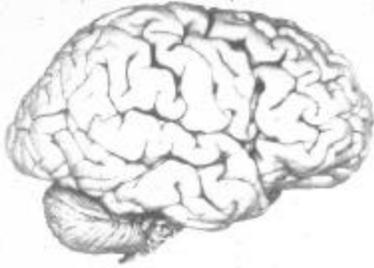


4th Annual Neuropsychology Research Day

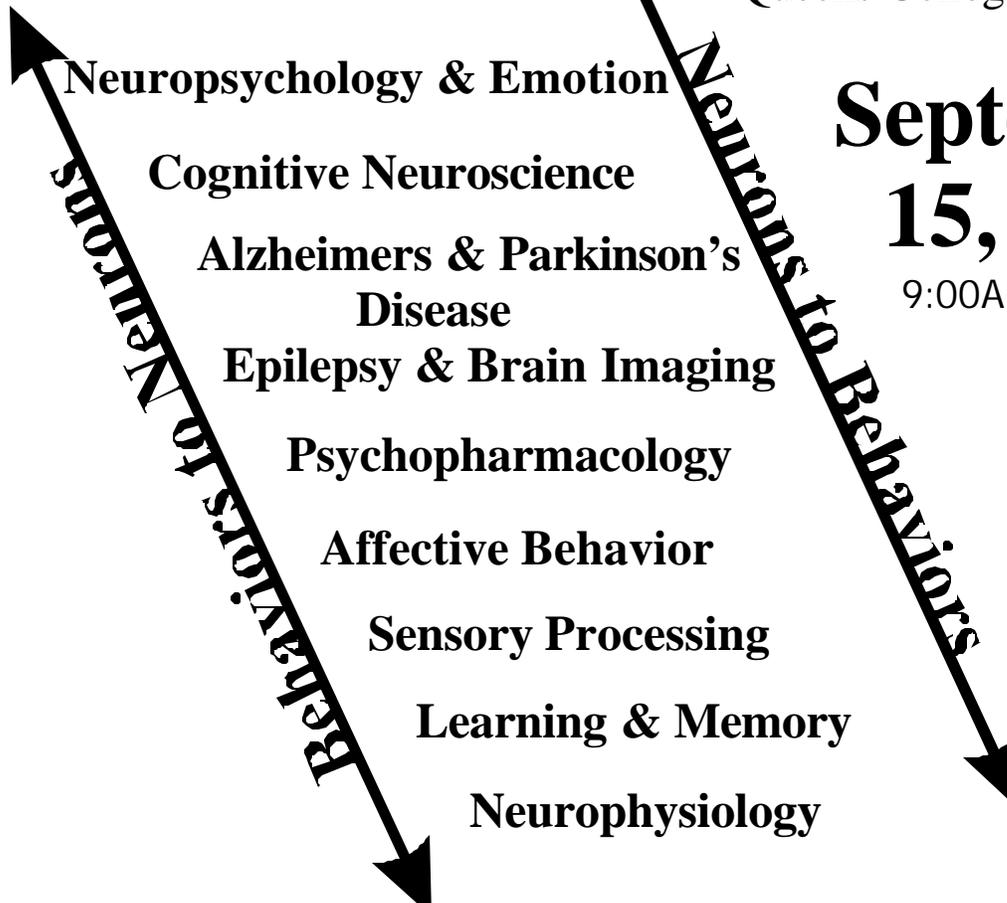


**Keynote Speaker:
Dr. Jeffrey Halperin**

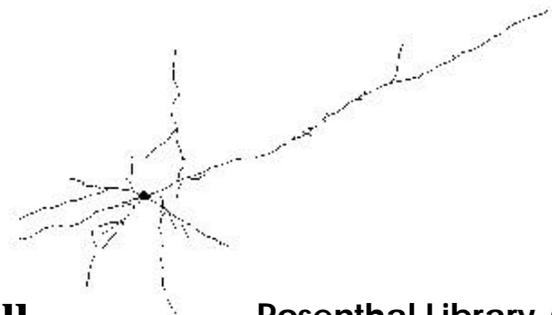
*Developmental perspectives on ADHD:
Implications for the role of the prefrontal cortex
in a complex behavioral disorder*
Queens College, CUNY

**September
15, 2006**

9:00AM-5:30PM



**For Further
Information Contact:
Joshua Brumberg
joshua.brumberg@qc.cuny.edu**



Rosenthal Library Auditorium
Queens College, CUNY

Fourth Annual Neuropsychology Research Day September 15, 2006

9:00-9:10 AM Welcome
Joshua Brumberg, Ph.D.,
Organizer and Founder Neuropsychology Research Day

Session I:

Moderator: Richard Bodnar, Ph.D., Chair, Department of Psychology

9:10-9:25 Genetic Variance Contributes to Naltrexone-Induced Inhibition of Sucrose Intake in Inbred and Outbred Mouse Strains
Cheryl Dym (Bodnar Lab)

9:25-9:40 Neurophysiology of Multisensory Integration in Children – Preliminary Findings From Event-Related Potentials.
Alice Brown (Fuxe and Gomes Labs)

9:40-9:55 Heparin-Binding Growth-Associate molecule (HB-GAM)-Deficient Mice Display Cognitive Rigidity and Contextual Neophobia.
Jason Krellman (Croll Lab)

9:55-10:10 Attentional Psychological Refractory Period Detects Early Response to Donepezil Treatment.
Jenny Ly (Foldi Lab)

10:10-10:25 Cocaine Self-Administration: The Role of GABA (and of course, dopamine) in the VTA.
David Lee (Ranaldi Lab)

10:25-10:45 Questions

10:45-11:00 Coffee Break

Session II:

Moderator Joshua C. Brumberg, Ph.D., Program Head,
Neuropsychology Ph.D. Program

11:05-11:20 Emotion and Medication Effects in Non-Demented Individuals with Parkinson's Disease.
Stephanie Assuras (Borod Lab)

- 11:20-11:35 Sex differences in digit ratio are disrupted in adolescents with schizotypal personality disorder.
Deborah Walder, PhD.
- 11:35-11:50 Saccadic Eye Movements: The Effect of Non-Visual Tasks on EMR in Eyes Open and Eyes Closed Condition
Dragana Micic (Ehrlichman Lab)
- 11:50-12:00 PM Questions
- 12:00-1:00 PM Lunch

Session III: Keynote Speaker

- 1:00-2:30 Words of Welcome:
Thomas C. Strekas, Ph.D.
Dean Division of Mathematics and Natural Sciences Queens College, CUNY
- Introduction of Keynote Speaker:
Joshua Brumberg, Ph.D.
Program Head, Neuropsychology Ph.D. Subprogram
Department of Psychology, Queens College, CUNY
- Keynote Speaker:
Developmental perspectives on ADHD: Implications for the role of the prefrontal cortex in a complex behavioral disorder
Jeffrey Halperin, Ph.D.
Distinguished Professor,
Department of Psychology
Queens College, CUNY
- 2:30-2:35 Break

Session IV:

- Moderator Joe Glick, Ph.D., Executive Officer, Psychology Ph.D. Programs
- 2:35-2:50 The Barrel Cortex a Window into Cortical Development and Circuitry.
Mary Rocco (Brumberg Lab)

- 2:50-3:05 Adult Neurogenesis: The songbird as a model system
Carolyn Pytte, Ph.D.
- 3:05-3:20 Studies on the Effect of Sex and Genetic Background on
Opioid Effects
Ben Kest, Ph.D.
- 3:20-3:35 Childhood Maltreatment Predicts Adolescent Substance Use
Disorders in Youth with ADHD
Virginia Fresiello (Halperin Lab)
- 3:35-3:50 Learning about 3D-Shape Selective Neural Mechanisms
From a Visual Illusion.
Andrea Li, Ph.D.
- 3:50-4:10 pm Questions

**Fourth Annual Neuropsychology Research Day
September 15, 2006**

Session I

Genetic Variance Contributes to Naltrexone-Induced Inhibition of Sucrose Intake in Inbred and Outbred Mouse Strains

Cheryl Dym (Bodnar Lab)

The study of genetic variance in opioid receptor antagonism of sucrose and other forms of sweet intake has been limited to reductions in saccharin intake in opioid-deficient CXBK mice, no systematic changes in sucrose intake in pre-pro-enkephalin knockout mice, and normal anorectic responses to naloxone in mice deficient in beta-endorphin. Marked genetic variance in inbred mouse strains has been observed for sucrose intake across a wide array of concentrations in terms of sensitivity, magnitude, percentages of kilocalories consumed as sucrose and compensatory chow intake. The present study examined potential genetic variance in systemic naltrexone's dose-dependent (0.01-5 mg/kg) and time-dependent (5-120 min) ability to decrease sucrose (10%) intake in eleven inbred (A/J, AKR/J, BALB/cJ, CBA/J, C3H/HeJ, C57BL6/J, C57BL10/J, DBA/2J, SJL/J, SWR/J, 129P3/J) and one outbred (CD-1) mouse strains. A minimum criterion sucrose intake (1 ml) under vehicle treatment, designed to avoid "floor effects" of antagonist treatment was not achieved in three (A/J, AKR/J, CBA/J) inbred mouse strains. Marked genetic variance in naltrexone's ability to inhibit sucrose intake was observed in the remaining strains with the greatest sensitivity observed in the C57BL/10J and C57BL/6J strains, intermediate sensitivity in BALB/cJ, C3H/HeJ, CD-1 and DBA/2J mice, and the least sensitivity in 129P3/J, SWR/J and SJL/J strains, and an 18-fold greater effect in the ID₅₀ of naltrexone-induced inhibition in C57BL10/J relative to 129P3/J mice. Naltrexone primarily affected the maintenance, rather than the initiation of intake in BALB/cJ, CD-1, C3H/HeJ, DBA/2J and SJL/J mice, but significantly reduced sucrose intake at higher doses across the time course in C57BL/6J, C57BL/10J and 129P3/J mice. Whereas SWR/J mice failed to display any significant reduction in sucrose intake at any time point following any of the naltrexone doses, naltrexone's magnitude of inhibitory effects was small (35-40%) in 129P3/J and SJL/J mice, moderate (~50%) in BALB/cJ, C3H/HeJ, CD-1 and DBA2/J mice, and profound (70-80%) in C57BL/6J and C57BL/10J mice. These data indicate the importance of genetic variability in opioid modulation of sucrose intake.

Neurophysiology of Multisensory Integration in Children

Alice Brown (Foxe and Gomes Labs)

Most adults and children effortlessly combine information from multiple sensory modalities in order to form unified perceptions of their environment. Multisensory integration, the ability of the nervous system to deal with the simultaneous convergence of stimuli from more than one sensory modality, is fundamental to basic perceptions (such as orienting) as well as to complex behaviors (such as learning language or driving a car). For many years the standard assumption was that initial processing of a given object proceeded in lower-order cortical regions that were entirely unisensory, and that this information was then projected (via feedforward convergence) to multisensory regions in higher-order cortices, wherein multisensory integration occurred relatively late in processing. Recently, a new theory has emerged which proposes that interactions between two or more sensory modalities occur at considerably *earlier* stages of sensory processing, onsetting within the same initial timeframe as unisensory processing. Primary support for this hypothesis comes from studies of event-related potentials (ERPs) in healthy adult subjects; the results of which will be briefly presented here. The purpose of the current study is to begin to characterize the neurophysiology of multisensory integration in children, and to compare this to what we have found in adults. Here we show ERP data from children of various ages performing a basic audio-visual simple reaction time (SRT) task. A preliminary analysis of the neurophysiological processes underlying multisensory integration in typically-developing (TD) children is presented. We anticipate that this research, the aim of which is to characterize how the brain of typically-developing children responds to and integrates multisensory stimuli and to track the developmental trajectory of said processes, will allow us to objectively assess sensory integration dysfunction in clinical populations. Specifically, we are interested in establishing a neurophysiological metric to advance our understanding of why individuals (for example, children with Autism) experience severe difficulties integrating inputs from the various sensory systems.

Heparin-Binding Growth-Associate molecule (HB-GAM)-Deficient Mice Display Cognitive Rigidity and Contextual Neophobia

Jason Krellman (Croll Lab)

Heparin-binding growth-associated molecule (HB-GAM) is an extra-cellular protein involved in a variety of neural developmental processes. Anxiety and impaired spatial learning have been reported in animals genetically null for HB-GAM, and behavioral testing conducted in our laboratory suggests further behavioral abnormalities in these animals. HB-GAM mutants performed as well as wild-type animals in the first version of the Morris Water Maze to which they were exposed, whether spatial or cued. However, HB-GAM mutants performed significantly worse than their wild-type counterparts in the second version of the

maze to which they were exposed. This pattern of water maze performance indicates impairment on the part of these mutants in adapting to changing contingencies. HB-GAM mutants also displayed cognitive rigidity in the Y-Maze, wherein a cohort of these animals made significantly more identical, consecutive arm choices than did their wild-type counterparts. HB-GAM mutants also required significantly more time to make their first choice of arm in the Y-maze, suggesting behavioral reticence. Similar reticent behavior among these animals was observed on the visual cliff, where they spent significantly more time on the platform of the apparatus and showed a significantly increased latency to approach the cliff; and in the social interaction paradigm, where they demonstrated a significantly increased latency to first contact with a novel conspecific. Behavioral reticence in HB-GAM mutants was also observed on the open field, where these animals required significantly more time to exit the center of the field upon first but not second exposure; and in the social approach paradigm, where they spent significantly more time in the center of the apparatus upon first but not second exposure. HB-GAM mutants' increased latency to behave only in their first exposure to these latter two paradigms suggests that their behavioral reticence might be driven by a contextual neophobia. Behavioral reticence, perseveration, and cognitive rigidity are observed in a number of human psychopathologies, and all of these features are present in the pervasive developmental disorders.

Attentional Psychological Refractory Period Detects Early Response to Donepezil Treatment.

Jenny Ly (Foldi Lab)

Background: Attentional functions decline in early Alzheimer's disease (AD). Animal models demonstrate that attention is directly mediated by cholinergic availability. We predicted that attention should therefore be sensitive to cholinesterase inhibitor treatment in AD. Our attention measure was the psychological refractory period (PRP), the time required to respond to a stimulus and 'reset' in order to process a subsequent stimulus. Objectives: To determine: a) sensitivity of PRP relative to other neuropsychological domains, and b) whether changes in PRP capture early treatment efficacy. Methods: *Participants:* Fourteen patients with AD undergoing de novo open-label donepezil treatment (mean age=78.9 yrs, ± 7.6 standard deviation; years education=13.78 \pm 3.90; MMSE=22.44 \pm 4.28; CDR=0.78 \pm 0.26). were evaluated at baseline (T1), after 8.1 \pm 2.4 weeks (T2), and 6 months (T3). ADAS-cognitive change score (T3-T1) determined group membership of responders (n=9, mean change=+1.98 \pm 0.65), and non-responders (n=5, mean change=-5.25 \pm 5.0, $t(12)=3.89$, $p=.002$). Groups were equated on age, education, and disease severity. *Measures:* Simple detection task presented at intertrial intervals (ITI) of 500, 800, 1100, 1500msec measured in median RT. Standard attention, language, memory, visuo-spatial domains were determined. Results: Global and domain scores showed no group differences at T1 or T2, $p>.1$. ANOVA on RT showed significant ITI

($F(3,36)=15.534$, $p<.000$), showing expected PRP effect at the shortest ITI. Interactions of GroupXITI (Huynh & Feldt $F(1.54,36)=3.5$, $p=.062$) and GroupXTimeXITI (H&F $F(3.0,36)=3.371$, $p=.029$) show that non-responders were significantly slower at 500msec compared to all other ITIs, and slowed further by T2. Responders maintained their speed from T1 to T2. Conclusions: Two groups of AD patients (responders and non-responders to cholinesterase inhibitors) showed comparable overall speed. However, as predicted, PRP was a more sensitive measure of treatment efficacy than standard neuropsychological measures. Non-responders required longer 'reset' times than responders. After short-term treatment, non-responders slowed even further, which may implicate poorer attentional resources and failure to respond to cholinergic availability.

Cocaine Self-Administration: The Role of GABA (and of course, dopamine) in the VTA

David Lee (Ranaldi Lab)

We have found that dopamine (DA) in the ventral tegmental area (VTA) plays an important role in cocaine self-administration. DA in the VTA acts at D1-type receptors on the terminals of GABA afferents causing release of this neurotransmitter. Thus, the neurochemical pathways whereby VTA DA might be involved in cocaine self-administration may include GABA neurotransmission. In the present study, we investigated this possibility. Rats were prepared with intravenous catheters and bilateral guide cannulae positioned to allow microinjections directly into the VTA or a site 1 mm dorsal to it. The rats were then trained to self-administer cocaine (1.0 mg/kg/injection) under a fixed-ratio 1 schedule of reinforcement and tested with microinjections of muscimol (0, 0.05 and 0.1 $\mu\text{g}/0.25 \mu\text{l}$) or picrotoxin (0, 0.025 and 0.05 $\mu\text{g}/0.25 \mu\text{l}$). Muscimol in the VTA, but not immediately dorsal to it, significantly reduced cocaine intake under the FR1 schedule. Furthermore, this reduction was significantly greater when muscimol was injected into the rostral compared to the caudal portions of the VTA. Inspection of individual records revealed no signs of non-specific behavioral effects of the muscimol treatments. Intra-VTA picrotoxin did not significantly affect cocaine self-administration. These data suggest that stimulation of GABA-A receptors in the VTA plays a significant role in cocaine self-administration and that this role is more pronounced in the rostral than in the caudal VTA.

Session II

Emotion and Medication Effects in Non-Demented Individuals with Parkinson's Disease

Stephanie Assuras (Borod Lab)

Impaired motor functioning is a significant feature of Parkinson's disease, which is often ameliorated by treatment with dopaminergic medication. In addition, research has suggested that patients with Parkinson's disease may experience emotion processing deficits. The purpose of the current study was to examine how viewing emotional pictures, including pleasant, unpleasant, or arousing content, affected motor responses of patients with Parkinson's disease (PD) and to ascertain whether this effect interacted with the presence or absence of dopaminergic medication. Fifteen PD and 15 healthy control (HC) participants viewed 54 emotional and non-emotional pictures presented as slides via computer. After a delay, participants were shown the original 54 pictures and an additional 54 distracters, and they were asked to identify the pictures originally presented. Reaction times measured from picture onset to keyboard button press were recorded. PD participants had slower reaction times than HC participants to all emotional and non-emotional stimuli. Both PD and HC participants had slower reaction times to high than low arousal pictures. All participants demonstrated the slowest reaction time when viewing unpleasant pictures, followed by pleasant and then neutral pictures. The fact that the effect of stimulus type on reaction time was not significantly different for the PD and HC groups suggests that PD, at least in the early-to-moderate stage, may not be impacting emotional processing, per se. Although patients' motor functions, as measured by clinical exam, were significantly better when on medication, reaction times were significantly faster when patients were off medication. Medication also had a negative impact on memory as revealed by a lower rate of accurate responses on than off medication. These findings have implications for the optimization of pharmacological therapy in PD patients.

Sex differences in digit ratio and relationship with child behavior ratings in adolescents with schizotypal personality disorder versus healthy comparisons

Deborah Walder, PhD.

Digit ratio is a sexually differentiated anatomic trait indexing prenatal gonadal hormone levels. This study examined digit ratio in schizotypal personality disorder (SPD) adolescents compared to healthy controls. Normal patterns of sexual differentiation and laterality effects were replicated. Among SPDs, there were no significant sex differences. There were diagnostic group differences only in White/Caucasian males. Findings suggest prenatal gonadal hormone abnormalities in schizophrenia risk.

Saccadic Eye Movements: The Effect of Non-Visual Tasks on EMR in Eyes Open and Eyes Closed Condition

Dragana Micic (Ehrlichman Lab)

The present experiment was conducted as a part of a study designed to test the hypothesis that different saccadic eye movement rate (EMR) during non-visual cognitive tasks reflects different requirements for searching long-term memory. The objective of this experiment was to examine EMR under eyes open and eyes closed conditions and to expand the set of cognitive tasks used in the study. Eye movements were recorded while participants were engaged in non-visual tasks requiring relatively low or high long-term memory retrieval. The low retrieval tasks were Counting, Continuous Performance, Mental Alphabet, Chain Retrieval, Phrase Letter Counting, and Delayed Repetition and the high retrieval tasks were Semantic Word Retrieval and Episodic Retrieval. The tasks to be performed under eyes open and eyes closed condition were matched for difficulty. The eyes closed condition produced a decrease in overall EMR. The within-task difficulty but not between-task difficulty or visual imagery appeared to be related to EMR. The task-related facilitation and suppression of eye movements was found under both eyes open and eyes closed condition. The pattern of results in eyes closed condition seemed to attest to the robustness of the task effects on EMR.

Session IV

The Barrel Cortex a Window into Cortical Development and Circuitry

Mary Rocco (Brumberg Lab)

Our laboratory has focused on two principal issues, the cortical circuits involved in sensorimotor integration and the development of cortical circuits in the mouse barrel cortex. Integration between primary somatosensory cortex and primary motor cortex is important in updating motor plans to the constantly changing sensory environment. We have developed an *in vitro* slice preparation that maintains the synaptic connectivity between whisker M1 and whisker S1. The anatomy suggests a very specific projection between the two areas. Furthermore, electrical stimulation in M1 and recording in S1 shows a strong facilitating response whereas S1 stimulation while recording in M1 does not. The novel sensorimotor slice provides us with the opportunity to study interareal communication *in vitro*. The other focus of the laboratory is how activity can influence cortical development. Once again using the mouse whisker-to-barrel system we have examined the influence of sensory activity on dendritic and extra cellular matrix development. Unilateral whisker trimming from birth increases

dendritic complexity and decreases a specific component of the extracellular matrix suggesting a possible substrate for changes in receptive field properties of neurons in deprived cortex. Our results suggest a role of sensory experience in influencing the development of cortical circuits.

Adult Neurogenesis: The songbird as a model system

Carolyn Pytte, Ph.D.

Until recently, neurons were thought to be irreplaceable. We were once taught that adult brains are unable to make new neurons, and that those we are born with must last a lifetime. The first cracks in this dogma began to appear with the discovery that songbirds give birth to waves of new brain neurons seasonally. We now know that the birth of new neurons, or neurogenesis, occurs throughout adulthood in all animals, including humans. Despite many advances in our understanding of this process, a fundamental question has yet to be answered: What is the function of new neurons that are incorporated into existing circuits? The first attempts to address this question led to the idea that new neurons facilitate behavioral plasticity, or learning. However, more substantial research shows that the evidence for this is spotty and this idea has now become controversial. The goal of my research has been to explore alternative explanations for the function of new neurons. One system that undergoes a great deal of new neuron recruitment is the motor pathway for song production in songbirds. Moreover, the acoustic structure of song provides us with a direct behavioral readout of the underlying neural circuitry. As in the mammalian hippocampus, it had been assumed that new neurons in the song system would promote new learning (in this case, learning new song motor patterns). However, I have recently found that rather than being correlated with song plasticity, increased numbers of new neurons are correlated with song stability, seen in the stereotypy of the song motor pattern. This gives us another hypothesis to pursue. Perhaps one function of new neurons is to replace old neurons that are no longer functioning efficiently. In this case, the role of new neurons is to provide a more accurate neural system, whether to learn new information or to express already existing information. I will describe the evidence for this idea and discuss the implications of these findings for the function of new neurons in other systems.

Studies on the Effect of Sex and Genetic Background on Opioid Effects

Ben Kest, Ph.D.

Although opioids such as morphine are the most effective drugs for the control of pain, their long-term use can lead to a variety of unwanted side-effects. These include hyperalgesia (i.e. a paradoxical increase in pain sensitivity), tolerance (i.e. reduced drug effect), and dependence. The Kest lab studies how intrinsic factors such as sex and genetic background impact these unwanted effects using a variety of techniques, and will present some recent studies and their findings.

Childhood Maltreatment Predicts Adolescent Substance Use Disorders in Youth with ADHD

Virginia Fresiello (Halperin Lab)

Objective: Children with attention-deficit/hyperactivity disorder (ADHD) are at heightened risk for maltreatment, as well as later substance use disorders (SUDs). This study investigated the relationship between childhood maltreatment and later SUDs among adolescents diagnosed with ADHD in childhood. Patients and Methods: The sample consisted of 80 ethnically diverse adolescents who were diagnosed with ADHD when they were 7 – 11 years old and re-evaluated approximately 10 years later. The Childhood Trauma Questionnaire (CTQ) was used at follow-up to screen for histories of childhood maltreatment. Substance abuse/dependence diagnosis for the adolescents was formulated in accordance with DSM-IV. Lifetime histories of problematic drug and alcohol use were obtained for each parent. Binary logistic regression examined the overall relationship between childhood maltreatment and subsequent adolescent SUDs. Binary logistic forward (Wald) regression was used to determine if subtypes of childhood maltreatment uniquely contributed to adolescent drug or alcohol abuse/dependence outcomes. Age, socioeconomic status, severity of childhood externalizing behaviors, and parental substance use were used as covariates in all analyses. Results: Total Maltreatment emerged as a highly significant predictor of adolescent SUDs (Wald=13.89, $p < .001$) after controlling for covariates. Further, Total Maltreatment was a significant predictor of drug abuse/dependence (Wald=13.86, $p < .001$); while prediction of alcohol abuse/dependence approached statistical significance (Wald=2.89, $p = .089$). Additional analyses indicated that Emotional Abuse and Neglect were significant predictors of drug but not alcohol abuse/dependence. Physical Abuse significantly predicted alcohol but not drug abuse/dependence. Conclusion: There is a robust relationship between childhood maltreatment and later SUDs in children with ADHD, highlighting the need for childhood maltreatment screening in this at risk group.

Learning about 3D-Shape Selective Neural Mechanisms From a Visual Illusion.

Andrea Li, Ph.D.

In perspective images of textured surfaces, perceptually correct 3D curvatures are conveyed by specific patterns of orientation flows (Li & Zaidi, 2004, 2001, 2000). In Kitaoka's illusion Zabuton, 3D shapes are conveyed by illusory orientation flows: straight horizontal and vertical edges of a checkerboard pattern appear curved because of high contrast interstices. We used concave and convex Zabutons in an adaptation paradigm to establish whether 3D shape aftereffects can be explained by adaptation of 1) local luminance mechanisms, 2) independent orientation selective mechanisms, 3) laterally-interactive orientation

selective mechanisms, or 4) 3D-shape selective neural mechanisms. After adaptation to concave or convex Zabutons, observers judged shape aftereffects as concave or convex for three types of checkerboard tests: in-phase with the adapting checkerboard (edges and grey values aligned), opposite-phase (edges aligned, grey values reversed), or phase-shifted by half-cycles in both dimensions (edges and grey values misaligned by 0.25 deg). Local luminance adaptation predicts that the aftereffect should be opposite in shape to the adapting curvature for the in-phase test, same as the adapting curvature for the opposite-phase test, and flat for the phase-shifted test. Adaptation of independent local orientation mechanisms predicts flat percepts for all of the test stimuli because the edges in the adapting stimulus are physically horizontal and vertical. Adaptation of laterally-interactive orientation selective mechanisms influenced by the effects of the interstices predicts opposite curvature aftereffects for the in-phase and opposite-phase tests, but flat percepts for the phase-shifted tests. Adaptation of 3D-shape selective mechanisms predicts opposite curvature aftereffects regardless of the test phase. Results are consistent with the adaptation of 3D-shape selective mechanisms that are insensitive to exact placement or contrast of contours in the receptive field. The nature of these proposed mechanisms will be discussed.



Neuropsychology Colloquia Fall 2006

<u>Day</u>	<u>Date</u>	<u>Speaker/Title</u>
Friday	September 15	4 th Annual Neuropsychology Research Day Jeffrey Halperin, Ph.D. Queens College, CUNY (Rosenthal 231) <i>Childhood Maltreatment Predicts Adolescent Substance Use Disorders in Youth with ADHD</i>
Wednesday	September 20	4 th Annual Alumni Speaker Robert Silva, Ph.D. Schering-Plough Research Institute <i>The Role of the c-jun N-terminal kinase (JNK) in the Mediation of Neuronal Programmed Cell Death.</i>
Monday	September 25	Lila Davichi, Ph.D. New York University <i>How We Remember: Evidence for Multiple Encoding Mechanisms.</i>
Wednesday	October 4	Adam Kohn, Ph.D. Albert Einstein School of Medicine <i>Adaptation to visual motion in area MT.</i>
Wednesday	October 11	Yakov Stern, Ph.D. Columbia University School of Medicine <i>Studying Cognitive Reserve.</i>
Monday	November 6	Alex Reyes, Ph.D. New York University <i>Signal Propagation in in vitro Neural Networks.</i>
Monday	November 13	Marcel Kinsbourne, M.D. Boston University and The New School <i>Neuropsychology of Consciousness.</i>
Monday	December 4	Esther Gardner, Ph.D. New York University School of Medicine

All seminars begin at 12:15PM

All talks are open to the public and held in The Razran Room (SB E-308) unless noted otherwise.
For further information contact joshua.brumberg@qc.cuny.edu