functions, attention, error-detection, and decision-making. Research has found evidence for two divisions of the ACC, which differentially process emotional and cognitive information, and tend to exert reciprocal inhibition on each other. Based on this, it would be reasonable to hypothesize correlations between grey matter volumes in each of the two divisions and measures of emotional or cognitive behavior. In a sample of 19 healthy controls (males, mean age = 40, SD = 8.87), structural MRI scans were obtained, as well as measures of emotional and cognitive functioning. Using impulsivity (Barratt Impulsiveness Scale – Non-planning; mean = 22.90, SD = 3.95) as an example of emotional behavior and working memory (WAIS-III Digit Span Backwards, mean = 15.55, SD = 2.94) as an example of cognitive behavior, VBM analyses were performed to ascertain if such associations existed. Consistent with expectations, a region of significant positive correlation with impulsivity was found in the affective division of the ACC, while a region of significant negative correlation with impulsivity was found in the cognitive division. Further, a region of positive correlation was found with working memory in the cognitive division of the ACC, though no regions of significant correlation were found with working memory in the emotional division of the ACC. These results support the emotional and cognitive division model of ACC organization. These results further suggest impulsivity may be understood as an emotional behavior that is insufficiently modulated by cognitive factors.

F32

Abnormal Reflexive Gaze Components in Face Processing in Autism, Dorit Kliemann, Isabel Dziobek, Alexander Hatri, & Hauke R. Heekeren, *Max-Planck-Institute, Freie Universität Berlin.* When individuals on the autism spectrum (ASC) look at faces, they generally spend less time looking at faces and focus less on the eye region. The current study investigated whether a recently proposed two-component model (Spezio, 2007) accounts for autism specific gaze behavior on emotional faces. Specifically, we tested whether a failure to actively orient to the eyes, as in patients with amygdala lesions, coexists with an aversion to directly fixate the eyes. Eighteen high-functioning individuals on the autism spectrum and 19 healthy matched controls performed a new facial emotion discrimination task (fearful, happy, neutral faces), in which we presented faces for 150ms in two vertical positions, such that fixation started either at the eyes or the mouth. Gaze behavior was measured via an eye-tracking system (Tobii Technology, Stockholm). The task targets i) the effect of aversion when focusing the eye region and ii) the effect of attentional capture by the eyes when directed to focus the mouth region. When starting gaze on the eyes, the ASC group shifted their gaze further downwards (i.e., towards the middle of the face) than controls, implying an effect of aversion in the ASC group. When starting gaze on the mouth, individuals with ASC showed a significantly reduced orienting towards the eye region as compared to controls. Additionally, within the ASC group, an index of eye avoidance was positively associated with a diagnostic measure (Autism Spectrum Quotient). The current results underline the interplay of two reflexive gaze components in abnormal face processing in ASC.

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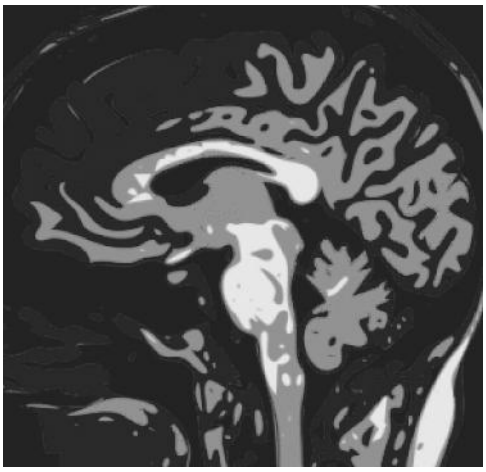

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