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WILEY Developmental Psychobiology

NEURAL AND VASCULAR DEVELOPMENT IN A RAT MODEL FOR DISEASES OF PREMATURITY. J.A. Adrian[1], J.T. Olsen[1], T.S. Morken[1,2], and M. Wideroe[1]. [1]Department for Circulation and Medical Imaging, Norwegian University of Science and Technology (NTNU), Trondheim, Norway. [2]Department of Laboratory Medicine, Children's and Women's Health. julia.anna.adrian@gmail.com

Preterm born infants are at high risk of white matter damage and abnormal retinal vascularization. Further, they often suffer from breathing disorders and thus require supplemental oxygen. Our aim was to investigate the influence of oxygen fluctuations, growth retardation, and their combined effect on brain microstructure and retinal vasculature by means of a neonatal rat model. Rat pups were held in intermittent hyperoxia-hypoxia (IHH, $n = 52$) or room air ($n = 32$) for the first 14 postnatal days. Diffusion tensor imaging (DTI) was performed on postnatal days 15 and 28, thereafter the rats' retinas were dissected and their vasculature stained. White matter structures were differentially affected by IHH exposure. The fractional anisotropy, a measure for white matter maturation, increased in all structures over time independent of oxygen condition. In limbic fibers, this increase was higher in the IHH compared to the room air group. Conversely, the fractional anisotropy of pups exposed to IHH increased less in commisural, projection and association fibers. Presumably, this was due to varying development time and maturation-dependent vulnerability of these regions. In gray matter, exposure to IHH led to a less increase in fractional anisotropy, and a less decrease in mean, axial and radial diffusivity over time than in room air controls. Retinal arteries and veins were abnormally dilated after IHH exposure. Interestingly, even though exposure to IHH led to subtle microstructural alterations in white and gray matter, and dilated vessels in the retina, DTI parameters were not associated with measures of abnormal retinal vascularization.

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A FACE ONLY A MOTHER COULD LOVE? INTERGENERATIONAL TRAUMA EXPOSURE REDUCES MALE ATTRACTIVENESS TO POTENTIAL MATES. S.R. Altmann*, J.M. Kan, and R. Richardson. School of Psychology, University of New South Wales, Sydney, Australia. s.altmann@unsw.edu.au

The fact that some members of our species are more attractive to the opposite sex than others is well known. However, other than the obvious candidates such as genetics, the factors that determine "attractiveness" remain elusive. The current research used a rodent model to examine this generally understudied, but clinically relevant question, and assessed whether exposure to trauma, either within one's own life, or intergenerationally, can impact male attractiveness in adulthood. To assess this question male rats were either exposed to Maternal Separation (MS), a well-validated early life stressor during infancy, or were born to mothers who had experienced MS with their previous litter. Control females were then tested in a mate preference task, wherein she was given four trials in which she could choose between two adult males contained within small wire cages, either a control male and a directly-stressed male, or a control male and a male born to a previously stressed mother. The results showed that while females do not discriminate between control males and directly-stressed males, they do discriminate between control males and males born to a previously stressed mother, spending significantly less time across trials in the side of the test arena containing the male born to a previously-stressed mother, and investigating the wire cage in which that male was held significantly less. These results show that an individual's intergenerational exposure to stress may be even more important than their own history of trauma in determining social outcomes such as the ability to attract a mate.

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MILD MATERNAL HYPERTHERMIA AS A NON-INVASIVE ANTIPROLIFERATIVE TERATOGEN IN GUINEA PIGS (CAVIA PORCELLUS). Y. Argumedo[1,2,*], K. Henshaw[1], B. Bailey[1], T.J. Bishop[1], T. Austin[1], and G.A. Kleven[1]. [1]Department of Psychology, [2]Boonshoft School of Medicine, Wright State University, Dayton, OH 45435. argumedo.2@wright.edu

Elevation of maternal body temperature by only a few °C results in damage to fetal nervous system tissue. The cells that are primarily effected are those that are actively dividing. However, extreme exposures are likely to cause maternal stress which is itself a teratogen. In order to avoid this confound, we combine acclimation techniques with a mild maternal exposure to hyperthermia using a warm water bath. Female IAF Hairless guinea pigs were acclimated before pregnancy to handling and all procedures. After acclimation, females were time mated to a Hartley multicolored male, resulting in offspring that have fur and colorations of the Hartley strain. Fetal movement and state organization were observed by ultrasound visualization from weeks 4–9 of a 10-week gestation. On gestational day 30 (peak proliferation in the striatum), pregnant females were assigned to either the mild hyperthermia bath (45 °C) or control group (40 °C). During the manipulation, pregnant females were lightly held in the bath with the bottom half of their body submerged for 15 min. In order to confirm that the procedures did not lead to elevations in cortisol, saliva samples were collected both before and after any bath manipulation or ultrasound observation of fetal behavior. After birth, offspring were

tested for differences in motor activity, social interaction, and temperature preference in order to determine long-term effects and correlation to fetal behavioral deficits. Taken together, these methods may have utility in a systematic investigation of targeted areas of the brain during rapid proliferation and growth.

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EXAMINATION OF SPONTANEOUS EYE BLINKING FROM INFANCY TO TODDLERHOOD DURING COGNITIVE TASKS. L.F. Bacher[1], A. Gonzalez[1], G. Javier[1], and M.A. Bell[2]. [1]Psychology Department, SUNY Oswego, Oswego, NY 13126. [2]Psychology Department, VA Tech, Blacksburg, VA 24061. leigh.bacher@oswego.edu

Spontaneous eye blinking (SEB), a putative index of dopamine function (DA), may be altered by certain cognitive activities and pathological conditions. To-date, SEB patterns in infants are generally similar to those of adults, however, very little is known about the development of SEB. Cross-sectional data suggest that SEB rate gradually increases from birth to young adulthood, but no longitudinal data have been reported between infancy and any later age group. The present analysis is from a continuing investigation SEB and cognitive function in human infants and children. We predicted (a) developmental increase in the rate and variability of SEB from 10 to 24 mos, (b) SEB at 10 mos would relate to some features of cognitive performance at 24 mos. The current sample of $N = 11$ healthy, term infants, completed a working memory task at 10 mos and several executive function tasks at 24 mos. SEB was coded blind to task phases and performance. Initial results indicate that SEB rate at 10 and 24 mos was positively correlated but with no evidence of developmental change. SEB variability was not correlated at 10 and 24 mos nor was there evidence of change. Data are suggestive that SEB rate at 10 mos might relate to cognitive performance at 24 mos. Although SEB is an indirect index of DA, results of this work could promote better understanding of the development of the DA system and its relationship to cognitive activity.

[NICHD HD049878 to MAB].

LASTING MEMORIES: FACILITATING CONTEXT FEAR IN INFANT RATS THROUGH BEHAVIORAL TAGGING. S.E. Bae* and R. Richardson. School of Psychology, The University of New South Wales, Sydney, Australia. s.bae@unsw.edu.au

The synaptic tagging and capturing hypothesis proposes that the formation of lasting memories requires two parallel processes: the setting of a protein synthesis-independent learning tag and the capture of plasticity-related proteins at these tagged sites. Behavioral tagging processes are analogous to synaptic tagging and capture and have been used to demonstrate how closely timed but unrelated novel experiences can transform a weak learning event into long-term memory in adult animals. In the current series of experiments, we show that these behavioral tagging effects are also present in infant rats, animals that typically demonstrate poor long-term context memory. Experiment 1 investigated whether novelty is sufficient to facilitate context fear memories in infant (P17) rats. Infant rats were trained to fear a context. Prior to this conditioning experience, half the rats explored a novel open field arena for 5 min. All animals were tested the following day. Open field exposed rats demonstrated enhanced context fear at test compared to infant rats not exposed to the open field suggesting that behavioral tagging processes may occur in the developing rodent. In order to equate the rats on their experiences, in Experiment 2 all animals were given open field exposure but half were exposed 1 hr before conditioning whereas the remaining were exposed 2 hr before conditioning. Animals were tested either 1 or 3-days following conditioning. Consistent with the results of Experiment 1, infant rats exposed to the open field 1 hr before conditioning demonstrated facilitated context fear at the 1-day test compared to infant rats exposed to the open field 2 hr before conditioning. These differences, however, did not persist at the 3-day test. The findings of this experiment demonstrate that the facilitating effects of novelty are time-dependent. These findings also suggest that whilst novelty facilitates the long-term retention of context fear memories, it does not affect the subsequent maintenance of that memory into a more remote store.

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BASIC ATTENTION AND INTERSENSORY PROCESSING SKILLS BECOME INCREASINGLY INTEGRATED ACROSS INFANCY. L.E. Bahrick, M.E. McNew, J.T. Todd, and K.C. Soska. Department of Psychology, Florida International University, Miami, FL 33199. bahrick@fiu.edu

Attention and intersensory processing skills, cornerstones for social and language development, are traditionally studied independently. The Multisensory Attention Assessment Protocol (MAAP; Bahrick et al., in prep; Todd et al., 2016) characterizes individual differences in these skills within a single nonverbal protocol. Using the MAAP, we examined how relations among attention maintenance, speed of shifting, and intersensory matching to audiovisual synchronous events change across infancy. Infants ($N = 67$) were tested at 3, 6, and 12 months longitudinally. Trials consisted of a 3 s central event (animated shapes) followed by side-by-side lateral events (12 s) of either faces speaking or objects impacting a surface. One lateral event was synchronous with its natural soundtrack; one was asynchronous. On "competition trials," the central event remained on during the lateral events, and on "no-competition trials" it was turned off. We calculated maintenance (looking time to lateral events), disengagement (speed to shift from central to lateral events on competition trials), orienting (speed to shift to the lateral events on no-competition trials), and intersensory matching (looking to sound-synchronous event). Measures of maintenance, disengagement, and intersensory matching became increasingly inter-correlated and less variable across age, particularly during competing stimulation. At 3 months, no significant relations were evident. At 6 months, infants with faster disengagement maintained longer attention to the lateral events ($r = -.36$, $p < .05$). At 12 months, infants with faster disengagement maintained longer attention to the lateral events and showed greater intersensory matching ($rs > .30$, $ps < .05$). Findings demonstrate that these building blocks for social and language development become increasingly coupled across infancy.

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IMPAIRED FEAR EXTINCTION RETENTION IN ADOLESCENT RATS: PHARMACOLOGICAL EVIDENCE FOR A FAILURE TO

RECRUIT NMDA RECEPTORS DURING EXTINCTION. K.D. Baker* and R. Richardson. School of Psychology, University of New South Wales, Sydney, Australia. k.baker@unsw.edu.au

Adolescents, both humans and rodents, exhibit a marked impairment in extinction of fear relative to younger and older groups which could be caused by a failure to efficiently recruit NMDA receptors (NMDARs) in adolescents. It is well-established that systemic administration of NMDAR antagonists (e.g., MK801) before fear extinction training impairs retention of extinction in adult and juvenile rodents but it is unknown whether this is also the case for adolescents. We investigated the effect of pharmacologically manipulating the NMDAR on fear extinction retention in adolescent rats in two experiments. When extinction retention is typically impaired (i.e., after one day of extinction training) animals given D-cycloserine (a partial NMDAR agonist) showed enhanced extinction retention relative to saline-treated animals while animals given MK-801 (an uncompetitive antagonist) did not exhibit any further impairment of extinction retention relative to the controls. When two days of extinction training was given to adolescent rats, saline-treated animals exhibited good extinction retention, and now the MK801-treated animals exhibited impaired extinction retention. These findings suggest that extinction in adolescence does not initially involve NMDARs and this is a likely mechanism that contributes to the impaired fear inhibition observed at this age. However, NMDARs appear to be recruited with extended extinction training or after administration of a partial agonist which lead to effective extinction retention.

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NEURAL CORRELATES OF ATTENTIONAL BIAS TO THREAT AMONG YOUTH WITH AND WITHOUT ANXIETY DISORDERS. M. Bechor*, M.S.[1], B.C. Reeb-Sutherland[1], M. Ramos, B.A.[1], J. Pettit[1], and W.K. Silverman.[2] [1]Department of Psychology, Florida International University, Miami, FL 33199, [2]Yale Child Study Center, Yale University, New Haven, CT 06520. mbech001@fiu.edu

Past investigations of event-related potential and attention bias to threat (ABT) have shown elevated amplitudes of P1 components in adults with high self-reported anxiety (Eldar & Bar-Haim, 2010). No studies have investigated this in youth. Electroencephalographic (EEG) data were collected from 19 youth with primary DSM-IV-TR anxiety disorders (M age = 11.63, SD = 2.27; 11 male) and 18 control youth (M age = 11.50 SD = 2.07; 12 male) while completing the dot probe task, a behavioral measure of ABT, with trials displaying neutral-threat (NT) or neutral-neutral (NN) face pairs (Eldar & Bar-Haim, 2010). Peak amplitudes at site Oz were averaged for P1 (70–180 ms). Groups did not differ by age ($t(36) = -.11$, $p = 601$) or gender: ($p(\chi^2 = .138) = .710$) but differed via parent report of youth anxiety (SCARED-P; $t(36) = 4.38$, $p < .00$). A repeated measures analysis of variance with Greenhouse–Geisser correction (between-subjects: Anxiety; within-subjects: Stimulus) determined there was a significant Anxiety × Stimulus interaction effect for P1 peak amplitude ($F(1,31 = 8.933$, $p = .005$), control youth exhibiting greater P1s ($M = 24.65$) than anxious youth ($M = 21.484$) during NN trials. These results suggest neural correlates of ABT are distinguishable between youth with and without anxiety disorders, potentially differing in early-stage, configural processing, as shown in adults (Bar-Haim, Lamy, & Glickman, 2005).

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BIRTHWEIGHT, FRONTAL EEG ASYMMETRY, AND TEMPERAMENT: POTENTIAL CONTEXT FOR DEVELOPMENT RISK IN FULL TERM INFANTS. M.A. Bell*, T.L. Blankenship, and R. Liu. Department of Psychology, Virginia Tech, Blacksburg, VA 24061. mabell@vt.edu

The prenatal environment is a critical context for the study of developmental risk. Young adults born with very low birth weight exhibit greater cautiousness and shyness, as well as greater right frontal EEG asymmetry, compared to young adults with normal birth weight (Schmidt et al, 2010; Waxman et al, 2013). We wanted to know if typical variations in full term, normal birthweight were related to similar patterns among temperament and frontal EEG asymmetry in young children. Fifty-three full-term, typically developing children (32 girls, 21 boys) and their mothers were one cohort of a larger longitudinal study on cognition-emotion development. At 5 months, mothers reported demographic information, including child birthweight and maternal education level. At 10 months, frontal EEG was recorded and mothers rated infant negative affect temperament using IBQ-R. At 36 months, mothers completed the Child Behavior Checklist, with anxiety problems as the outcome measure. There were sex differences in birthweight (boys = 8.02 lbs; girls = 7.43 lbs; $p = .02$). After controlling for child sex and maternal education level ($F = 1.51$, $p = .23$), infant birthweight ($\beta = -.41$; 15% variance), frontal EEG asymmetry ($\beta = -.28$; 7% variance), and negative affect ($\beta = .41$; 15% variance) predicted 39% of the variance in 36-month anxiety problems ($F = 7.91$, $p < .001$). These data suggest that birthweight, temperament, and frontal EEG asymmetry are interrelated in children born full term. They also suggest that birthweight of full term infants be given greater consideration in studies of developmental risk.

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COORDINATED MOVEMENT IS INFLUENCED BY PRENATAL LIGHT EXPERIENCE IN BOBWHITE QUAIL HATCHLINGS (COLINUS VIRGINIANUS). S.C. Belnap* and R. Lickliter. Department of Psychology, Florida International University, Miami, FL, 33199. sbelnap@fiu.edu

Hemispheric lateralization is a pattern of specialized brain organization that enables separate and parallel processing, thus maximizing efficiency and improving fitness. There is mounting evidence suggesting that motor coordination may be an additional advantage of hemispheric specialization. In precocial birds, light plays a key role in the development of hemispheric specialization, thereby influencing perceptual and cognitive processing. The aim of this study was to investigate how prenatal light experience can influence the development of coordinated movement in bobwhite quail hatchlings. Embryos were randomly assigned to four prenatal light conditions: no light (Dark), 2 hr of total light experience (2HR), 6 hr of total light (6HR), and a normal low-light controls. Hatchlings were video recorded performing a walking task at three developmental time points (12, 24, and 48 hr) following hatching. Testing videos were scored and analyzed for frequency and duration of forward movement, a measurement of motor coordination, and falls, a measurement of

instability. Results indicated that duration of falls increased in both light conditions, suggesting that fallen hatchlings took longer to recover compared to control chicks. However, the frequency of falls only increased in the 2HR light condition. The average frequency of steps during forward locomotion did not vary between groups, and only the dark condition showed differences in duration of steps. On average dark hatchlings took longer to execute the same number of steps compared to control chicks. Taken together these results suggest prenatal light experience can influence the development of motor coordination.

NEURAL CORRELATES OF FUTURE EPISODIC MEMORY IN 4-YEAR OLDS. T.L. Blankenship*, A.P. Ross, and M.A. Bell. Department of Psychology, Virginia Tech, Blacksburg, VA 24061.tashau8@vt.edu

Episodic memory, or memory involving item and context, is necessary when thinking about the future. In order to plan for future events, we often mentally re-visit similar past events, thus recruiting episodic memory (Atance & O'Neill, 2001). In fact, adult studies suggest that future episodic memory involves similar, but distinct, neural pathways as episodic memory (Addis et al., 2007). Studies have begun to examine future episodic memory during early childhood (e.g., Cuevas et al., 2015). However, little is known about the neural correlates of future episodic memory early in development. We examined the contributions of temporal EEG power to both an episodic memory and future episodic memory task in forty-one 4-year-old children. The episodic memory task involved children recognizing locations, and the future episodic memory task required children to plan ahead given a scenario (e.g., going to a birthday party). EEG was collected while the children learned the locations (encoding), identified the locations (recognition), and planned ahead (future episodic memory). Separate regression equations were used to examine the contributions of EEG at temporal scalp locations to episodic memory and episodic future memory task performance. The predictors collectively accounted for 23% of the variance in both episodic and future episodic memory performance. Right temporal power during encoding ($\beta = .74$) and left temporal power during recognition ($\beta = -.59$) contributed unique variance to episodic memory. Right temporal power during encoding ($\beta = -.63$) and right temporal power during recognition ($\beta = .73$) contributed unique variance to future episodic memory.

[NIH grant HD049878 to MAB].

CONCURRENT EXPOSURE TO METHYLMERCURY AND D-AMPHETAMINE DURING ADOLESCENCE IMPAIRS REVERSAL LEARNING IN MICE: A LOGISTIC ANALYSIS. S.R. Boomhower*, R.A. Sauer, K. Johnson, and M.C. Newland, Department of Psychology, Auburn University, Auburn, AL 36849. srb0028@auburn.edu

Gestational exposure to methylmercury (MeHg), an environmental neurotoxicant, produces lasting deficits in behavioral flexibility and increased sensitivity to dopamine agonists, but the impact of MeHg exposure during adolescence remains to be explored. To assess the role of DA in MeHg's developmental neurotoxicity, we compared the effects of adolescent MeHg and D-amphetamine (D-AMP) exposure. Male C57Bl/6n mice were randomly assigned to two MeHg-exposure groups (0 and 3 ppm) and two D-AMP-exposure groups (saline and 1 mg/kg/day), producing four treatment groups ($n = 10–12$/group): Control, MeHg, D-AMP, and MeHg + D-AMP. MeHg exposure (via drinking water) spanned postnatal days 21–60 (the murine adolescent period), and once daily i.p. injections of D-AMP or saline spanned postnatal days 28–42. As adults, mice were trained on a spatial-discrimination-reversal (SDR) task in which the spatial location of a lever press predicted reinforcement. Following two SDRs, a visual-discrimination task (extradimensional shift) was instated in which the presence of a stimulus light above a lever predicted reinforcement. Responding was modeled using a logistic function, which estimated the rate (slope) of a behavioral transition and trials required to complete half a transition (half-max). MeHg, D-AMP, and MeHg + D-AMP exposure increased estimates of half-max on the second reversal. MeHg exposure also increased half-max and decreased the slope term following the extradimensional shift. MeHg + D-AMP produced more perseverative errors and omissions following a reversal. These data provide indirect evidence for the hypothesis that disruption of DA neurotransmission is a mechanism of MeHg-induced behavioral toxicity.

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GENE BY ENVIRONMENT EFFECTS ON ATTACHMENT, EMOTION REGULATION, AND DEPRESSIVE SYMPTOMS IN MIDDLE CHILDHOOD. J.L. Borelli[1], A. Gómez[1], P.A. Smiley[1], H.F. Rasmussen[1], L.C. Seaman[2], and E.L. Nurmi[2]. [1]Department of Psychology, Pomona College, Claremont, California, 91711. [2]Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, California, 90095. jessica.borelli@pomona.edu

FKBP5 confers risk for depression. This study extends findings to a non-psychiatric sample of children and mothers to examine gene (FKBP5) by environment (maternal overcontrol) effects on attachment insecurity and child's downstream behavioral and physiological measures (emotion regulation, post-stressor respiratory sinus arrhythmia, and depressive symptoms). Higher levels of overcontrol predicted lower child attachment security in FKBP5 risk allele carriers only (p's < .02). Child attachment security interacted with FKBP5 to predict higher emotion suppression, $\Delta R^2 = .05$, $p = .03$, depressive symptoms, $\Delta R^2 = .05$, $p = .002$, and reduced RSA change, $\Delta R^2 = .02$, $p = .05$. Findings are conceptualized from a differential susceptibility framework.

EFFECTS OF LATE GESTATIONAL CANNABINOID EXPOSURE ON BEHAVIORAL DEVELOPMENT IN RATS. K.R. Breit*, B. Zamudio, and J.D. Thomas. Center for Behavioral Teratology, San Diego State University, San Diego, CA 92120. kbreit@mail.sdsu.edu

Given recent legalization of marijuana in certain states, cannabis use has increased, even among pregnant women. Active ingredients in cannabis, including THC, cross the placental barrier and can directly affect the fetal brain development. However, little is known of the consequences of exposure to the increasing potency in cannabis products available today, and although longitudinal clinical studies are currently underway, results will not be available for some time. Using a rodent model, the present study investigated the effects of clinically relevant cannabinoid (CB) levels on behavioral development. From postnatal day (PD) 4–9, a period of brain development equivalent to the 3RD trimester, Sprague–Dawley rats received i.p. injections of the CB1 receptor agonist CP55,940 (.10, .25, .40 mg/kg/day) or vehicle.

Motor coordination development (PD 12–20), anxiety (PD 25), and spatial learning (PD 40–46) were evaluated. CB exposure significantly altered the developmental trajectory of motor performance, where coordination milestones occurred earlier compared to controls. The long-term effects of this altered trajectory are still unknown. Behaviors in the elevated plus maze did not differ between groups, suggesting that gestational CB exposure may not directly alter anxiety-related behaviors; however, the highest dose of CB significantly impaired spatial memory among females, but not males. These data suggest that cannabis exposure late in gestation may influence fetal development in a domain and sex-specific manner. Further research investigating possible consequences of developmental exposure to other cannabis constituents may guide future medical and public policy, particularly for pregnant women.

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EXAMINING PATHWAYS BETWEEN NEONATAL AUTONOMIC MEASURES AND LATER LANGUAGE SKILLS DURING INFANCY. N.H. Brito[1], M. Ordonez-Retamar[1], J.D. Nugent[1], M.T. Corwin[1], K.G. Noble[2], M.M. Myers[1,3], A.J. Elliott[4], and W.P. Fifer[1,3]. [1]Division of Developmental Neuroscience, New York State Psychiatric Institute, New York, NY 10032. [2]Department of Biobehavioral Sciences, Teachers College, Columbia University, New York, NY 10027. [3]Departments of Psychiatry and Pediatrics, Columbia University Medical Center, New York, NY 10032. nhb2111@cumc.columbia.edu

Fetal and neonatal heart rate (HR) and variability (HRV) have been associated with concurrent and later cognitive skills during infancy (Bornstein & Suess, 2000b; El-Sheikh & Buckhalt, 2005; Feldman, 2006; Fox, 1989; Richards & Cameron, 1989). A past study reported that fetuses with slower and more variable HR, as opposed to faster and less variable HR, had significantly better language skills during toddlerhood (DiPietro et al., 2007). The present study examines if phonetic discrimination (PD) explains the link between early autonomic measures and later language skills in a sample of 59 full-term infants. Autonomic measures were collected at birth, PD was tested at 9-months, and language abilities were measured at 9 and 15 months of age. Results showed that infants with slower and more variable HR (i.e., greater RMSSD) scored higher on expressive language skills at 9 months (HR $r = -.29$, $p = .04$; HRV $r = .30$, $p = .03$) and 15 months (HR $r = -.30$, $p = .03$; HRV $r = .42$, $p = .003$). HR, but not HRV, was significantly associated with PD abilities at 9-months ($r = .43$, $p = .003$); infants with slower HR did not discriminate between two non-native contrasts, suggesting earlier perceptual tuning to the phonemes of their native language. These results are consistent with past studies demonstrating links between earlier perceptual tuning and stronger language skills later in childhood and may indicate a possible pathway through which early autonomic regulation predict future language skills.

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INHIBITORY CONTROL TASK PERFORMANCE AND EEG COHERENCE AT AGE FOUR. A.P.R. Broomell*, T.L. Blankenship, and M.A. Bell. Psychology, Virginia Tech, Blacksburg, VA 24061. apross@vt.edu

The day/night task is a popular measure for quantifying executive functioning in children. The straight version of the game requires the child to label the cards as they appear, with the sun card labeled "day" and the moon card labeled "night." The Stroop condition requires the child to say "day" to a picture of moon and stars and "night" to a picture of a sun. This study added a third condition to the day/night task which required the child to set-shift between the two previously described conditions by adding a red border to half of the cards. Children were instructed to play the silly way when there was a border and the regular way when there was no border. Forty-one children (twenty-one girls) aged four completed the three conditions of the task while EEG was collected. A 3 (condition) × 2 (hemisphere) repeated measures MANOVA showed a main effect for both condition $F(2, 37) = 13.29$, $p < .01$ and hemisphere $F(1, 38) = 15.68$, $p < .01$. Coherence between fontal regions (F4–F8 and F3–F7) decreased significantly from the straight to Stroop to borders conditions. The left hemisphere was consistently lower in coherence than the right hemisphere across the conditions. The decrease in coherence signifies that the cortical areas are working independently of each other. This suggests that in young children an increase in cognitive load is associated with a decrease in EEG coherence, while the left frontal lower coherence represents a trait of the sample.

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FACTORS INFLUENCING DEVELOPMENTAL DIFFERENCES IN RETENTION OF PAVLOVIAN FEAR CONDITIONING. K.L. Brown*, M.J. Sodoma, and J.H. Freeman. Department of Psychological and Brain Sciences, The University of Iowa, Iowa City, IA 52242. kevin-brown@uiowa.edu

Pavlovian fear conditioning is a useful preparation for studying developmental changes in aversive learning and memory. The present study represents our efforts to identify factors influencing developmental differences in expression of fear memories. Postnatal day (P) 17 or 24 rats were trained with a white noise conditional stimulus (CS) and a floor shock unconditional stimulus (US) in context A. At test, the CS was presented in an environment (context B) that differed from the training context in visual, tactile, and olfactory features. Age differences in expression of fear memory during white noise CS presentations—as indexed by freezing, the absence of movement except those required for respiration—were largely dependent on (1) the associative nature of CS and US presentations at training; (2) the number of CS-US presentations at training; and (3) the interval between training and testing. Additionally, neuronal activity in the prelimbic cortex was assessed during testing in a subset of subjects through use of tetrode recordings from a surgically implanted hyperdrive. Richardson and colleagues have reported developmental differences in involvement of the prelimbic cortex in expression of learned fear using immunohistochemistry and temporary inactivation (Li, Kim, & Richardson, 2012, Behavioral Neuroscience, 126, pp. 217–225). Robust CS freezing and CS-related unit activity characteristic of prelimbic recordings in adults were evident in rats trained on P24 but not in rats trained on P17. Importantly, freezing levels were comparable to non-surgery counterparts. These findings provide the basis for novel investigations into mechanisms underlying developmental differences in memory retention and retrieval.

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THE RAT IN THE INCUBATOR: MIMICKING NICU SETTINGS FOR TRANSLATIONAL STUDIES OF EARLY ADVERSITY. S. Brummelte. Department of Psychology, Wayne State University, Detroit, 48202. sbrummelte@wayne.edu

Preterm infants have to undergo a lot of stressful and painful procedures while they are in the Neonatal Intensive Care Unit (NICU) and recent research suggests that the number of skin-breaking procedures is related to brain maturation of preterm infants. However, there is a dearth of knowledge about what comprises an optimal NICU environment and some potentially contributing factors to negative outcome are difficult to study in humans. Thus, in our animal model, we aim to mimic NICU settings and we are currently investigating the modulating effect of maternal care on the negative impact of neonatal pain exposure.

EFFECTS OF ACTIVE AND OBSERVATIONAL EXPERIENCE ON EEG ACTIVITY DURING EARLY CHILDHOOD. L.J. Bryant* and K. Cuevas. Psychological Sciences, University of Connecticut, Waterbury, CT, 06702. lauren.bryant@uconn.edu

The neural mirroring system (NMS) has been hypothesized to underlie action understanding by serving as a mechanism by which one uses existing motor experience with an action as a frame of reference when perceiving similar actions by others (Gallese et al., 1996). Consistent with this hypothesis, studies with infants and adults have demonstrated greater mu rhythm desynchronization (MRD; an EEG measure of NMS activation) during the perception of actions with which the observer has motor, rather than visual, experience (e.g., Cannon et al., 2014; Gerson et al., 2015). Associations between MRD and action experience have not yet been investigated during early childhood. Based on the at-home training paradigm used by Gerson et al. (2015), we manipulated 3- to 6-year-old children's ($N = 16$) active and observational experience with two tools and then examined EEG mu (7–10 Hz) and central beta rhythm (17–21 Hz) desynchronization as measures of NMS activity during observation and execution of these actions. Children exhibited neural mirroring within the mu rhythm, as indicated by significant MRD during both action observation and execution (one-sample t-tests; $ps < .05$). Although mu and beta rhythm activity at central sites did not differ as a function of training condition ($Fs < 1$), desynchronization within the 7–10 Hz band was greater during perception of the active training task at occipital sites, $t(15) = -2.67$, $p = .02$. We attribute this differential activity of the occipital region to visual attention, which may mediate associations between experience and occipital alpha rhythm desynchronization.

LONGITUDINAL EYETRACKING INVESTIGATION OF ATTENTIONAL BIASES TOWARDS THREAT IN EARLY CHILDHOOD. J.L. Burris* and S.M. Rivera. [1]Department of Psychology, University of California, Davis, CA 95616. jlburris@ucdavis.edu

Persistent attentional biases towards threatening information in the environment have been linked to anxiety in populations from age 5 through adulthood (Bar-Haim et al., 2007). These biases are most commonly identified using an emotional face dot probe task (DPT) (Bradley et al., 1999). The classic presentation of this task involves verbal instruction and requires a button response—responses that would be impossible for an infant to complete; thus, the presence and development of attentional biases towards threat as identified using the DPT in the first 4 years of life is unreported. In the current longitudinal study an emotional face DPT was modified for use on an infrared eye-tracker to allow for passive viewing and was shown to 35 typically developing infants ages 9–25 months and then again at a follow up visit 2 years later. Results indicate a significant bias towards both happy and angry faces with no difference between the emotions at the initial time point. At the follow-up visit the bias towards threat was significantly greater than the bias score to happy faces ($t(34) = 2.35$, $p < .05$), and importantly, the bias towards happy at the follow-up visit no longer significantly differed from zero ($t(34) = 1.90$, $p > .05$). These results indicate an initial affective bias in infancy that changes to show threat specificity over a 2-year window. The results will be discussed in the context of the changing patterns of attention to affective information in the environment in the first few years of life and its potential impact on the development of anxiety.

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VIGILANCE AND AVOIDANCE IN CHILDREN WITH DYSREGULATED FEAR. K.A. Buss[1], S. Morales[1], and R.J. Brooker[2]. [1]Department of Psychology, The Pennsylvania State University, University Park, PA 16802. [2]Department of Psychology, Montana State University, Bozeman, MT 59717. kab37@psu.edu

Dysregulated fear is a pattern of behavior marked by high fear to low threat situations in infancy and is associated with a 4-fold increase in risk of social anxiety symptoms by age 6 and continued risk for anxiety and depression into early adolescence. In search for mechanisms underlying this pattern behavior, we have found emerging evidence that DF is also associated with a larger profile of physiological and neural processes. In particular we have shown DF to be associated with both increased vigilance toward (i.e., monitoring marked by the ERN) and avoidance (i.e., attention bias away) from threat. We will present data showing dysregulation of neural (EEG/ERP), physiological (RSA) and neuroendocrine (cortisol) markers of DF. Together these findings demonstrate how taking a biopsychosocial approach improves prediction of who is at risk for anxiety symptoms in middle childhood and adolescence.

PREPARED FOR PREJUDICE? 6-MONTH-OLD INFANTS SELECTIVELY ASSOCIATE ETHNIC OUT-GROUP FACES WITH FEARFUL VOCALIZATIONS. D. Butler[1], Y. Kanakogi[1], M. Imafuku[1], D. Cowan[2], M. Nielsen[2], S. Kennedy[2], and M. Myowa-Yamakoshi[1]. [1]Graduate School of Education, Kyoto University, Kyoto, 606-8286 Japan. [2]School of Psychology, University of Queensland, St. Lucia, 4072, Australia. davidbut@psy.uq.edu.au

Prejudice impacts upon intergroup relations, yet it remains unclear what psychological mechanisms are required for it to arise. Children as young as 3 years show prejudice, suggesting that protracted social exposure is not necessary. However, the developmental picture remains unclear given the absence of evidence from infancy. Here, using an eye tracker to record gaze during an intermodal matching paradigm, our preliminary results indicate that 6-month old infants looked longer at movies of ethnic out-group faces when hearing a fearful rather than a happy voice. No difference emerged for in-group ethnic faces. Such evidence reaffirms that protracted social exposure

is not required; indeed, humans may be born biologically prepared to easily fear individuals belonging to certain out-groups or coalitions in a manner similar to other relevant stimuli such as snakes.

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THE NEUROENVIRONEMTNAL LOOP OF PLASTICITY: PARENTAL & PERIPHERAL REGULATION OF EMOTION NEUROBIOLOGY ACROSS THE LIFESPAN. B.L. Callaghan[1,*], D.G. Gee[2], L. Gabard-Durnam[1], A. Fields[1], C. Caldera[3], K.L. Humphreys[4], B. Goff[3], J. Flannery[5], E.H. Telzer[6], M. Shapiro[3], and N. Tottenham[1]. [1]Psychology, Columbia University, New York, New York, 10027. [2]Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College, New York, New York, 10065. [3]Psychology, University of California Los Angeles, Los Angeles, California, 90095. [4]Psychology, Stanford University, Stanford, California, 94305. [5]Psychology, Oregon University, Eugene, Oregon, 97403. [6]Psychology, University of Illinois at Urbana Champagne, Champaign, Illinois, 61820. bridgetcallaghan281@gmail.com

Caregiving experiences shape brain structure and function. Hence, it is not surprising that perturbed early caregiving has profound neural effects, especially in regions important for emotional responding. We have recently proposed a model for examining how early caregiving experiences come to influence central nervous system development and behavior in ways that contribute to lifelong mental health – the 'Neuro-Environmental Loop'. In this talk I will present two lines of supporting evidence for that model. Specifically, I examine the effects of early life experiences on parental scaffolding of amygdala-prefrontal circuitry and how the peripheral nervous system (i.e., the gut) comes to influence those processes. It was recently reported that parents buffer/dampen amygdala reactivity during specific developmental stages, e.g., in childhood, but not in adolescence. We have tested the hypothesis that childhood amygdala buffering may be affected by early care experiences in ways that have consequences for long-term mental health. Specifically, we demonstrate that amygdala buffering is affected by parental deprivation in early life. We also show that amygdala buffering in childhood is associated with future anxiety. Interestingly, we have also demonstrated that early life adversity affects the gut microbiome in ways that relate to anxiety and amygdala development. By bringing these lines of evidence together, I will demonstrate how early care experiences affect the organism at the whole-body level, establishing trajectories of brain development contributing to mental health and illness. This encompassing perspective opens the door for future treatments aimed at ameliorating the effects of early adversity.

AN INVESTIGATION OF THE RELATION BETWEEN NEUROMOTOR MILESTONES AND HAND PREFERENCE USING PRINCIPAL COMPONENTS ANALYSIS. J.M. Campbell[1], E.C. Marcinowski[2], and G.F. Michel[3]. [1]Department of Psychology, Illinois State University, Normal, IL 61761. [2]Department of Physical Therapy, Virginia Commonwealth University. [3]Department of Psychology, The University of North Carolina at Greensboro. jmcamp9@ilstu.edu

A dynamic systems perspective proposes that change in the development of postural control during infancy elicits changes in infant expressed hand preference (Corbetta & Thelen, 1996). Babik, Michel, Sheu, and Campbell (2014) reported that postural development influenced the manifestation of symmetrical (bimanual) grasping of objects during infancy, but not a hand preference. We assessed the relation of specific neuromotor milestones and manifest hand preference using principal component analysis (PCA). PCA permits assessment of the relation of manifest hand preference to the dimensions of Touwen's indices of neuromotor development. Infant (n = 298, 166 males) hand preference for acquisition and the development of motor and postural control was assessed monthly from 6 to 14 months. Group based trajectory analyses revealed four latent groups of infants who were developing along different hand preference trajectories (Early Right, Early Left, Late Right, No Preference). PCA examined the relation of the twelve items on the Touwen neuromotor scale to the hand preference groups. The results show that there are no differences in patterns of eigenvalues on the factors for each hand preference group. Thus, differences in the development of specific neuromotor milestones does not relate to manifest hand preference, which supports the findings of Babik et al. (2014). PCA performed each month revealed that in the earlier months (6–9), items which measure sitting ability contribute more heavily to overall neuromotor score than do other items. In later months, items which relate to the development of standing and walking have higher eigenvalues. These results support Touwen's assertion that these items assess neuromotor development.

ASTHMA DURING ADOLESCENCE CONTRIBUTES TO ADULT ANXIETY BEHAVIOR AND NEUROBIOLOGICAL PHENOTYPE. J.I. Caulfield[1,2,3,*], M.J. Caruso[1,3], R.A. Bourne[1], S.A. Cavigelli[1,2,3]. [1]Department of Biobehavioral Health, Pennsylvania State University, University Park, PA 16802. [2]Graduate Program in Neuroscience, Huck Institute for Life Sciences, The Pennsylvania State University, University Park, PA 16802. [3]Center for Brain, Behavior, and Cognition, Pennsylvania State University, University Park, PA 16802. joc5376@psu.edu

Adolescence is a developmental period sensitive to perturbations that can affect adult neuronal and behavioral processes associated with internalizing disorders. Asthma, a common chronic health challenge that affects 9% of U.S. adolescents, is often comorbid with anxiety and depression. Little is known regarding neurobehavioral impacts of this chronic adolescent challenge. Microglia, the immune cells of the brain, activate in response to peripheral insult. Their over-activation has been implicated in neuropsychiatric disorder development. Mechanisms underlying the comorbidity of asthma and internalizing disorders, and microglia involvement in this relationship, have not been established. A mouse model of adolescent asthma was used to test mechanistic relationships between asthma, anxiety, and microglia. Three experimental groups experienced the following components of asthma: (1) "Airway inflammation" via repeated house dust mite extract (HDM) exposure; (2) "Labored breathing" via methacholine (MCH) exposure; and (3) "Airway inflammation and Labored breathing" via both HDM and MCH exposure. As adults, MCH animals demonstrated an anxious phenotype, spending 30% less time on open arms of the elevated plus maze compared to non-MCH animals. These mice exhibited decreased serotonin transporter gene expression in brainstem, as well as elevated serotonin receptor 1a, mineralocorticoid, and Cd11b (microglia marker) expression in hippocampus

compared to non-MCH mice. HDM mice exhibited 50% less basal circulating corticosterone compared to controls. Female HDM-MCH animals demonstrated higher Cd11b expression in hippocampus compared to male HDM-MCH animals. These results indicate that clinical symptoms of asthma, particularly labored breathing, during adolescence enable increased adult anxiety-related behavior and brain function.

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TIMING MATTERS: THE INTERVAL BETWEEN ACUTE STRESSORS WITHIN CHRONIC STRESS AFFECTS BEHAVIORAL AND PHYSIOLOGICAL OUTCOMES. S.A. Cavigelli,[1,2,3] A.D. Bao,[3] M.J. Caruso,[1,3] M. Chen,[3] J.I. Caulfield,[1,2,3] R.A. Bourne,[4] and J.M. Smyth[3,5]. [1]Center for Brain, Behavior, and Cognition. [2]Huck Institute of Life Sciences. [3]Department of Biobehavioral Health, [4]Department of Biology, [5]Social Science Research Institute, Pennsylvania State University, University Park, PA 16802. sac34@psu.edu

Prior studies have shown that the frequency, duration, and intensity of stressors can significantly affect health-related behavior and physiology. Few studies, however, have investigated whether the temporal pattern of acute stressors within a broader chronic stress context influences behavioral and physiological outcomes. That is, do the negative sequelae of chronic stress depend on whether the acute stressors within chronic stress occur in relatively close temporal proximity or are more broadly spaced over time? The current study experimentally examined this issue by holding stressor frequency, duration, and intensity constant, while varying the temporal pattern of chronic, mild, unpredictable stressors in Sprague-Dawley rats. We used three experimental groups: (1) a "Clustered" stress group that received three daily 15-min stressors within an hour, (2) a "Dispersed" stress group that received the same stressors spread out over the day, and (3) a Control group that received regular handling but no stressor exposure. The chronic stress protocol was administered for 4 weeks with health-related behavioral and physiological outcomes measured at the end. Rats in the Clustered, but not Dispersed group gained less weight, consumed less sucrose, had a blunted acute corticosterone response, and a more robust IL-6 response to endotoxin compared to Control rats. The results provide preliminary, but provocative, evidence that the temporal distribution of acute stressors within chronic stress may impact behavioral and physiological processes, independent of total stressor exposure. Greater understanding of how stressor temporal patterns affect behavior and physiology has important implications for advancing stress theory and determining stress-related health outcomes.

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PRENATAL EXPOSURE TO MATERNAL CULTURAL STRESSORS IN RELATION TO NEWBORN HEALTH OUTCOMES IN INFANTS OF MEXICAN DESCENT. G.N. Chim, S. Gonzalez, A. Maldonado, and K.L. D'Anna Hernandez. Department of Psychology, California State University San Marcos, San Marcos, 92069. chim001@cougars.csusm.edu

Mexican-Americans are a fast-growing population that experience acculturation, adaptation to norms and values of a new culture, and stress associated with it. This includes acculturative stress, stress involved with cultural adaptation, and discrimination, negative attitudes and unjust treatment towards a group. Fetal exposure to maternal cultural stressors during pregnancy may be associated with risk for adverse mental and physical health in newborns, but this is not yet known. This study hypothesized that high levels of maternal acculturation, acculturative stress and discrimination during pregnancy would be associated with higher levels of salivary C-reactive protein (sCRP), a marker of inflammation related to health outcomes, in infants and higher infant sCRP levels would be associated with early indices of risk in infants. Pregnant Mexican-American women were recruited early in pregnancy and assessed for acculturation, acculturative and discrimination. At birth, neonatal outcomes and sCRP were collected. At 2 months infant heart rate variability was recorded. Fetal exposure to maternal acculturative stress (r= .090, p = .699) and discrimination (r = −.028, p = .904) were not related to infant sCRP or infant heart rate (acculturative stress, r = .089, p = .591;) or discrimination (r = −.016, p = .923). However, less acculturation was positively correlated with high infant sCRP was positively correlated. None of the cultural stressor were associated with gestational age or birthweight nor was sCRP associated with birth outcomes (ps > .05). Thus, the process of acculturation, and not stress, may be associated with the programming of infant sCRP levels. Further research should address cultural practices and behavior during the perinatal period with potential consequences for infants.

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LITTER CHARACTERISTICS AND NEWBORN SENSORIMOTOR FUNCTION IN A RAT MODEL OF SPINA BIFIDA. S.M. Conway[1,*], V. Mendez-Gallardo[2], H.E. Swann[1], K. Hunter[3], N. Burgett[1], and M.R. Brumley[1]. [1]Department of Psychology, Idaho State University, Pocatello, ID 83209. [2]Department of Psychology, Penn State University, Media, PA 19063. [3]Department of Biological Sciences, University of Idaho, Moscow, ID 83843. conwstev@isu.edu

Myelomeningocele (MMC) is the most common and severe type of spina bifida in which the developing spine and neural tube fails to close during prenatal development. This typically results in a small portion of the lower spinal cord and meninges protruding from the back of the individual, accompanied by severe motor and sensory deficits. In rats, retinoic acid (RA) exposure in high doses during fetal development has been shown to induce morphologic and clinical symptoms similar to humans with MMC. The aim of the current study was to examine litter characteristics and sensorimotor function in MMC-affected rat pups. Pregnant rats were gavage-fed 2 ml olive oil or all-trans retinoic acid (40, 45, 50 mg/kg) on gestational day 11. Pups underwent behavioral testing on postnatal day 2. Litter characteristics and newborn sensorimotor function varied across RA doses. Pups prenatally exposed to 45 and 50 mg/kg RA weighed significantly less than olive oil and 40 mg/kg RA pups. Litters exposed to 45 mg/kg RA suffered significantly higher mortality rates compared to other groups. Additionally, bladder function was significantly impaired in pups exposed to 40 mg/kg RA. One test of sensorimotor function was lateral contact righting. Preliminary data suggests differences in righting strategy across doses of RA; also, latency to right appears to change across trials, but not as an effect of RA treatment. Additional tests of sensorimotor function and morphology were examined.

TAKING THE STRESS OUT OF THE STORM: PROBIOTICS PREVENT SEX-DEPENDENT CHANGES IN PUBERTAL TIMING IN RATS EXPOSED TO EARLY-LIFE STRESS. C.S.M. Cowan* and R. Richardson. School of Psychology, The University of New South Wales, Sydney, Australia. c.cowan@unsw.edu.au

Puberty marks the beginning of a period of dramatic physical, hormonal, and social change. This instability has made adolescence infamous as a time of 'storm and stress', and it is well-established that stress during adolescence can be particularly damaging. However, prior stress may also shape the adolescent experience. In both humans and rodents, early-life adversity is associated with sex-dependent changes in the timing of puberty onset that may render the individual ill-equipped to cope with their rapidly changing bodies and social contexts. In the present series of experiments, we demonstrate that probiotic treatment restores species-typical developmental trajectories of puberty onset in rodents exposed to early-life stress. Specifically, puberty onset was assessed using a measure of physical development (preputial separation in males and vaginal opening in females). Rats were exposed to either standard rearing (SR) or early-life stress (maternal separation; MS). Some MS animals also received probiotic treatment throughout MS (postnatal days 2–14). Replicating previous research, stressed males and females exhibited later and earlier pubertal onset, respectively, as compared to their SR counterparts. However, these alterations in pubertal timing were reversed by probiotic treatment. These results are in keeping with our previous findings that probiotics reverse stress-induced changes in learned fear behaviours, highlighting the remarkable and wide-ranging restorative effects of probiotics in the context of early-life stress.

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REJECTION BY STRANGER AND KIN: FRONTAL THETA OSCILLATIONS. M.J. Crowley, J. Wu, and L. Vazquez. Child Study Center, Yale School of Medicine, New Haven, Connecticut, 06520. michael.crowley@yale.edu

Using the Cyberball social exclusion paradigm, we examined EEG theta dynamics of social rejection while mother child dyads (n = 20) played with one another and a stranger. In children (8–12 years), theta power (4–7 Hz) in a time window seen in feedback and conflict processing (200–500 ms) was greater in response to rejection events putatively delivered by their mother. Mothers showed greater theta power in response to rejection events by an unfamiliar woman in a time window examined in ostracism research (300–800 ms). Differential effects for mothers and children may reflect the demands and goals of roles within the mother-child relationship.

IMITATION DURING INFANCY: FROM LEARNING AND MEMORY TO NEURAL MIRRORING. K. Cuevas, Psychological Sciences, University of Connecticut, Storrs, CT 06269. kimberly.cuevas@uconn.edu

The aim of this presentation is to highlight Carolyn Rovee-Collier's contributions to the field as well as current work that she has influenced, with a focus on imitation. Imitation has been used to examine multiple aspects of cognition, including latent learning, social learning, and memory. I will begin by reviewing Dr. Rovee-Collier's research on deferred imitation, emphasizing findings related to both latent learning and memory development. I will then discuss my recent work examining the behavioral and neural processes involved in early social learning. This research focuses on the neural mirroring properties of the EEG mu rhythm and individual differences in imitation.

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WHEN LARVAL NUTRITION IS LIMITED, ADULT DROSOPHILA SACRIFICE VISUAL ACUITY TO MAINTAIN CONTRAST SENSITIVITY. J.P. Currea[1,*], J. Smith[2], J.C. Theobald[2]. [1]Psychology, Florida International University, Miami, FL, 33199. [2]Biology, Florida International University, Miami, FL, 33199. jpcurrea@fiu.edu

Wild adult fruit flies, Drosophila melanogaster, vary in size due to resource competition during development, but how this variation impacts eye size, visual acuity, sensitivity, and flight behavior remains largely unknown. Because holometabolous insects partition their development, growth is largely restricted to the larval stage, and limited larval nutrition results in smaller adult flies. Smaller adult flies possess smaller eyes that, in principle, must sacrifice acuity or sensitivity. Small flies are common in nature where larval nutrition is limited and ephemeral. However, because fruit fly vision is currently understood from uniformly large, lab-reared adults, how their visual development copes with a lack of nutrition is unknown. Do smaller flies sacrifice acuity, sensitivity, or both and is this sacrifice developmentally adaptive to early experience? To address these questions, we conducted a series of experiments assessing the effect of nutritional deprivation on eye size, vision, and flight. The discrete spatial sampling of the compound eye has a sampling limit. Stimuli with spatial frequencies above that limit result in an illusion known as aliasing, whereby the direction of motion is seen opposing the true motion. Using an immersive visual arena and psychophysical paradigm, we show that smaller eyes are less acute, corresponding to aliasing at lower spatial frequencies. Smaller eyes sacrifice acuity, likely to maintain a minimum contrast sensitivity needed for processing the dim image caused by the fruit fly's naturally low daylight, high flight speed, and small optic aperture.

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DEFICIENT FRONTO-STRIATAL ACTIVATION AS AN EARLY BIO-MARKER FOR BULIMIA NERVOSA. M. Cyr[1,*] X. Yang[1], G. Horga[2], and R. Marsh[1]. [1]The Division of Child and Adolescent Psychiatry in the Department of Psychiatry, the New York State Psychiatric Institute and the College of Physicians & Surgeons, Columbia University, New York, NY. [2]The Division of Translational Imaging, the New York State Psychiatric Institute and the Department of Psychiatry, College of Physicians & Surgeons, Columbia University, New York, NY. cyrmar@nyspi.columbia.edu

Objective: This study assessed the functioning of fronto-striatal circuits in adolescents with bulimia nervosa (BN) and used machine learning to determine whether deficient functioning of these circuits could accurately classify adolescents with and without the disorder. Method: Functional magnetic resonance imaging was used to assess conflict-related brain activations in two samples of female adolescents with and without bulimia nervosa during performance of a Simon task. The samples differed in age and in illness severity in the BN groups. Univariate (i.e., conjunction analyses) and multivariate (i.e., multi-voxel

pattern analyses) approaches were used to compare group differences in fronto-striatal activations across younger and older samples of adolescents, and determine whether accurate diagnostic classification could be achieved in the younger sample based on group-specific patterns in the older sample. Results: Across samples, adolescents with and without BN performed similarly on the task. Both univariate and multivariate approaches revealed group differences in fronto-striatal activations in response to conflict stimuli. Clinical status was accurately classified from these activation patterns; group-specific patterns detected in the older sample accurately classified adolescents as BN or healthy in the younger sample. Conclusions: Deficient activation of fronto-striatal circuits can be identified early in the course of BN, when binge-eating and purging behaviors are less severe. Our findings suggest that fronto-striatal disturbances may constitute a useful biomarker for the disorder, and a tool for understanding its developmental trajectory, as well as the development of novel treatments.

FETAL EXPOSURE TO MATERNAL CULTURAL STRESSORS IS ASSOCIATED WITH ADVERSE LOW BIRTHWEIGHT AND FETAL CORTISOL LEVELS IN OFFSPRING OF MEXICAN DESCENT. K. D'Anna-Hernandez. Psychology Department, California State University, San Marcos, California 92069. kdanna@csusm.edu

Prenatal stress is associated with hypothalamic-pituitary-adrenal (HPA) development in offspring. Mexican-American women experience cultural stressors related to acculturation, adaptation to a new culture, associated with poor perinatal outcomes. If cultural stressors contribute to adverse birth outcomes is not clear. Maternal cultural stressors were collected in 85 pregnant Mexican-American women. Neonatal hair was cut as a retrospective fetal cortisol along with gestational age and birthweight. Maternal discrimination was associated with increased fetal cortisol (r = .388, p = .067). Greater maternal acculturative stress (t = 2.619; p = .059) and cortisol (t = 2.019; p = .059) was associated with low birthweight. Exposure to prenatal cultural stressors may pose risk for fetal development.

LONGITUDINAL AND CONTEXTUAL STABILITY OF CORTISOL AND A-AMYLASE IN INFANTS FROM 6 TO 12 MONTHS AND THEIR MOTHERS. K. de Barbaro[1,2], A. Chiba[1], S. Khandrika[3], C. Zavala[1], and G.O. Deák[1]. [1]Cognitive Science, University of California, San Diego, CA, 92093. [2]School of Interactive Computing, Georgia Institute of Technology, Atlanta, GA, 30308. [3]Division of Biology, University of California, San Diego, CA, 92093. gdeak@ucsd.edu

Abundant research suggests that cortisol and α-amylase (sAA) – indirect biomarkers of HPA and peripheral sympathetic activity, respectively – interact in complex ways during stress. To better understand how these interactions develop and how these biomarkers predict psychosocial adaptivity across the lifespan, we tested the developmental and contextual stability and familial similarity of these biomarkers in infants and mothers. Saliva samples were collected from 48 infant-mother dyads during laboratory and home visits at 6, 7, and 12 months of age, and assayed for cortisol and sAA. Samples were collected from infants and mothers at the start of each visit, and from infants again 20 min later. Laboratory visits included several cognitive and psychosocial tests; home visits consisted of unscripted mother-infant play. We observed no differences between infant pre- and mid-session samples (p < .30 by paired t-tests), consistent with the absence of an acute stressor. Infants showed moderate/high stability in both biomarkers across sessions (Pearson's r ranges: cortisol: .50–.69; sAA: .79–.81). Within-age correlations between contexts was moderate for cortisol (.38–.50) but high for sAA (.68–.91). The biomarkers were non-significantly correlated, confirming previous findings. Mothers also showed moderate, significant stability in both biomarkers across sessions (correlations for cortisol: .35–.50; sAA: .45–.59). Mother- infant concurrent biomarkers were correlated within-contexts (cortisol: .41–.78; sAA: .37–.65), but were non-significant between contexts (e.g., mother laboratory and infant home samples). Our results confirm individual and familial stability of peripheral HPA and sympathetic biomarkers that are dynamically coordinated and context-sensitive.

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EFFECTS OF EARLY POSTNATAL UNDERNUTRITION ON AFFECTIVE BEHAVIOR, CONDITIONED FEAR ACQUISITION AND EXTINCTION, AND HIPPOCAMPAL NEUROGENESIS IN MALE AND FEMALE SPRAGUE DAWLEY RATS. R.M. De Guzman*, L.M. Colon, A.M. Poulos, and J.L. Workman. Department of Psychology and Center for Neuroscience Research, University at Albany – State University of New York, Albany, NY 12222. rdeguzman@albany.edu

Early-life undernourishment during critical periods of development has enduring neural and behavioral consequences. Early-life malnutrition in humans increases the risk for depression and suicidal thoughts during adolescence and adulthood. Neurological investigations using rodents, however, have primarily studied males. Further, many rodent models restrict food availability to dams, which alters maternal care. This study tested whether early postnatal undernutrition alters affective behaviors in the forced swim and open field tests and hippocampal neurogenesis in male and female Sprague Dawley rats during adolescence and adulthood. Rats underwent either thelectomy (surgical removal of teats to inhibit milk let-down), sham, or no surgery (control) before mating. Rats were mated and upon birth, all dams had ad lib access to food and water. Litters were rotated between sham and thelectomized rats every 12 hr to restrict feeding, whereas control litters were not restricted. Total pup-directed behaviors did not differ significantly between control, sham, or thelectomized rats, but sham rats retrieved more than thelectomized and control rats. Undernutrition reduced offspring body mass, reduced anxiety-like behaviors in the open field in adolescents only, and increased immobility in the forced swim test in adults only. In adolescents, early postnatal undernutrition increased doublecortin (DCX)-expressing cells in the dorsal hippocampus in males only, whereas undernutrition did not significantly alter DCX-expressing cells in females. Data on fear conditioning and hippocampal neurogenesis in adults will also be presented. This research will enhance our understanding of developmental consequences and the risk for psychological illness in people who experienced early-life undernourishment.

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INVESTIGATING PHYSIOLOGICAL ALLOSTATIC LOAD EFFECTS ON PEER PROBLEMS IN KINDERGARTEN. C.E. DePasquale*, C.E. Pitula, S.B. Mliner, and M.R. Gunnar. Institute of Child Development, University of Minnesota, Minneapolis, MN 55455. depas010@umn.edu

Orphanage rearing and severe social deprivation are associated with physiological dysregulation in many systems (Bruce et al., 2013; Danese & McEwen, 2012) which in turn impact development and behavioral adjustment (Gunnar & van Dulmen, 2007). However, less is known about how these systems coordinate or affect each other. Similarly, we do not know if the combined dysregulation of multiple systems leads to physiological allostatic load that in turn affects development, here specifically competent peer functioning. This study examines four measures of high allostatic load − hypocortisolism, low pre-ejection period (i.e., high sympathetic tone), extreme left frontal EEG asymmetry, and growth stunting, collected in orphanage-adopted children ($n = 75$) within 2 years post-international adoption as compared to that of Minnesota-born children ($n = 44$) and those adopted internationally from foster care ($n = 44$). The separate and combined effects of these four physiological systems on observer- and teacher-rated peer problems in Kindergarten classrooms were explored. Early institutional care was found to predict the allostatic load index reflecting all four physiological measures ($t(98) = -2.27$, $p < .05$), with particularly strong associations with hypocortisolism and growth stunting, ($t(115) = -12.53$, $p < .001$; $t(110) = 5.39$, $p < .001$ respectively). The allostatic load index did not mediate the association of orphanage-rearing on poor peer functioning. Only hypocortisolism predicted teacher-reported peer problems ($t(110) = 2.72$, $p < .01$), but did not serve as a significant mediator of orphanage rearing effects on peer problems. While poor peer functioning is often observed for orphanage-adopted children, these results do not support a key role for physiological allostatic load mediating this outcome.

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CHANGES IN MILK CORTISOL ACROSS THE NEONATAL PERIOD PREDICT LATER CHRONIC HYPOTHALAMIC-PITUITARY-ADRENAL (HPA) AXIS ACTIVITY IN INFANT RHESUS MONKEYS. A.M. Dettmer[1,*], A.M. Murphy[1], D. Guitarra[1], K. Rosenberg[2], S.J. Suomi[1], M.A. Novak[2], J.S. Meyer[2], and K. Hinde[3]. [1]Eunice Kennedy Shriver National Institute of Child Health & Human Development, National Institutes of Health, Poolesville, MD, USA, 20837. [2]Department of Psychological & Brain Sciences, University of Massachusetts Amherst, Amherst, MA, USA, 01003. [3]School of Human Evolution & Social Change, Center for Evolution and Medicine, Arizona State University, Tempe, AZ, USA, 85287. adettmer@gmail.com

Glucocorticoids (GCs) in milk are known to influence offspring physiology, stress responsivity, behavior, and cognition. However, the influence of naturally occurring variations in milk GCs on chronic HPA axis activity is unknown. We tested the hypothesis that changes in milk cortisol across the first month of life would predict later long-term HPA axis activity in infant rhesus monkeys (Macaca mulatta). Milk was collected from rhesus monkey mothers ($N = 22$) on postnatal days 14 and 30 and analyzed for cortisol content via radioimmunoassay. Hair samples were collected from their infants on postnatal days 14 (baseline) and 165 (5.5 months, reflecting cortisol accumulation since the day 14 sample) and analyzed for cortisol content via enzymeimmunoassay. Hair cortisol concentrations (HCCs) at 5.5 months were regressed onto changes in milk cortisol content from days 14 to 30. Greater increases in milk cortisol across the first month of life predicted lower infant HCCs at 5.5 months ($R^2 = .20$, $p = .037$). Greater increases in milk GC concentrations, within a natural physiological range, may program long-term HPA axis activity as measured by HCCs. Elevated milk cortisol in the first month of life in monkeys may program stress inoculation, consistent with earlier rodent studies in which pups nursing from corticosterone-treated mothers have lower hormonal responses to novel challenges. These findings add to the literature in rodents and nonhuman primates indicating that consumption of elevated maternal-origin GCs via milk during early development contribute to the organization of infant HPA-regulation.

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EFFECTS OF TREADMILL SPEED ON TAIL-PINCH-INDUCED STEPPING BEHAVIOR IN THE NEONATAL RAT. N. Devine*, R.B. Kempe, and M.R. Brumley. Department of Psychology, Idaho State University, Pocatello, ID, 83209. devinanc@isu.edu

Introduction: Treadmill training is used as a therapeutic intervention to assist people with impaired locomotor abilities. Here we investigated the influence of treadmill speed on the stepping behavior induced by mechanical stimulation (tail-pinch) in neonatal rats. Method: One-day-old rat pups in 4 groups differentiated by treadmill speed were suspended over a miniature treadmill. Following a baseline period, a tail-pinch was administered and stepping behavior was recorded for 5 min. Results: Following tail pinch, all pups showed a robust alternating stepping response that decreased within 2 min. Significantly more forelimb steps occurred at the medium treadmill speed, whereas no differences in the number of hindlimb steps were found between groups. Discussion: A tail-pinch stimulus induced a stepping response in neonatal rat pups. The medium treadmill speed elicited a greater number of forelimb steps than the other treadmill speeds. It is not clear why treadmill speed influenced stepping of the forelimbs more than the hindlimbs following mechanical stimulation of the tail. This study suggests that the developing central nervous system adapts to sensory experiences that influence locomotor behavior, even before the onset of independent walking.

[NIGMS #P20GM103408].

EPIGENETIC ALTERATIONS AND THEIR PHENOTYPIC CORRELATES IN AN ANIMAL MODEL OF CAREGIVER MALTREATMENT. T.S. Doherty*, S.M. Keller, J. Blaze, and T.L. Roth. Psychological and Brain Sciences, University of Delaware, Newark, DE 19716. tdoherty@psych.udel.edu

Early adverse experiences are often associated with aberrant behavioral phenotypes. This is especially true when a caregiving relationship is the source of adversity. Though decades of research have been dedicated to understanding this connection, the molecular underpinnings have yet to be elucidated. Recently, epigenetic mechanisms such as DNA methylation have come to light as promising mechanistic candidates for disrupted behavioral outcomes following exposure to early adversity. DNA methylation involves the addition of methyl groups to cytosines, resulting in altered patterns of gene expression. Previous work from our laboratory has uncovered gene-specific alterations in methylation levels in distinct brain regions in response to early-life stress (brief and repeated exposures to caregiver maltreatment). Similar to the behavioral phenotypes studied here, these alterations varied between sexes and time points (age) examined. The goal of the current study was to investigate behavior

of adolescent and adult rats subjected to caregiver maltreatment. Infant male and female Long Evans rats were subjected to either nurturing care (from their biological mother or foster dam) or maltreatment from a foster dam for 30 min daily from postnatal day (PN) 1 to PN7. We then assessed performance on several behavioral tasks at PN30 and PN90, including novel object recognition, novelty-suppressed feeding, sucrose preference, and fear conditioning. Several behavioral deficits were observed. As the behavioral deficits parallel methylation alterations, future work will investigate the possibility of a causal relationship between these variables.

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THE ROLE OF PUBERTY ON SYNAPTIC PRUNING WITHIN THE MEDIAL PREFRONTAL CORTEX OF MALE AND FEMALE RATS. C.M. Drzewuecki[1,*], J. Willing[2], and J.M. Juraska[1,2]. [1]Program in Neuroscience, University of Illinois at Urbana-Champaign. [2]Psychology Department, University of Illinois at Urbana-Champaign, Champaign, IL, USA. drzewie2@illinois.edu

Adolescence is a period of development marked by improvement in executive functioning as well as maturation of the prefrontal cortex (PFC), including decreases in overall volume and thickness within the human PFC during this time. In adolescent rodents, losses of neurons, dendrites, dendritic spines and neurotransmitter receptors have been documented within the medial prefrontal cortex (mPFC), sometimes with sex-specific patterns. However, changes in the overall number of synapses during this time have not yet been examined. In the present study, we stereologically quantified the number of synaptophysin-immunoreactive boutons in the male and female rat mPFC across multiple time points from the juvenile period into adulthood (postnatal days (P) 25, 35, 45, 60 and 90). We found that female rats reached peak numbers of synaptophysin boutons at P35, coinciding with the average onset of puberty. Among males, there was no significant main effect of age on synaptophysin boutons, though pubertal onset was associated with significant synaptic losses at P45. These results suggest that puberty may be a critical period for synaptic pruning within the rat mPFC, potentially contributing to typical maturation of adolescent executive function.

MATCHING GENDER INFORMATION IN FACE AND VOICE IN 3 MONTH-OLD INFANTS. K. Durand, C. Marion, R. Brochard, B. Schaal, and J.-Y. Baudouin. Developmental Ethology and Cognitive Psychology Group, Center for Smell, Taste, and Food Science, Dijon, France-CNRS UMR 6265. karine.durand@u-bourgogne.fr

Infants are daily exposed to gender, a perceptual category specified through different senses (e.g., face and voice attributes are used to assign gender to a person). During the first few months, Infants are known to discriminate gender in voices and faces and to prefer female faces/voices. But their capacity to match multisensory gender attributes appears to emerge later (6 to 9 months). Here, we investigated whether 3-month-olds can match auditory and visual attributes of gender. The experiment consisted of 2 × 3 10-s trials where 24 infants saw paired static faces, one male one female while exposed to 3 auditory conditions: male or female voice sound-track (natural speech, MV-FV) or a non-human control sound (CS). Because infants prefer looking at female faces, we calculated the mean proportion of looking time to the female face in the 3 auditory conditions. A significant main effect of voice was reached ($F(2,46) = 4.38$, $p = .0181$): Infants looked longer at the male face when they heard the MV (relative to FV and CS ($ps < .02$). Mean difference scores further indicated that infants did not prefer looking at the female face in the FV condition relative to CS ($T(23) = .09$) whereas they looked more at the male face in the MV condition ($T(23) = -2.39$, $p = .0252$). In sum, infants appear to match the audible-visible attributes of gender for males only. It could be that the CS acted in the same way than the FV, i.e., when hearing a new sound, infants directed their attention more toward a female face. These findings raise new questions about the development of gender's multisensory perception.

THE RELATIONSHIP BETWEEN INFANT SLEEP, PARENTAL SLEEP, BEHAVIOR, AND DAILY EMOTIONS. C. Ellberg, L. Hibel. Department of Human Ecology, University of California, Davis, CA, 95616. ccellberg@ucdavis.edu

Infants wake frequently in the night, often requiring parental intervention. While studies have examined the relationships between infant and parental sleep, and the implications of problematic infant sleep on parental stress and depression, few have examined the relationship between parental functioning, daily emotions, and sleep patterns. The objective of this study is to examine the relationship between parental and infant sleep, their relationship to daily parent functioning and behavior, and parental and infant daily emotions. Approximately 30 families with infants between the ages of 5 and 19 months old will participate in the study for a total of 8 days and 8 nights. Using a variety of tools including actigraphy, sleep logs, and ecological momentary assessments we hope to explore these questions. Preliminary analyses show that our infants are sleeping roughly 9 hr a night, while mothers are sleeping 8. We have seen that infants waking for longer periods during the night have mothers who are waking longer in the night, and infants sleep longer when their mothers spend more time awake at night. Future analyses will examine how daily emotions and behavior relate to these sleep patterns. We hope to identify the daily behaviors and emotions that contribute to the most efficient sleep patterns.

EARLY LIFE STRESS DOES NOT RESULT IN IMPAIRED GENERALIZED EXTINCTION IN ADULT RATS. N.D.S. Elliott*, and R. Richardson. School of Psychology, University of New South Wales, Sydney, Australia. nathalie.elliott@unsw.edu.au

Anxiety disorders have a severe and long-lasting impact on an individual's quality of life and overall functioning. A growing body of research suggests that alterations in fear generalization processes play a role in the pathogenesis of anxiety disorders. However, no research to date has examined how the generalization of extinction learning influences the development of psychopathology. In this study, we examined generalized extinction after early life stress, which has been shown to be associated with anxiety. Rats were exposed to maternal separation on postnatal days 2–14 (MS; a rodent model of early life stress) or reared as normal. In adulthood, rats received fear conditioning to two distinct tone conditioned stimuli (CS1 and CS2). The following day, rats received extinction training to one CS (CS1). It was predicted that MS rats would exhibit less generalized extinction.

First, MS and SR rats that received extinction training showed lower levels of fear to both CSs compared with non-extinguished controls. However, contrary to predictions, both MS and SR rats tested the next day showed generalized extinction, such that they demonstrated low levels of fear to both the extinguished CS (i.e., CS1) and the non-extinguished CS (i.e., CS2). That is, animals prone to the development of anxiety were not impaired at generalized extinction. These findings contribute to our understanding of the role of generalization in anxiety disorders, and suggest that altered generalization of fear inhibition may not influence the development of psychopathology.

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INFANT ATTENTION & CORRESPONDING EEG: POTENTIAL INDICATORS OF CHILDHOOD AD/HD. C.M. Eng[1,*], L.A. Patton[1], S.D. Calkins[2], and M.A. Bell[1]. [1]Psychology, Virginia Tech, Blacksburg, VA 24061 [2]Human Development and Family Studies, The University of North Carolina Greensboro, Greensboro, NC 27402. cassondraeng@gmail.com

Infant attention and the corresponding brain-behavior associations are understudied in the development of AD/HD. Retrospectively, we compared the looking behavior and frontal EEG during an attention task at 5 months of age of 19 infants diagnosed during childhood for AD/HD to those of 19 matched control infants. Participants of this study are part of a longitudinal study examining individual differences in the development of executive function across early development. The electrophysiological and behavioral data acquired at the research lab visit at 5 months were the focus of the current study. Maternal report of an AD/HD diagnosis at subsequent laboratory visits (ages 6 or 9 years) was used to classify children into AD/HD and non-AD/HD categories. During the lab visit, EEG was recorded while infants were presented with a Sesame Street video clip. Trained assistants coded shifts in gaze during the attention task and peak look duration was calculated. There were group differences in attention behavior at 5 months, with the AD/HD group exhibiting longer looking times compared to the normative control group of infants ($F = 6.32$, $p = .01$; AD/HD: $m = 16.25$ s; No AD/HD: = 9.28 s). The AD/HD group exhibited lower EEG power values (all p's < .03) and elevated EEG coherence ($p < .005$) compared to the control group at frontal locations during the attention task. The findings of reduced EEG power and elevated EEG coherence at 5 months of age support previous findings found in childhood AD/HD emphasizing deficient activity and atypical connectivity in the frontal region of the brain.

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SEROTONIN MODULATES MITOCHONDRIAL BIOGENESIS AND FUNCTION IN CORTICAL NEURONS. S.E. Fanibunda[1,*], A. Sood,[1] A.D.B. Vaidya[2], U. Seetharam-Kolthur[1], and V.A. Vaidya[1]. [1]Department of Biological Sciences, Tata Institute of Fundamental Research, Mumbai, India. [2]Medical Research Centre, Kasturba Health Society, Mumbai India. sashainafanibunda@gmail.com

Serotonin modulates neuronal differentiation, growth and synaptic plasticity of neurons. Within neurons, mitochondria also play an important role in influencing specific neuronal functions such as synaptic plasticity, neurotransmission, and cell survival. To fulfil these unique and specialized neuronal functions, mitochondria in neurons, encounter a greater energy challenge than in other cells. The relationship between serotonin and mitochondrial physiology in neurons is currently poorly understood. We hypothesized that serotonin may impinge on mitochondrial biogenesis and function. In cortical cultures, serotonin evokes a dose dependent increase in mitochondrial biogenesis, assessed by an increase in mRNA and protein expression of specific mitochondrial markers, as well as mtDNA levels. Further, serotonin also increases cellular ATP content; this increase in mitochondrial output may arise through an increase in biogenesis or an increase in OxPhos efficiency, experiments are ongoing to delineate these mechanisms. We have found that DOI the 5HT2A receptor agonist mimics the effects of serotonin, also increasing mtDNA and ATP production, while the 5HT2A receptor antagonist MDL100,907 inhibits these effects. Further, downstream of the 5HT2A receptor, the phospholipase C and MAP kinase pathways; but not the Akt-PI3-kinase signalling pathways were found to mediate the effects of serotonin on mitochondrial biogenesis. The SIRT1 inhibitor EX-527 ablates the effects of serotonin on mitochondrial biogenesis and function, placing SIRT1 as a critical mediator of serotonin's effects on mitochondrial physiology. The impact of serotonin on mitochondria may bear relevance in the context of neuronal energy deficits, as well as contribute to serotonin's effects on neuronal growth and plasticity.

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FAMILY NURTURE INTERVENTION MITIGATES ASSOCIATION BETWEEN PLACENTAL ABNORMALITIES AND EARLY BRAIN ACTIVITY OF PRETERM INFANTS. M.R. Firestein[1,*], P.G. Grieve[2], M.M. Myers[3], and M.G. Welch[2,3,4]. [1]Psychology, Columbia University, New York, NY, 10027; [2]Pediatrics, Columbia University College of Physicians and Surgeons, New York, NY, 10032; [3]Psychiatry Developmental Neuroscience, New York State Psychiatric Institute, New York, NY, 10032; [4]Pathology & Cell Biology, Columbia University College of Physicians & Surgeons, New York, NY, 10032. Mrf2138@columbia.edu

Normal placental function is critical for the development of the fetus. Trophoblast inclusions (TIs), placental abnormalities resulting from atypical infoldings of the trophoblast bilayer, may be a marker for abnormal neurodevelopment as there is a significantly greater occurrence of TIs in placentas of children at risk for autism (Walker et al., 2013). Preterm infants are at risk for a wide range of adverse developmental outcomes. A randomized controlled trial at Columbia University Medical Center enrolled 150 preterm infants to receive either standard NICU care (SC) or Family Nurture Intervention (FNI). FNI aims to improve co-regulation between mother and infant with the overarching goal of improving infant development. Infant EEG studies were conducted at 34–36 weeks (early) and 37–44 weeks (term). Previously, we reported increased EEG power at term in frontal polar regions and decreased EEG coherence within and between the frontal polar regions in FNI infants compared to SC. Changes in EEG power (slopes) from the early to term studies were significantly greater in FNI infants compared to SC. Compared to SC infants without TIs, SC infants with TIs had significantly lower increases in EEG power (theta) from early to term. However, FNI infants had higher positive slopes

regardless of TIs. The interaction between group and TIs on EEG slope was found within the left and right frontal polar and parietal regions and the left temporal region. These results suggest placental TIs are associated with abnormal development of brain activity of preterm infants and that FNI attenuates this adverse effect.

EFFECT OF PARENTAL DRINKING BEHAVIOR ON PRE-ADOLESCENTS' AFFECT AND ATTENTIONAL BIAS TO ALCOHOL-RELATED CUES. C.A. Forestell, L.A. Collier, and C.L. Dickter. Psychology Department, The College of William & Mary, Williamsburg, VA 23185. caforestell@wm.edu

Previous research has indicated that children's affective responses to the odor of alcohol differ as a function of parental drinking behavior. The goal of the present experiment was to expand upon this work to determine whether pre-adolescents' implicit cognitive responses to visual cues of alcohol are affected by parental drinking. Thus, in the current study we recruited 149 children between the ages of 8 and 12 years and measured their implicit affective and attentional responses to pictures of alcohol-related cues using the Affective Misattribution Procedure (AMP) and the dot probe task, respectively. Mothers completed questionnaires to describe the emotional context in which they drink and whether they use alcohol to "escape" by changing their state of mind and reducing feelings of dysphoria. Although children's affective responses did not differ as a function of parental drinking behavior, those who had an escape drinking parent demonstrated an implicit attentional bias toward alcohol-related cues. Those whose parents were not escape drinkers did not demonstrate an attentional bias. These findings suggest that the emotional context in which the parent consumes alcohol can affect children's attention towards alcohol.

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THE NEUROCIRCUITRY OF FEAR EXTINCTION IN THE DEVELOPING RAT. D.E. Ganella[1,2,*], C.H.J. Park[1,2], D. Nguyen[1,2], L. Lee-Kardashyan[1], A.G. Paolini[1,3], and J.H. Kim[1,2]. [1]Florey Department of Neuroscience, Florey Institute of Neuroscience and Mental Health, Melbourne, Victoria 3052. [2]The University of Melbourne, Parkville, Victoria 3052. 3. Health Sciences, RMIT University, Bundoora, Victoria 3083. despina.ganella@florey.edu.au

Extinction of conditioned fear differs across development. While adult rats exhibit 'renewal' of fear when tested in a context different to where they received extinction, juvenile rats do not. This is thought to be due to the immaturity of communication between the ventral hippocampus (vHPC), infralimbic cortex (IL), and the amygdala. We investigated this by temporarily disconnecting the IL-amygdala-vHPC circuitry during extinction to create a 'juvenile' neurocircuit in adult rats. Before extinction, saline or muscimol ($GABA_A$ agonist) were microinfused in the IL and vHPC in either an ipsilateral, contralateral or bilateral configuration. The next day, saline and ipsilateral-muscimol groups displayed renewal of extinguished fear. In contrast, rats receiving contralateral or bilateral infusions of muscimol prior to extinction failed to show renewal, suggesting that extinction 'erases' the fear memory when this circuitry is disrupted. To further delineate how amygdala projection neurons are involved in extinction at different developmental stages, we injected retrograde tracers (fluorogold and cholera toxin subunit B) into the IL and vHPC, of juvenile, preadolescent and adult rats. Rats underwent fear conditioning, extinction, and were then perfused. Using immunohistochemistry, we identified for the first time basolateral amygdala neurons that simultaneously project to both the IL and vHPC at all ages examined during extinction. Further analyses are underway to assess the age-related differences in amygdala neuron immunostaining.

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LIPOPOLYSACCHARIDE-INDUCED CHANGES IN ADOLESCENT PREFRONTAL CORTEX AMPA RECEPTORS AFTER EARLY LIFE STRESS. P. Ganguly* and H.C. Brenhouse. Department of Psychology, Northeastern University, Boston, MA 02115. h.brenhouse@neu.edu

Early life stress (ELS) exposure in rodents alters the development of prefrontal cortex (PFC) activity, which is largely regulated by ionotropic glutamate receptors such as AMPA. Recent studies have shown that the cytokine tumor necrosis factor-α (TNF-α) causes rapid trafficking of GluR2-lacking AMPARs to the surface membrane, which can enhance neuronal excitotoxicity. TNF-α levels are also increased after ELS, suggesting a possible neuroimmune mechanism that yields ELS populations more vulnerable to psychiatric disorders. We hypothesized that ELS yields PFC dysfunction via heightened neuroimmune activity and consequentially altered AMPA composition. We aimed to determine (a) whether ELS in the form of maternal separation would increase vulnerability to a subsequent adolescent immune challenge with lipopolysaccharide (LPS), hence increasing TNF-α mediated rapid exocytosis of GluR2-lacking AMPARs to the plasma membrane and (b) whether TNF-α antagonist Ibudilast administration could prevent ELS and/or LPS induced changes. Male and female rats were reared under control or ELS conditions. Animals were administered LPS and/or Ibudilast during adolescence. Open field test, PFC extraction for qPCR analysis of TNF-α and western blots on membrane fractions of GluR2 and GluR1 were performed. We observed that LPS decreases GluR2 levels in the PFC, while Ibudilast protects against GluR2 loss in male and female adolescents. ELS male rats, but not female rats, also showed lower GluR2 levels. LPS exacerbates this loss, while Ibudilast protects against GluR2 depletion. These findings suggest that ELS affects neuroimmune signaling in male adolescents, which leads to decreased PFC GluR2 that may reflect increased trafficking of GluR2-lacking AMPAR.

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THE IMPACT OF MEMORY LOAD AND PERCEPTUAL CUES ON PUZZLE LEARNING BY 2-YEAR-OLDS. P. Gerhardstein. Department of Psychology, Binghamton University, Binghamton NY 13902. gerhard@binghamton.edu

Early childhood is characterized by memory capacity limitations and rapid perceptual and motor development (Rovee-Collier, 1996). A demonstration of several such influences on development are presented and discussed, from tests using an imitation task with young children. Children were asked to complete a magnetic puzzle following a demonstration. Memory load (number of pieces) and added support from perceptual cues (internal feature cues and contextual cues) were manipulated, and both were found to impact goal-directed

imitation in 2-year-olds, but did not affect manipulation of the puzzle pieces. Additional studies manipulating the presentation and test media (video and touchscreen contexts) underscore the limits imposed by perception and memory.

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AGE-DEPENDENT EFFECTS OF CHRONIC ELECTROCONVULSIVE SEIZURE (ECS) TREATMENT. S. Ghosh*, M. Jaggar*, M. Maheshwari, and V.A. Vaidya. Department of Biological Sciences, Tata Institute of Fundamental Research, Mumbai, Maharashtra – 400005, India. vvaidya@tifr.res.in

Electroconvulsive seizure therapy (ECS) is a fast-acting antidepressant treatment that has been shown to have much higher efficacy than traditional pharmacotherapy in patients with geriatric depression. However, the molecular and cellular mechanisms that underlie the behavioral consequences of ECS remain poorly elucidated. While studies in preclinical rodent models have identified enhanced neurogenesis, increased trophic factor levels, altered gene transcription, and altered synaptic plasticity as potential downstream consequences of ECS, a major limitation of the field is that all such studies have been performed at a single developmental time-point – young adulthood. We decided to investigate whether the behavioral, cellular and molecular consequences of ECS are different based on age of exposure. We administered ECS to young (3 month) and middle-aged (12 month) rats, and examined effects on depressive-like behavior, neurogenesis, plasticity-associated markers and gene transcription in the hippocampus. At both ages studied, ECS evoked strong antidepressant-like responses on the forced swim test, and significantly increased cell proliferation in the hippocampus. Interestingly, ECS induced a severe decline in perineuronal net number in the hippocampus at both ages, a phenotype reminiscent of early developmental time-points. ECS-evoked changes in transcription of extracellular matrix components, inflammation-associated markers, and autophagy-associated genes were strikingly different across the ages, while immediate early genes and trophic factors showed a broadly similar pattern of regulation. Our results demonstrate both overlapping and distinct consequences of ECS at different stages of the lifespan, and raise the possibility that different mechanisms may underlie the behavioral effects of ECS at the time-points studied. *These authors contributed equally to the work.

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POSTPARTUM FLUOXETINE EXPOSURE AND EXERCISE INTENSITY DIFFERENTIALLY AFFECT MATERNAL BEHAVIOR AND HIPPOCAMPAL NEUROGENESIS IN A RAT MODEL OF POSTPARTUM STRESS. A.R. Gobinath[1,*], R.J. Richardson[2], C. Chow[2], J.L. Workman[2], S.E. Lieblich[2], A.M. Barr[3], and L.A.M. Galea[1,2]. [1] Program in Neuroscience, University of British Columbia, Vancouver, Canada, V6T 1Z3. [2] Department of Psychology, University of British Columbia, Vancouver, Canada, V6T 1Z4. [3] Department of Anesthesiology, Pharmacology, and Therapeutics, University of British Columbia, Vancouver, Canada, V6T 1Z3. agobinath@psych.ubc.ca

Postpartum depression (PPD) affects approximately 15% of mothers. Pharmacological antidepressants such as fluoxetine (Prozac) are commonly used to treat PPD. However, maternal fluoxetine use is controversial due to concerns of neonatal antidepressant exposure. For this reason, non-pharmacological therapies such as exercise may be an alternative intervention. Unfortunately, it is unclear whether exercise is efficacious for treating PPD. To investigate this, we treated rat dams daily with high levels of corticosterone (40 mg/kg), to induce a depressive-like phenotype, or oil during the postpartum period. Within the oil and corticosterone conditions, four additional antidepressant groups were created: 1. Fluoxetine (10 mg/kg) + exercise (voluntary running); 2. Fluoxetine + no exercise; 3. Saline (vehicle for fluoxetine) + exercise; 4. Saline + No exercise. Daily running activity was recorded and using a median split, dams were further categorized as "high-running" or "low-running." Preliminary results reveal that maternal fluoxetine reversed corticosterone-induced disruptions in maternal care, especially in low-running dams. Exercise also tended to decrease immobility (depressive-like behavior) in the forced swim test. The combination of exercise and fluoxetine attenuated stress-induced rises in serum corticosterone in comparison to fluoxetine alone. Finally, exercise bolstered doublecortin expression in ventral but not dorsal dentate gyrus in comparison to non-exercising dams. Of corticosterone-treated dams, the combination of high-running and fluoxetine increased doublecortin expression in ventral dentate gyrus in comparison to fluoxetine alone. Our findings will shed light on how the postpartum antidepressant treatments (Prozac, exercise) interact to differentially affect the well-being of the mother.

[CIHR IGO-103692 to LAMG].

EARLY LIFE STRESS INCREASES MICROGLIA ACTIVATION IN JUVENILE MALE RATS AND CONFERS SENSITIZATION IN MICROGLIA TO LPS INDUCED IMMUNE ACTIVATION. S.A. Goff, V. Thompson, P. Ganguly, H.C. Brenhouse. Department of Psychology, Northeastern University, Boston, MA 02115. goff.s@husky.neu.edu

Overwhelming evidence suggests that adversity during early life markedly increases vulnerability to numerous neuropsychiatric disorders including depression, anxiety, and schizophrenia. Importantly, stress during this time modifies circulating levels of stress hormones, which in turn has downstream effects on neuroimmune function. We hypothesize that, these changes likely negatively impact overall neural development via neuroimmune signaling – particularly within the prefrontal cortex (PFC) – leading to altered pathology associated with neuropsychiatric dysfunction. While the etiological mechanisms are not fully understood, resident microglia are thought to be a common source of increased neuroimmune activity through production of inflammatory molecules (e.g., cytokines, chemokines) in response to disruption in homeostasis. Microglia are capable of provoking long-term changes in brain structure and function, particularly within local microcircuitry. Importantly, they can become chronically sensitized, or 'primed', to over-activation following insult. Early life stress via maternal separation (MS) is thought to alter microglial reactivity to subsequent immune activation across development. To better understand the impact of MS on developing microglia, male rat pups were separated from their dams for 4 hr per day from P2-20. As an immune challenge following MS, rats were exposed to lipopolysaccharide (LPS) at distinct developmental time points (P9, P20, or P40), and the concentrations of ramified and amoeboid PFC microglia were quantified to gain insight to activity states. Our findings reveal that by P20, MS rats differential response to LPS immune activation. Taken

together, these findings provide compelling evidence for a role of early life adversity in altering microglia function in later life.

CONSISTENT PRESCHOOL HAND PREFERENCE PREDICTS LANGUAGE SKILLS AT 5 YEARS OF AGE. S.L. Gonzalez[1,*], E.L. Nelson[1], J. Latta[2], J.M. Campbell[3], E.C. Marcinowski[4], and G.F. Michel[2]. [1]Department of Psychology, Florida International University, Miami, FL 33199. [2]Department of Psychology, University of North Carolina at Greensboro, Greensboro, NC 27403. [3]Department of Psychology, Illinois State University, Normal IL 61790. [4]Department of Physical Therapy, Virginia Commonwealth University, Richmond, VA 23284. sgonz219@fiu.edu

Previous research found that consistent hand preference from 6–14 months predicted language ability at 24 months. Here, we focus on consistency in hand preference across 2, 3, and 5 years in relation to language development at 5 years. Currently, 25 children have completed the Preschool Language Scales, 5th edition (PLS-5; Zimmerman et al., 2011) through 5 years. Mean percentage of right-hand use (%R) with 95% confidence intervals (CI) across 2, 3, and 5 years was calculated. Children with %R ± CI that crossed 50% by more than 5% were classified as inconsistent in their hand preference. Overall, 25% of children exhibited an inconsistent hand preference, and 75% exhibited a consistent hand preference. The consistent group scored higher on the PLS-5 Expressive Communication (EC) subscale ($M = 115.15$, $SE = 5.36$), compared to the inconsistent group ($M = 88.80$, $SE = 3.53$, $p = .025$, $d = 1.48$). The consistent group also scored higher on the PLS-5 Auditory Comprehension (AC) subscale ($M = 106.80$, $SE = 3.19$), compared to the inconsistent group ($M = 96.20$, $SE = 1.8$, $p = .008$, $d = 1.01$). Moreover, %R at 2, 3, and 5 years were significantly correlated (all $ps < .001$). PLS-5 EC and AC scores at age 5 were also significantly correlated with previously collected EC and AC scores at age 3 (all $ps < .02$). These preliminary results support a continued relation between consistent hand preference and language development into the preschool years.

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INCREASED INTAKE OF SUCROSE-SACCHARIN SOLUTION IN ADOLESCENCE AFTER PRENATAL ETHANOL EXPOSURE IN LATE GESTATION. J.K. Gore-Langton and L.P. Spear. Developmental Exposure Alcohol Research Center (DEARC), Department of Psychology, Binghamton University, Binghamton, NY 13902-6000. jgorela1@binghamton.edu

Exposure to moderate doses of ethanol (1 or 2 g/kg) late in gestation increases ethanol consumption during infancy and adolescence. This heightened ethanol intake in rat pups has been shown to generalize to a sucrose + quinine solution, that mimics the sweet and bitter components of ethanol, suggesting that prenatal ethanol exposure may heighten later reinforcing efficacy of the component taste(s). Findings of prenatal exposure on later intake of sweet and bitter taste substances are mixed and little studied during adolescence- the time when ethanol consumption typically begins, often in the form of sweet and/or carbohydrate-loaded beverages. The present study used a prenatal exposure model previously shown to increase ethanol intake and sucrose responding in juvenile animals to determine intake of a sweet substance in adolescence. Sprague-Dawley rats intubated with 2 g/kg ethanol (EtOH) or water (H20) late in gestation (days 17–20) were examined for consumption of a sucrose-saccharin solution (SS) on P28 or 29. EtOH animals consumed significantly more SS in g/kg than H20 controls. The EtOH animals, however, also weighed significantly less, potentially contributing to these g/kg intake differences. Indeed, when intake was analyzed as raw grams group differences were largely minimized. Differences in g/kg intake were not a function of alterations in fluid balance given that the two groups did not differ in home cage water intake. This increase in SS consumption complicates interpretation of studies using a sweetened ethanol solution to examine prenatal exposure effects on later intake.

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LOW CORTISOL MODERATES THE EFFECT OF TESTOSTERONE ON REACTIVE AGGRESSION AMONG YOUNG WOMEN WITH CALLOUS-UNEMOTIONAL TRAITS. N. Goulter, E.R. Kimonis, T.F. Denson, and D.P. Begg. School of Psychology, The University of New South Wales, Sydney, Australia. n.goulter@unsw.edu.au

The dual-hormone hypothesis posits that an imbalance of cortisol and testosterone levels increases risk for aggressive behaviour. For example, among male adolescents testosterone was positively associated with aggression when cortisol concentrations were low. By contrast, testosterone was positively associated with reactive aggression to social provocation when cortisol was also high among female undergraduates (reverse hypothesis). Psychopathy, and its putative developmental precursor callous-unemotional (CU) traits, are robustly linked with aggression and associated with distinct neuroendocrine patterns. To illustrate, among individuals with high testosterone concentrations, psychopathy scores were highest when the ratio of stress-reactive testosterone-to-cortisol was also high. Few studies have focused on female psychopathy and we are not aware of any study that has tested whether cortisol and testosterone interact to predict aggression among young women with CU traits during social provocation. Female undergraduates oversampled for high CU traits were personally insulted and subsequently participated in a task with the provocateur in which they could vary the intensity and duration of white noise blasts, with higher selections indicating greater reactive aggression. Salivary cortisol and testosterone were collected at baseline and 10 min post task. Results of hierarchical regression analyses supported the dual-hormone hypothesis, such that the effect of testosterone on reactive aggression was moderated by low cortisol concentrations. Findings extend current understanding of female CU traits, and suggest that biomarkers may distinguish young women on a developmental pathway to psychopathy.

DISTINCT BIOMARKERS FOR CONCURRENT AND PROSPECTIVE ENGAGEMENT IN NON-SUICIDAL SELF-INJURY IN ADOLESCENT GIRLS. G. Han[1,*], M. Giletta[2], M.K. Nock[3], K.D. Rudolph[4], M. Prinstein[5], and P.D. Hastings[1]. [1]Center for Mind and Brain, University of California-Davis, Davis, CA 95616. [2]Developmental Psychology, Tilburg University, Tilburg, Netherlands. [3]Department of Psychology, Harvard University, Cambridge, MA 02138. [4]Department of Psychology, University of Illinois at Urbana-Champaign, Champaign, IL 61820. [5]Department of Psychology, University of North Carolina at Chapel Hill, Chapel Hill, NC 27514. hghan@ucdavis.edu

Non-suicidal self-injury (NSSI) is a serious transdiagnostic problem behavior primarily utilized as an acute self-regulatory strategy. The action is experienced as releasing stress, suggesting that physiological mechanisms of stress regulation may underlie NSSI. We used an adapted Trier Social Stress Test to evaluate adrenocortical (cortisol) and parasympathetic (respiratory sinus arrhythmia; RSA) responses to acute social evaluative stress in female adolescents ($N = 177$; $M = 14.59$ years, $SD = 1.39$) with ($n = 80$) and without ($n = 97$) histories of self-injury. NSSI was assessed with the Self-Injurious Thoughts and Behaviors Interview during the initial visit and in 6 follow-up assessments separated by 3-months gaps from 3-months to 18-months. Modeling repeated measures of physiology in a multilevel model framework, we found an attenuated cortisol response curve to acute psychosocial stress in female adolescents who had engaged in NSSI. However, we did not find group differences in RSA associated with NSSI at the first assessment. Longitudinal analyses conducted with generalized estimating equation framework revealed that girls with higher baseline RSA, an index of efficient emotion regulation, were less likely to engage in NSSI prospectively, after accounting for prior history of NSSI and depressive symptoms at baseline. Thus, we characterized distinct biomarkers for concurrent and prospective engagement in NSSI during adolescence. Broader implications for understanding emotion (dys)regulation as a multisystem construct will be discussed.

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THE EXPERIENCE OF CHILDHOOD TRAUMA AND RECENT STRESS INTERACT TO INFLUENCE FUNCTIONAL CONNECTIVITY OF THE VENTRAL STRIATUM AND MEDIAL PREFRONTAL CORTEX ASSOCIATED WITH DEPRESSION. J.L. Hanson[1,2,*], A.R. Knodt[1], S.R. Radtke[1], B.D. Brigidi[1], and A.R. Hariri[1]. [1]Duke University, Department of Psychology & Neuroscience, Durham, NC 27708. [2]University of North Carolina at Chapel Hill, Center for Developmental Science, Chapel Hill, NC 27599. jamielarshanson@gmail.com

The experience of childhood maltreatment is a significant risk factor for the development of depression. This risk is particularly heightened after exposure to additional, more contemporaneous stress. While behavioral evidence exists for such "stress sensitization," little is known about biological correlates of this putative process. Identifying such correlates may not only substantiate the "stress sensitization" model, but also provide biomarkers of risk for later depression. Suggestive clues have emerged from targeted neurobiological investigations that experiences of early life stress, such as childhood maltreatment, may influence the structure and function of a corticostriatal circuit supporting motivation and action. Moreover, dysfunction of this circuit has been implicated in the pathophysiology of depression. The limited available research, though informative, has not investigated whether differences in reward-related corticostriatal circuit function may be associated with "stress sensitization," or if any circuit-level effects explain subsequent risk for depression. To begin to fill in these important gaps, we turned to the Duke Neurogenetics Study (DNS), an ongoing project assessing a wide range of behavioral and biological traits in a large cohort of non-patient, 18–22 year-old university students. Investigating reward-related functional connectivity within the corticostriatal circuit of 926 participants, we found evidence for increased connectivity between the ventral striatum and the medial prefrontal cortex (Interaction $\beta = .199$, $p < .005$) in individuals exposed to greater levels of childhood maltreatment who also experienced greater levels of recent life stress. We also found that this aberrant pattern of connectivity was associated with elevated symptoms of depression, specifically reduced positive affect ($\beta = .089$, $p < .005$). These findings suggest a novel neurobiological mechanism linking cumulative stress exposure with later depressive symptoms and provide support to the "stress sensitization" model of depression.

INTERRELATION OF SOCIAL-EMOTIONAL AND METABOLIC PHENOTYPES IN MICE ACROSS DEVELOPMENT. C. Harshaw, J. Leffel, and J. R. Alberts. Department of Psychological & Brain Sciences, Indiana University, Bloomington, IN, 47405. charshaw@indiana.edu

Increasing evidence suggests a connection between metabolic and social-emotional phenotypes, particularly in mice and other small mammals. For example, Robyn Hudson, Heiko Rödel and colleagues have demonstrated that thermal and metabolic phenotypes displayed by rabbits and rats during early development correlate with a number of 'personality' (i.e., social-emotional) phenotypes in adulthood. Here, we explore this question in litters of C57BL/6 mice assayed for variation in both metabolic homeostasis and social-emotional behavior across development, including tests of maternal separation (P7/P9), huddling (P8/P10), social interaction (SI; ∼P30), sociability and social memory (SSM; ∼P49), and open field (OF; ∼P57). Significant relationships were found between measures of thermal and metabolic homeostasis during early development and a number of adult phenotypes. For example, rectal temperature relative to littermates (T_{rect}^{rel}) immediately after huddling in response to cold on P8 and P10 significantly predicted activity levels in several tests in adulthood, including habituation trials for SI and OF. T_{rect}^{rel} taken immediately after 5 min maternal separation on P7 and P9, on the other hand, predicted proportion of time spent in the center of the OF as well as latency to approach an unfamiliar mouse during the sociability phase as well as proximity to the familiar mouse during the social memory phase of the SSM test. Our results indicate that individual variation in metabolic and thermal homeostasis likely plays a significant role in the social and emotional phenotypes displayed by adult C57BL/6 mice.

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PRENATAL PROGRAMMING OF POSTNATAL PLASTICITY: AN ANIMAL MODEL. S. Hartman[1,*], K.L. Bales[2], and J.Belsky[1]. [1]Department of Human Development and Family Studies, University of California, Davis, Davis, CA 95616. [2]Department of Psychology, University of California, Davis, Davis, CA 95616. slhartman@ucdavis.edu

Recent theoretical reasoning and empirical evidence suggests that prenatal stress may increase sensitivity to the environment, thereby making infants especially susceptible to both positive and negative developmental experiences (Pluess & Belsky, 2011). Because prenatal stress is associated with various confounding factors and can not be manipulated in humans, we turned to an animal model to test our predictions. Thus, we investigated this prenatal-programming hypothesis by experimentally manipulating prenatal stress and quality of the early rearing environment in prairie

voles, a socially monogamous and bi-parental species. During the last week of gestation, pregnant voles were randomly assigned to either a prenatal stress condition (daily exposure to a lactating, hence aggressive, female) or control condition (left undisturbed). Shortly after birth, infant pups were cross-fostered to either high-quality or low-quality rearing parents. After reaching adulthood, voles were assessed for anxiety behavior using a forced swim test and subsequent corticosterone (CORT) reactivity. Results showed that prenatally-stressed voles displayed the highest anxiety behavior and CORT levels when cross-fostered to low-quality parents but the lowest anxiety behavior and CORT levels when cross-fostered to high-quality parents. For voles not prenatally stressed, parental quality did not predict anxiety behavior or CORT levels. These findings suggest that prenatal stress is not a uniformly negative experience but may instead induce heightened developmental plasticity.

PHYSIOLOGICAL ATTUNEMENT IN MOTHER-INFANT DYADS AT CLINICAL HIGH RISK: THE INFLUENCE OF MATERNAL DEPRESSION AND POSITIVE PARENTING. C.L. Hendrix[1,*], Z.N. Stowe[2], D.J. Newport[3], and P.A. Brennan[1]. [1]Emory University, Department of Psychology, Atlanta, GA 30322. [2]University of Arkansas for Medical Sciences, Little Rock, AR 72205. [3]University of Miami Health System, Miami, FL 33136. clhendr@emory.edu

The intra-dyadic co-regulation (i.e., attunement) of hypothalamic-pituitary-adrenal (HPA) axis functioning in mothers and their children may contribute to the development of this biological stress response system across early childhood. The present study used Hierarchical Linear Modeling to examine HPA axis attunement between mothers and their infants in a cohort of 233 mothers who received treatment for psychiatric illness during pregnancy (87.3% with lifetime diagnoses of Major Depressive Disorder). Cortisol was measured from 4 saliva samples provided by mothers and their infants during a lab visit that included mother-infant interaction and infant stressor tasks at 6 months postpartum. Maternal depression was measured using the Beck Depression Inventory and Structured Clinical Interview for DSM-IV. Maternal positive affect was coded from a videotaped 3-min mother-infant interaction. Maternal and infant cortisol were positively correlated across the 4 time points, suggesting attunement (b = .25, SE = .06, t-ratio = 3.93, p < .001). Dyads in which the mother showed more positive affect had stronger cortisol attunement (b = .006, SE =0.003, t-ratio = 2.10, p = .03). Maternal depression was not associated with cortisol attunement (b = .01, SE = 0.01, t-ratio = 0.64, p = 0.53). There were also significant cross-partner, time-lagged associations between mother and infant cortisol that appeared to be activated by stress. For example, higher maternal cortisol response to a separation stressor predicted higher infant cortisol response to the next stressor (β = 016, p < .01), over and above the infants' own cortisol response to the separation stressor. The present study is the first to identify cortisol attunement in a clinical sample of mother-infant dyads and offers novel insight into the directionality of mother-infant cortisol attunement.

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DOES MATERNAL SEPARATION IN GUINEA PIG PUPS RESULT IN SENSITIZATION OF A DEPRESSIVE-LIKE STATE? M.B. Hennessy[1], A.D. Schreibeis[1], P.A. Schiml[1], and T. Deak[2]. [1]Department of Psychology, Wright State University, Dayton OH 45435. [2]Behavioral Neuroscience Program, Department of Psychology, Binghamton University, Binghamton, NY 13902. michael.hennessy@wright.edu

Early-life stress is hypothesized to increase vulnerability for later development of depression by sensitizing underlying stress-responsive physiological systems (e.g., hypothalamic-pituitary-adrenal, inflammatory). The guinea pig appears to be useful as a model for studying these effects. When separated from the mother for 3 hr, pups exhibit a depressive-like response that sensitizes with repeated separation. The sensitization appears mediated by inflammatory factors because it can be suppressed with administration of anti-inflammatory compounds prior to the initial separation. To further establish the validity of the guinea pig model, we examined whether the sensitization would generalize to another stress-related paradigm—the forced swim test. Pups either were or were not separated for 3 hr on Day 23. Beginning 24 hr later, all pups were placed into a vessel of deep water for 5 min on three consecutive days. Over days, the duration of swimming and latency to become immobile declined, while duration of immobility increased. Of particular interest, previously separated pups were immobile significantly longer than were previously non-separated pups. These results show that sensitization of depressive-like behavior following earlier maternal separation generalizes to an entirely measure and paradigm known to be selectively sensitive to antidepressant medication. Thus, rather than being response-specific or based on conditioning to aspects of the separation environment, the sensitization that we have observed appears to be of an underlying depressive-like state.

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CONTRIBUTIONS OF THE MEDIAL PREFRONTAL CORTEX (mPFC) TO CONTEXTUAL FEAR CONDITIONING IN ADOLESCENT RATS. N.A. Heroux*, P.A. Robinson-Drummer, H.R. Sanders, J.B. Rosen, and M.E. Stanton. Department of Psychological and Brain Sciences, University of Delaware, Newark, Delaware, 19716. Nheroux@psych.udel.edu

The context preexposure facilitation effect (CPFE) is a contextual fear conditioning paradigm in which learning about the context, acquiring the context-shock association, and retrieving/expressing contextual fear are temporally dissociated into three distinct phases. In contrast, learning about the context and the context-shock association happens concurrently in standard contextual fear conditioning (sCFC). Our lab has previously shown that the CPFE and sCFC induces the expression of the transducible transcription factor egr-1 in the medial prefrontal cortex of adolescent and adult rats (Schreiber et al., 2014; Chakraborty et al., 2016). The current set of experiments assessed the regional contributions of the mPFC to contextual fear conditioning by utilizing intra-mPFC infusions of the GABA-a receptor agonist muscimol prior to each phase of sCFC and the CPFE. Intra-mPFC

infusions of muscimol (0.5 μg/0.25 μl/side) prior to context preexposure (Experiment 1) or retention testing (Experiment 3) disrupted retention test freezing to a level that did not differ from nonassociative controls. In contrast, Experiment 2 found that the same muscimol infusions prior to context-shock training only partially disrupted retention test freezing measured 24 hr later. Finally, Experiment 4 found that the same muscimol infusions prior to sCFC training did not significantly impair postshock or retention test freezing. In summary, the mPFC is necessary for learning during all three phases of the CPFE, but is not required for learning sCFC, in adolescent rats. Future experiments will examine the role of the mPFC in the ontogeny of contextual fear learning within the CPFE across normal and abnormal development.

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BEHAVIORAL EFFECTS OF PRENATAL AND POSTNATAL KETAMINE EXPOSURE IN RHESUS MACAQUE INFANTS ARE DEPENDENT ON MAOA GENOTYPE. J.A. Herrington*, L. A. Del Rosso, and J. P. Capitanio. California National Primate Research Center, UC Davis, Davis CA 95616. jaherrington@ucdavis.edu

Ketamine is an N-methyl-D-aspartate (NMDA) receptor antagonist used in anesthetic and therapeutic practices and is also a known abused substance. Recent evidence suggests that exposure to ketamine during sensitive periods of neural development results in neural apoptosis and modified behavior. Since monoamine neurotransmitters play important roles in prenatal and early postnatal neural development, and ketamine can inhibit monoamine transporters, we hypothesized that there would be behavioral consequences of prenatal and early postnatal exposure to ketamine moderated by genotype of the promoter in the monoamine oxidase-A (MAOA) gene. From a large sample of animals ($N = 531$), we compared groups of rhesus monkeys that had experienced a single exposure to ketamine during prenatal and/or early postnatal development to animals with no exposure to ketamine as a control group. Animals were classified by putative activity levels for the MAOA genotype, and were tested between 3 and 4 months of age on a battery of tests designed to assess responsiveness to brief maternal separation, face recognition memory, and contact with novel objects. Behavior differed based upon both the trimester of ketamine exposure, as well as MAOA genotype. These results add to a growing body of literature which support the idea that an individual's genetic characteristics can affect whether there are long-lasting effects of prenatal and early postnatal ketamine exposure.

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MOTHER-INFANT BIOBEHAVIORAL RELATIONSHIPS IN STRESS AND NON-STRESS CONTEXTS L.C. Hibel. Department of Human Ecology, University of California, Davis, CA, 95616. lchibel@ucdavis.edu

Mother-child emotional and physiological relationships across a mother-infant free-play, followed by an infant stress task, were examined in 120 mothers and their 6-month-old infant. During the free-play, mother and infant positive (but not negative) affect was moderately correlated. Cortisol slopes were not related and affect-cortisol relationships (within and across individual) were not present. Mother-child biobehavioral relationships emerged post-stressor. Infant negativity to the stressor predicted both mother and child cortisol slopes post-stressor. Infant negativity increased and mother positivity decreased across the stress task, mother-infant positivity remained correlated (negativity remained uncorrelated). Implications of maternal stress will also be explored.

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PROCEDURES FOR INDUCING VOLUNTARY BINGE-LEVEL CONSUMPTION OF ETHANOL IN ADOLESCENT RATS. D. Hosová and L.P. Spear. Developmental Exposure Alcohol Research Center (DEARC), Department of Psychology, Binghamton University, Binghamton, NY 13902-6000. dhosova1@binghamton.edu

Alcohol consumption typically begins in adolescence, and this age group is most prone to engaging in binge drinking (production of blood ethanol concentrations [BECs] >80 mg/dl). Studies assessing the long-term consequences of heavy adolescent alcohol exposure typically employ intragastric, vapor or intraperitoneal administration. Although these procedures enable precise dosing to produce target BECs, they are varyingly stressful, administer the full dose at once, and/or bypass digestion. Yet, voluntary consumption models in outbred rat strains rarely produce binge-level BECs. In recent work exploring approaches to induce voluntary binge-like consumption levels in adolescent Sprague-Dawley rats, we used a schedule induced polydipsia (SIP) procedure whereby food deprived (85% free-feeding weight) adolescents were given 30 min. Access to ethanol in a solution of Boost® daily from postnatal days 28–41, with flavored pellets dispensed on a fixed interval 1-min schedule. Binge-like intake patterns were seen over days, with BECs well into the binge range on some days and ethanol consumptions overall averaging in the binge range. Given that subsequent work revealed that these intakes were not schedule-dependent, the present studies assessed which procedural aspects were necessary for producing these elevated consumptions. Effects of drinking with a partner or alone, with or without concurrent pellet access, and with or without moderate food deprivation were assessed. Results showed that no one factor was absolutely necessary for elevated consumption levels, with the greatest consumption evident in moderately food-deprived animals drinking with a partner. Provision of pellets during the access period did not significantly impact intake.

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NEONATAL MERCURY EXPOSURE ALTERS HIPPOCAMPUS-DEPENDENT MEMORY AND ANXIETY IN RATS. P.S. Hunt, Department of Psychology, College of William & Mary, Williamsburg, VA 23187 USA. pshunt@wm.edu

Mercury is a teratogen and prenatal exposure to this heavy metal can produce significant negative effects in the offspring. Work with humans that were exposed to mercury during gestation has revealed that cognitive deficits are long-lasting and may be more severe when exposure occurs during the third trimester of pregnancy. Here we use a model of neonatal mercury exposure wherein rats were injected with mercury (0, 1, or 2 mg/kg) once daily on postnatal days 4–9. Animals were tested in early adolescence (PD 30–35). Major findings were that hippocampus-dependent tasks (trace and contextual fear conditioning) were more sensitive to mercury effects than was delay conditioning; mercury-exposed animals expressed less conditioned fear than controls. Further, the highest dose (2 mg/kg) resulted in abnormal responses on measures

of anxiety (elevated plus maze and open field tests), the pattern of which suggests reduced anxiety in mercury-exposed animals. Collectively the results indicate that ?third-trimester equivalent? exposure to mercury can produce deficits in some types of memory, and exposure to higher levels produces more general effects through reduced fear/anxiety. These results confirm that mercury is a teratogenic agent that has long-lasting consequences for cognitive and emotional behaviors.

BRAIN-DERIVED NEUROTROPHIC FACTOR: A POTENTIAL DRIVER OF THE ACCELERATED NEUROBEHAVIORAL DEVELOPMENT INDUCED BY EARLY-LIFE STRESS. K.B. Huntzicker[1,*], G. Manzano-Nieves[1], and K.G. Bath[2]. [1]Dept. of Neuroscience, Brown University, Providence, RI 02906.[2]Dept. of Cognitive, Linguistic, and Psychological Sciences, Brown University, Providence, RI 02906. kathleen_huntzicker@brown.edu

In humans, childhood exposure to adverse experiences leads to elevated risk of development of cognitive and affective pathology in adulthood. We hypothesize that these outcomes are the consequence of stress-associated changes in the timing of neurodevelopmental events, impacting circuit structure and function. We further predict that alterations in neurodevelopment result from atypical expression of trophic factors (BDNF), which drives acceleration in maturation. Accordingly, we employed maternal bedding restriction, a mouse model of ELS, from postnatal days 4–11. Using this manipulation, we previously found that ELS leads to earlier emergence of the latent period of contextual fear inhibition and earlier expression of markers of circuit maturation. Here, we collected hippocampal brain tissue from mice across early development and assessed effects of ELS on neurotrophin expression, finding that ELS was associated with an earlier rise in BDNF and suppressed expression of TrkB.T1 (a dominant negative receptor for BDNF), as assessed by realtime qPCR. Using immunohistochemistry, we observed earlier proliferation of parvalbumin-expressing neurons, a process initiated by developmental changes in BDNF levels. To test if changes in BDNF are necessary and sufficient to alter timing of neural and behavioral development following ELS, we employed a genetic approach. Specifically, we tested if the presence of the BDNF Val66Met polymorphism, a model of diminished BDNF release, blocks accelerated neurodevelopment following ELS as well as if genetic deletion of TrkB.T1 receptors, in the absence of ELS, leads to accelerated neurodevelopment. Based upon preliminary results, BDNF is both necessary and sufficient for ELS-associated changes in neurodevelopmental timing.

BOYS VS. GIRLS: THE UNEQUAL BENEFITS OF TRAINING ON PRESCHOOLER'S SPATIAL SKILLS. A.S. Joh. Department of Psychology, Seton Hall University, South Orange, NJ 07079. amy.joh@shu.edu

Research on spatial cognition has discovered a striking sex difference due to a male advantage. The present study further explored this phenomenon by examining whether the sex difference also exists in preschool-age children and whether training can alleviate this differences. Three- to four-year-old children ($N = 273$) participated in 12 different studies using variants of the same spatial task. The results show that by 3 years of age, boys outperform girls—but only after receiving additional training experiences. The results highlight the importance of early experience on later development.

COMPENSATORY CROSS-SYSTEM ACTIONS BETWEEN PARASYMPATHETIC AND SYMPATHETIC RESPONDING TO ANGER. S. Kahle*, J.G. Miller, and P.D. Hastings. Department of Psychology, University of California, Davis, Davis, CA 95616. skahle@ucdavis.edu

In this study, 52 6-year-olds ($M = 6.19$ years; $SD = .21$ years) completed a frustration induction task (an impossible possible), and cardiac autonomic physiology was measured before, during, and following the task. Indices of sympathetic (pre-ejection period; PEP) and parasympathetic (respiratory sinus arrhythmia; RSA) activity were computed in 30s epochs. Piecewise latent growth curve models showed significant sympathetic reactivity during the task (slope $M = -.33$*) reflecting PEP shortening by 1.65 ms. There was also significant sympathetic recovery after the task (slope $M = 1.06$*), reflecting PEP lengthening by 3.18 ms. In contrast, a significant pattern of parasympathetic reactivity for the group was not captured, although there was significant parasympathetic recovery following the task (slope $M = .34$*) such that RSA increased 1.02 on average. Thus, children showed sympathetic arousal followed by dual-system mediated recovery. Covariances among the factors revealed cross-system associations. Children who showed greater sympathetic reactivity during the task (PEP shortening) also had stronger parasympathetic recovery (RSA increases; $r = -.51$*). Children who had higher RSA at the start of the task (intercept $M = 5.80$*) showed a flatter sympathetic recovery slope ($r = -.57$*). These relations show lagged contingencies between systems in response to anger, and reflect patterns of both coactivation and reciprocal activation within and across different components of an emotional process. The similarities between the current findings and those that were observed in this same longitudinal sample three years prior (Kahle et al., 2016) will be discussed in terms of developmental changes in self-regulation. (*$p < .05$)

PREVIOUS MATERNAL STRESS LEADS TO IMPAIRED MATERNAL BUFFERING IN SUBSEQUENT INFANT RAT OFFSPRING. J.M. Kan* and R. Richardson. School of Psychology, The University of New South Wales, Sydney, NSW, Australia, 2052. Janice.kan@unsw.edu.au

Early in life, the mother is a powerful regulator of stress and pain reactivity. However, emerging research shows that maternal buffering is impaired following direct exposure to stress. In this research, we show a generational effect of stress on maternal buffering, such that reduced buffering is also observed when infants are indirectly exposed to stress through their mother. Females were mated and either standard-reared or maternally separated from their infant offspring for 3 hr/daily from postnatal day (PD) 2–14. The same females were mated a subsequent time, but no further maternal separation occurred. The maternal buffering test was conducted on these subsequent offspring at PD14-15. Infant offspring of standard-reared (SR) or previously maternally-separated (MS) mothers were given unpredictable shocks either alone or in the presence of an anaesthetised mother. Both the intensity of the animal's behavioural reactions as well as the number of ultrasonic vocalisations (USVs) emitted was measured. Animals from both conditions exhibited strong behavioural responses and emitted high numbers of USVs when tested alone. Importantly, while offspring of SR mothers decreased their responding in the presence of a mother (i.e., they exhibited social

buffering), the offspring of mothers who had been separated from their previous litter continued to show high levels of responding. In other words, these infants were impaired in maternal buffering. Together, this research suggests that offspring born to previously stressed mothers may be less resilient in the face of distress and illustrate that past maternal experiences can have a potent and lasting generational effect.

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SALIVARY CORTISOL AND ALPHA-AMYLASE REACTIVITY IN RELATION TO CHRONIC PHYSIOLOGICAL STRESS IN PRESCHOOLERS. K. Kao[1,*], S.N. Doan[2], A.M. St. John[1], J.S. Meyer [3], and A.R. Tarullo[1]. [1]Psychological and Brain Sciences, Boston University, Boston, MA 02446. [2]Department of Psychology, Claremont McKenna College, Claremont, CA 91711. [3]Department of Psychology, University of Massachusetts Amherst, Amherst, MA 01003. katiekao@bu.edu

The current study investigated the association of salivary cortisol, the end product of the hypothalamic-pituitary-adrenal (HPA) axis, and alpha-amylase (sAA) reactivity an indicator of autonomic nervous system (ANS) to young children's hair cortisol levels. Both physiological systems interact to maintain regulatory responses to stress (de Kloet et al., 2005). However, no studies have examined ANS or HPA axis functioning, specifically salivary cortisol and sAA reactivity to a challenge, in relation to chronic physiological stress, indexed by hair cortisol. Preschoolers listened to an argument and were asked to complete an impossible task. We collected salivary samples approximately 30 min after a calming period (baseline), 20-min post-stressor (reactivity) and 40-min post-stressor (recovery). We collected hair cortisol concentration (HCC) from both parent and child as a biomarker of chronic physiological stress. In our sample ($N = 51$, 27 males, $M = 4.20$ years), higher cortisol reactivity ($r(41) = .37$, $p = .019$) and higher levels of parent HCC ($r(38) = .49$, $p = .002$) were associated with higher levels of child HCC, while sAA reactivity was not related to child HCC. Child HCC was regressed on parent HCC and salivary cortisol reactivity ($F(2,35) = 12.18$, $p = < .001$). Both parent HCC ($\beta = .50$, $p < .001$) and child salivary cortisol reactivity ($\beta = .41$, $p = .003$) uniquely contributed to child HCC. When parents had higher chronic physiological stress, children had higher chronic physiological stress suggesting that chronic physiological stress may be intergenerationally transmitted. Results also demonstrate that children who are highly reactive to a stressor show higher levels of cumulative HPA activity, which may lead to more chronic physiological stress over time and add to children's biological risk for health problems.

QUIPAZINE EFFECTS ON SENSORY RESPONSIVENESS IN SPINAL TRANSECTED NEONATAL RATS. S.D. Kauer*, H.E. Swann, and M.R. Brumley. Department of Psychology, Idaho State University, Pocatello, ID 83209. kauesier@isu.edu

Quipazine is a serotonin receptor agonist that has been used to induce motor activity and promote recovery of function after spinal cord injury in neonatal and adult rodents. Sensory stimulation also activates sensory and motor circuits and promotes recovery after spinal cord injury. In rats, tail pinch is an effective and robust method of sacrocaudal sensory afferent stimulation that also induces motor activity, including locomotion. Activation in response to tail pinch persists even after a spinal cord transection. Here we examined the motor response to tail pinch following treatment with quipazine in spinal cord transected (at mid-thoracic level) and intact neonatal rats. Rat pups were secured in the supine posture with limbs unrestricted. Quipazine or saline was administered intraperitoneally and after a 10-min period, a tail pinch was administered. A 1-min baseline period prior to tail pinch administration and a 1-min response period post-tail pinch was observed and hindlimb motor activity, including locomotor-like stepping behavior, was recorded and analyzed. Total hindlimb movements increased for all surgery and drug conditions following a tail pinch. Spinal subjects exhibited increased low amplitude limb activity compared to shams, which exhibited an increase in high amplitude hindlimb activity. Spinal subjects also exhibited coordinated stepping behavior in response to the tail pinch, in addition to the increased movements induced by quipazine. Thus, this study examined the interaction between sensory stimulation and the serotonin system within spinal cord circuits.

RESCUING ABERRANT MATERNAL BEHAVIOR BY ALTERING DNA METHYLATION. S.M. Keller, T.S. Doherty, and T.L. Roth. Psychological and Brain Sciences, University of Delaware, Newark, DE 19716. skeller@psych.udel.edu

Long-term changes in DNA methylation result from exposure to caregiver maltreatment early in life. Experiencing maltreatment likewise alters behavioral trajectories. For example, both humans and animals mistreated in early-life often display aberrations in caregiving towards their own offspring. Whether changes in DNA methylation are involved in these behavioral aberrations is not known. In the current study, female rodents were exposed to caregiver maltreatment for the first seven days of life. As adults, they were infused with the DNA methylation inhibitor, zebularine, for one week following parturition. After drug administration, maternal behavior was recorded in these dams. Preliminary data indicate zebularine administration normalizes maternal behavior in females with a history of maltreatment such that they perform mostly nurturing behavior towards offspring. Due to its critical role in development, methylation status of the brain derived neurotrophic factor (Bdnf) gene was examined. Additionally, global and hydroxymethylation will be assayed in these dams in several brain regions implicated in maternal behavior, including the nucleus accumbens and medial preoptic area. Alterations in DNA methylation induced by motherhood will also be described, as data indicate that motherhood induces divergent methylation changes in females with a history of maltreatment compared to females with a history of normal infancy.

THE ROLE OF ENVIRONMENTAL COMPLEXITY IN THE PROTECTION AND REHABILITATION AGAINST EARLY-LIFE ADVERSITY. A.C. Kentner. School of Arts & Sciences, MCPHS University, Boston, MA 02115. amanda.kentner@mcphs.edu

The utility of environmental enrichment (EE) in pediatric settings has shown success in autistic children and those at risk for cerebral palsy. However, the specific components of EE (e.g., sensorimotor stimulation, enhanced parental care) that may lead to clinical benefit are not understood. Perinatal exposure to infection is identified as a risk factor for neurodevelopmental disorders such as autism. In our work we use animal models of early-life inflammation to explore the

potential for EE to offer neuroprotection and remediation against associated cognitive and behavioral detriments. Moreover we characterize the specific EE components and neurophysiological mechanisms that underlie such benefits.

EXTINCTION-RESISTANT METH EXPERIENCE DURING ADOLESCENCE: GENOME-WIDE TRANSCRIPTOME ANALYSIS FOLLOWING METHAMPHETAMINE SELF-ADMINISTRATION. J.H. Kim[1,2], H.B. Madsen[1,2], V.M. Perreau[1,2], I.C. Zbukvic[1,2], A.J. Lawrence[1,2], and S.J. Luikinga[1,2]. [1]Behavioral Neuroscience Division, The Florey Institute of Neuroscience and Mental Health, Parkville, 3052 VIC, Australia. [2]University of Melbourne, Parkville, VIC 3052 Australia. drjeehyunkim@gmail.com

Adolescent methamphetamine (meth) abuse is a significant problem in Australia and USA. Drug abuse involves experiencing a positive state that is associated with surrounding cues. This association is hard to forget and leads to cravings and more drug use. Considering that strong 'good' memories form the basis of addiction, we investigated how meth associated memories are differently regulated in adolescent and adult rats. When adolescent and adult rats self-administered meth, adolescent rats showed more persistent responding to the lever as well as meth-associated cue light when meth was taken away. We are currently examining molecular changes in the dorsal striatum using genome-wide transcriptome analyses following saline vs meth self-admin in adolescent and adult rats to uncover gene expression differences following meth self-admin in those ages.

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NEUROENDOCRINE FACTORS DISTINGUISH JUVENILE PSYCHOPATHY VARIANTS. E.R. Kimonis[1], N. Goulter[1], D.J. Hawes[2], R.R. Wilbur[3], and M.W. Groer[3]. [1]School of Psychology, The University of New South Wales, Sydney, Australia. [2]School of Psychology, University of Sydney, Australia. [3]College of Nursing & College of Medicine, University of South Florida. e.kimonis@unsw.edu.au

Interest in the neurobiological underpinnings of antisocial behaviour has grown significantly in recent decades, and extensive research in this area has centered on the hypothalamic–pituitary–adrenal axis. Developmental models of antisocial behaviour have evolved considerably in recent years, driven in large part by a growing recognition of heterogeneity among individuals with such behaviour. Compared to other antisocial individuals, those with callous-unemotional (CU) traits—the affective component of psychopathy (e.g., lack of guilt/empathy) and its putative developmental precursor—exhibit a particularly severe and chronic trajectory of antisocial behaviour, and a range of unique neurobiological correlates related to the processing of emotional stimuli. However, the characteristic pattern of emotional hypo-reactivity observed in primary CU/psychopathy is not evident in secondary CU/psychopathy, which is thought to originate from childhood adversity and co-occurring anxiety. This study tested whether salivary cortisol-to-DHEA concentrations, which at high levels indicate risk for chronic stress and poor mental health, distinguished secondary from primary variants of CU traits. Using latent profile analysis, 232 incarcerated adolescent boys (M_{age} = 16.75) were disaggregated into psychopathy variants according to CU, anxiety, and aggression scores. Based on a subset with neuroendocrine data (n = 201), aggressive secondary CU variants had lower afternoon DHEA levels and higher cortisol-to-DHEA ratios and comorbid psychopathology compared with all other groups. In contrast, two primary CU variants (aggressive/non-aggressive) emerged with low to average psychopathology and high DHEA levels. Findings contribute to a growing literature base suggesting that biomarkers may distinguish youth on separable developmental pathways to psychopathy.

DIFFERENCES IN MATERNAL TREATMENT OF GENETICALLY ALTERED MOUSE NEONATES DEPENDS ON LITTER FOSTER CONFIGURATION INDEPENDENT OF GENOTYPE. G.A. Kleven[1], C.M. Estrada[3], Y.M. Argumedo[1,2], and N. Kovar[1]. [1]Department of Psychology, [2]Boonshoft School of Medicine, Wright State University, Dayton, OH, 45435. [3]Department of Psychology, University of Cincinnati, Cincinnati, OH 45221. gale.kleven@wright.edu

Previously we reported behavioral differences in genetically altered Pitx3 mice that were related to rearing conditions independent of genotype. Pitx3 is a recessive mutation that causes failure of dopaminergic neurons in the substantia nigra to differentiate during prenatal development. We have also identified behavioral deficits in fetal Pitx3 subjects that are reversed by L-Dopa. Taken together these results raise the question as to whether the mouse dam may be able to identify and treat pups differently in the presence of a mixed litter configuration. To test this hypothesis, heterozygous Pitx3 females were mated to mutant male mice. The resulting pregnancies produce half mutant and half heterozygous controls. Newborn mouse pups were fostered back to parturient dams in one of three combinations: (a) all mutant Pitx3 pups, (b) all heterozygous controls, or (c) equal mix of mutant and heterozygote pups. Maternal behaviors scored from 1 hr video of the home cage on postnatal day 1 (P1) were: retrieval of pup, grooming of self or pup, nursing, and nesting behavior. Although most retrieval and nursing measures did not differ, maternal grooming of male mutant pups was significantly higher than those of heterozygote control males, particularly when the foster configuration was a mixed group with both mutant and heterozygote pups present. These results demonstrate that the mouse dam can identify differences between genetically altered pups and controls when fostered together in the same litter. In genetically altered mice with behavioral deficits, such as the Pitx3, a homogenous litter configuration may be desirable.

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SOCIAL NETWORKS ACROSS FISSION-FUSION CHANGES: TEMPORAL ORGANIZATION AND REPRODUCTIVE CONSEQUENCES. G.M. Kohn*. Psychological and Brain Sciences, Indiana University, Bloomington, Indiana, 47405. gmkohn@indiana.edu

Many social vertebrates inhabit loosely structured groups where both group size and composition fluctuates over short timescales. The ability to sustain non-random interaction preferences across group

changes is important in maintaining social organization. Nonetheless, we currently know very little about which interaction preferences are consistent across fission-fusion changes, the temporal social dynamics responsible for them, and their consequences for reproductive success. Here I discuss a series of studies that investigate the organization of social networks in flocks of Brown-headed Cowbirds across fission-fusion changes. I found that female cowbirds create enduring subgroups with familiar individuals across multiple fission-fusion changes. I then show how moment-by-moment changes in sequential interaction patterns preferentially reinforce familiar connections over others in the network, and that stronger familiarity preferences during autumn predict later reproductive output during the breeding season. These results highlight how investigating the patterns and processes underlying social networks across varying timescales can yield new insights into the emergence and evolution of animal social organization.

EFFECTS OF EARLY CHILDHOOD PARENTING BEHAVIORS ON LATE CHILDHOOD NEURAL FUNCTIONING. D.C. Kopala-Sibley[1,*], M. Cyr[2], J. Orawe[1], M. Finsaas[1], A. Huang[1], H.-C. Leung[1], D.N. Klein[1,3]. [1] Department of psychology, Stony Brook University, Stony Brook, NY 11794. [2]Department of psychiatry, New York State Psychiatric Institute, New York, NY, 10032. [3]Department of psychiatry, Stony Brook University, Stony Brook, NY 11794. daniel.kopala-sibley@mail.mcgill.ca

Early caregiving has lasting influences on children's psychosocial development. While this effect is undoubtedly mediated via neural development, relatively little research has examined the effects of parenting in early childhood on brain function in late childhood. Eighty 3-year olds and their mothers participated in a lab-based interaction task from which maternal hostility and the quality of their relationship were assessed. When children were approximately 10 years old, functional magnetic resonance imaging data was acquired while they completed resting-state task and viewed affective faces. Resting state connectivity analyses showed that more maternal hostility predicted decreased connectivity between both the right and left lateral parietal cortex and the medial prefrontal cortex, whereas a better quality relationship predicted increased connectivity between the right lateral parietal cortex and the medial prefrontal cortex. Task results showed that elevated maternal hostility predicted increased reactivity of the inferior parietal cortex to sad faces relative to neutral faces. Psychophysiological interaction (PPI) analyses with a seed in the left or right amygdala subsequently showed that maternal hostility predicted differences in amygdala connectivity during exposure to sad or happy faces relative to neutral faces with a range of areas, including the medial prefrontal cortex, inferior parietal cortex, posterior or anterior cingulate, and the anterior hippocampus. A better quality relationship predicted differences in amygdala connectivity with the anterior cingulate, medial prefrontal cortex, and the temporal-parietal junction during exposure to sad or happy faces. Results support the long term influence of parenting on resting state functional connectivity and a range of neural markers of affective processing.

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LONG-TERM EFFECTS OF IN UTERO SERTRALINE EXPOSURE (A SELECTIVE SEROTONIN REUPTAKE INHIBITOR) ON MALE AND FEMALE RATS. J.M. Kott[1,*], S.M. Mooney-Leber[1], S.A. Perrine[2], and S. Brummelte[1]. [1]Department of Psychology, [2]Department of Psychiatry and Behavioral Neurosciences, Wayne State University, Detroit, MI, USA. jennifer.kott@wayne.edu

Sertraline, a selective serotonin reuptake inhibitor (SSRI), has the ability to cross the placental barrier in pregnant women and may consequently impact the development of a fetus. Anti-depressant-induced changes in the serotonergic system may have drastic effects on brain development and thus the behavioral outcome of the offspring. This study seeks to investigate the long-term consequences of sertraline exposure during pregnancy in a translational animal model of preconceptional stress/depression. In this model, female Sprague-Dawley rats were first treated with a vehicle (sesame oil) or the stress-hormone corticosterone (CORT, 40 mg/kg, s.c.) for 21 days to induce a depressive-like phenotype. After 16 days of CORT or oil administration, these "depressed' or healthy (control) rats were further divided to either receive sertraline (20 mg/kg, p.o.) or a vehicle (water) daily and then mated with healthy males one day after the cessation of CORT treatment. This approach was chosen to mimic a situation in which a woman experiencing depression requires treatment with an SSRI, but then becomes pregnant, and is faced with the choice whether or not to continue the antidepressant medication. Therefore, half of the sertraline-animals discontinued the treatment on gestational day 16, while the other half continued treatment through parturition. Results revealed altered neurotransmitter levels in the brains of neonatal animals exposed to sertraline during gestation. However, preliminary data suggests that sertraline does not have a significant impact on anxiety-related behaviors in adult animals, though more data needs to be analyzed to determine the long-term consequences of the in utero exposure.

NEUROBEHAVIORAL IMPLICATIONS FOR EARLY EXPOSURE TO MATERNAL VOICE IN THE VERY LOW BIRTHWEIGHT PREMATURE INFANT. C. Krueger. College of Nursing, University of Florida, Gainesville, Florida, 32605. ckrueger@ufl.edu

The objective was to determine whether exposure to repetitive, low decibel recordings of maternal voice regulates early neurobehavioral development in very low birth weight (VLBW) preterm infants. Infants born during their 27th to 28th gestational week were randomly assigned to one of two groups. Group 1 heard a recording of their mother reciting a rhyme twice a day from 28 to 34 weeks postmenstrual age (PMA). Group 2 waited four weeks and heard the recording from 32 to 34 weeks PMA. Heart rate variability (using a spectral analysis of heart periods) and heart rate (for detection of a cardiac orienting response) was recorded weekly during a silent period and while the recording of the rhyme (read by an unfamiliar female) was played back to each infant, respectively. Weekly measures of high frequency tone varied significantly by group assignment ($p < .05$) with consistently higher levels of tone in Group 1 compared to Group 2. At 33 weeks PMA heart rate varied significantly between groups ($p < .05$). Group 1 infants responded to the recording with a cardiac orienting response (small cardiac deceleration) and Group 2 infants showed no acceleration or deceleration in heart rate. Findings suggest that the preterm infant's neurobehavioral response varies, depending on the developmental timing or when exposure to a repetitive maternal recording is begun. Group differences are discussed in relation

maturity of the autonomic nervous system, auditory sensitization and ongoing environmental stimuli within the Neonatal Intensive Care Unit.

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MATERNAL HEART RATE REACTIVITY TO INFANT STIMULI MODERATES PERCEPTION OF INFANT AFFECT. S. Kuzava, A. Frost, K. Bernard. Department of Psychology, Stony Brook University, Stony Brook, New York, 11790. sierra.kuzava@stonybrook.edu

Accurate perception of infant characteristics and behavior is thought to significantly contribute to sensitive caregiving (Swain, Lorberbaum, Kose, & Strathearn, 2007). Further, parental perception of negative infant temperament has the potential to elicit and reinforce problem behavior in children over the course of development, which may result in adverse outcomes (De Fruyt & De Clercq, 2014). Few studies, however, have characterized both the psychological and physiological factors contributing to parents' ability to accurately differentiate their infants' positive and negative attributes. In this study, we examined whether maternal bias in evaluating infant negative affect predicts differences in physiological reactivity to infant crying and laughing sounds. Infants (N = 43) were videotaped in several distress-eliciting tasks, which were independently coded by researchers for infant negative affect. Parent-reported infant temperament was collected via the Infant Behavior Questionnaire. Maternal bias was operationalized as the difference between the negative affect IBQ composite and researcher-coded negative infant affect. Mothers' heart rate variability (HRV) was then measured during presentation of infant laughing and crying sounds. Results from OLS regression indicated that increased maternal bias was significantly associated with decreased difference in HRV between laughing and crying clips (β = −.353, p = .017) while controlling for infant gender and maternal education. This model accounted for a significant amount of the variance in HRV difference between stimuli (R^2 = .227, p = .017). These results suggest that lack of physiological differentiation between positive and negative infant stimuli may contribute to misperception of negative infant affect.

PROGRESSIVE DEFICITS IN SUSTAINED ATTENTION IN THE HIV-1 TRANSGENIC (TG) RAT AS A MODEL FOR HIV-1 ASSOCIATED NEUROCOGNITIVE DISORDERS (HAND). A.L. Lafond*, K.A. McLaurin, R.M. Booze, and C.F. Mactutus. Department of Psychology, University of South Carolina, Columbia, South Carolina, 29208. alafond@email.sc.edu

The human immunodeficiency virus (HIV) is a significant public health problem throughout the world currently afflicting 35 million people. Despite the success of combined antiretroviral therapy (cART) with decreasing mortality rates, neurocognitive deficits characteristic of HAND appear relatively intractable to therapy; attention and executive function are the processes commonly affected. In the present study, we tested the hypothesis that with advancing age, there will be an HIV-1 viral protein-induced progressive loss of neurocognitive function as indexed by sustained attention performance. A longitudinal approach was employed that used both male and female HIV-1 Tg and Fischer-344N control rats (background strain). Beginning at 60 days of age, sustained attention was tested with a signal detection task consisting of 162 trials that were either reinforced (hit or correct rejection) or non-reinforced (miss or false alarm) with sucrose pellets until a criterion was met (70% accuracy for 5 consecutive or 7 total days). The control rats learned and improved on the task when retested every 60 days, and with this distributed practice, reached asymptotic criterion approximating 6 days at 300 days of age. In contrast, the HIV-1 transgenic rats displayed an initial impairment, an asymptotic criterion approximating 7.5 days at 300 days of age, and deterioration of performance beginning at 360 days of age. The HIV-1 Tg-induced impairment was most prominent in female rats. The present study is the first to demonstrate progressive deficits in sustained attention in the HIV-1 Tg rat and is proposed as a translational model for HAND.

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RESILIENCY AND ADAPTATION TO EARLY SENSORY IMPOVERISHMENT IN HOSPITALIZED PRETERM INFANTS EXPOSED TO ENVIRONMENTAL NOISE VS. WOMB-LIKE SOUNDS. A. Lahav. Harvard Medical School, Boston, MA 02115 USA. amir@hms.harvard.edu

Brain development is largely shaped by early sensory experience. However, it is currently unknown whether, how early, and to what extent the newborn's brain is shaped by exposure to mother's voice. Our studies demonstrate experience-dependent brain plasticity in preterm newborns exposed to authentic recordings of maternal sounds before full-term maturation. These results suggest that the brain is more adaptive to womb-like maternal sounds than to the environmental noise present in the neonatal intensive care unit. Resiliency and adaptation to early sound exposure will be discussed in light of the developmental problems often seen in children born prematurely.

STRESS HISTORY AND GENETIC POLYMORPHISMS IN HYPOTHALAMIC-PITUITARY-ADRENAL AXIS REGULATION. H.E. Lapp*, R.G. Hunter, and C.L. Moore. Department of Psychology and Developmental Science Research Center, University of Massachusetts Boston, Boston, MA 02125. hannah.lapp001@umb.edu

A history of major early life stress (ELS) and social discrimination have been linked to altered acute social stress responses in adulthood. However, there are important individual differences in the size and direction of these effects. We explored developmental and contextual sources of individual differences in the relationship between ELS and adult responses: perceived status, social support, background activity of HPA axis, genetic variants in aspects of stress response system. In keeping with other reports, it was predicted that both childhood adversity (ACE) and perceived social discrimination (Lifetime and Daily) would be negatively related to salivary cortisol response and recovery in the Trier Social Stress Test (TSST) of adults. Moderating effects were expected and assessed for several variables: contextual neuroendocrine activity (cortisol accumulations in hair during past 3 months, baseline salivary cortisol); for perceived social support (perceived social status, other), and for genetic polymorphisms in the neuroendocrine system. Participants (N = 90; ages 18–66) were

recruited from the greater Boston area. Baseline salivary cortisol level was elevated in the High ELS group ($p < .01$, $\eta_p^2 = .24$). FKBP5 T carriers had significantly lower baseline cortisol levels ($p < .05$, $r = .30$). There was a significant association between baseline cortisol and Lifetime Discrimination ($p = .003$, $r_s = .30$) and Daily Discrimination ($p = .044$, $r_s = .214$). Percent change in cortisol from baseline in response to the TSST was blunted in the High ELS group ($p < .05$, $\eta^2 = .22$). These findings suggest multiple contributions across psychological, genetic, and social domains to vulnerability and resilience in hypothalamic-pituitary-adrenal axis regulation which should be explored further.

VIDEO MODELING AND IMITATION IN CHILDREN WITH ASD: PRELIMINARY ANALYSES. A. Learmonth[1], R. Barr[2], P. Gerhardstein[3], E. Janerhofer[2], J. Napolitano[1], A. Blazkiewicz[1], M. Lui[2], and N. Strautman[2]. [1]Department of Psychology, William Paterson University, Wayne, NJ 10901. [2]Department of Psychology, Georgetown University, Washington, DC 20057. [3]Department of Psychology, Binghamton University, Binghamton, NY 13902. learmontha@wpunj.edu

Research has demonstrated that children with Autism Spectrum Disorder have an imitation deficit in comparison to typically developing children (Edwards, 2014). Consequently, teaching social skills, many of which are learned through imitation, to children with autism can be challenging (Chawarska, Macari & Shic, 2012). To compensate, some intervention programs use video modeling, which is thought to be easier and more comfortable for children with ASD due to its predictability and low social salience (Golan et al., 2009, Moore & Calvert, 2000). Video modeling removes many stimuli that seem to be difficult for children with autism, such as eye contact, background noise, and social interaction. However, few studies have attempted to compare video models to live models directly in children with ASD. The current study was tests the hypothesis that children with autism will imitate better from a video than from a live model. Young children (32–54 months) were shown a live or video demonstration of a puzzle task. We predicted that, while children with ASD would imitate less overall, imitation scores in the ASD group would be higher following a video demonstration. Although data collection is ongoing, our preliminary data with 3- to 4-year-old children with ASD ($n = 10$) show that they imitated gestures and puzzle completion comparably to a larger group of typically developing children ($n = 32$) on both live and video conditions. Both groups were more likely to copy the specific gestures with the virtual pieces on the touchscreen than the real puzzle pieces.

ENVIRONMENTAL ENRICHMENT THERAPY FOR AUTISM: OUTCOMES WITH INCREASED ACCESS. M. Leon[1], E. Aronoff[2], and R. Hillyer[2]. [1]Center for Autism Research and Translation, Center for the Neurobiology of Learning and Memory, Department of Neurobiology and Behavior, 2205 McGaugh Hall, The University of California Irvine, [2]Mendability, LLC, 915 South 500 East American Fork, UT 84003. melon@uci.edu

Two randomized clinical trials from our group have shown that environmental enrichment can ameliorate symptoms of autism spectrum disorder, and here we determined its efficacy under real-world circumstances. 1,002 children and young adults were given daily environmental enrichment by their parents, guided by an online system. The parents were asked to assess the symptoms of their child with a comprehensive questionnaire in regular intervals for 7 months. An intention-to-treat analysis showed significant gains for a wide range of symptoms that included: learning, memory, anxiety, attention span, motor skills, eating, sleeping, sensory processing, self-awareness, communication, social skills, and mood/autism behaviors. The children of compliant caregivers were more likely to have significant improvement in their symptoms. The treatment was effective across a wide age range and initial symptom severity. There was equal progress for males and females. Environmental enrichment in the form of Sensory Enrichment Therapy, delivered via an online system, therefore appears to be an effective, low- cost means of treating a wide range of symptoms across different ages, gender, and symptom severity.

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COGNITIVE RECRUITMENT IN YOUTH WITH ANXIETY DURING A SPEEDED RESPONSE TASK. A.K. Leonard[1,*], M.L. Ramos[1], M. Bechor[1], W.K. Silverman[2], J.W. Pettit[1], B.C. Reeb-Sutherland[1]. [1]Department of Psychology, Florida International University, Miami, FL USA. [2]Child Study Center, Yale University School of Medicine, New Haven, CT USA. aleon100@fiu.edu

Anxiety is one of the most common and most costly psychiatric disorders. Therefore, it is important to understand the underlying neural mechanisms and identify potential biomarkers for anxiety. Participants with anxiety may have depleted attentional resources within a threatening context such that those with anxiety exhibit a decreased attentional responses compared to controls. To examine potential underlying neural mechanisms of this phenomenon, the current study investigated the N2 component in youth diagnosed with anxiety ($n = 25$, 12 male, 11.72 years) and healthy controls ($n = 19$, 12 male, 10.89 years). Participants completed 384 trials (50% congruent) of the arrow version of the Eriksen flanker task while simultaneous EEG was collected. Data was filtered, segmented, and baseline corrected offline, and the N2 was identified within a 200–350 ms window post response and maximal at site FCz. While controlling for age, a repeated measures ANOVA with trial type (congruent, incongruent) as the within subjects factor and group as the between subjects factor yielded a significant type x group interaction effect was observed ($F(1,41) = 5.988$, $p < .05$). Post hoc analysis suggested healthy controls have a stronger N2 response to incongruent compared to congruent trials ($t(18) = 3.254$, $p < .005$) while the N2 in youth with anxiety did not differ between trials ($p > .2$). These results suggest that youth with anxiety may have depleted resources during conflict monitoring compared to non-anxious youth possibly due to the increased negative emotional context of making errors. In contrast, controls may be conserving and utilizing their attentional resources even within this negative context to accurately resolve conflict.

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MEASURING BIASED ATTENTION TO THREAT IN INFANCY. V. LoBue. Department of Psychology, Rutgers University, Newark, NJ 07102. vlobue@psychology.rutgers.edu

A growing literature has implicated biased attention to threat as a potential mechanism in the development of various anxiety-related

behaviors. However, there is little data on biased attention in infants, limiting our ability to examine the broader question of how biased attention to threat might lead to later anxiety. Here we present data from a large cross-sectional sample of infants (4–24 mos) on three new eye-tracking tasks designed to investigate three core attention mechanisms—attention bias to threat (baby dot-probe task), attention vigilance (vigilance task), and the ability to disengage from threat (overlap task). In the baby dot-probe task, we found a general decrease in latency to fixate probes that followed threatening (i.e., angry) versus non-threatening (i.e., happy) faces with age. Further, for infants high in negative affect, increased attention to threatening faces was associated with slower responding to the probe. Similarly, in the vigilance task, we found that latency to first fixate threatening faces was associated with higher levels of negative affect, but only for older infants. Finally, in the overlap task, we found that higher maternal anxiety predicted infants' latency to disengage from threatening faces. Together, findings across the three tasks point to the presence of early attentional biases for social threats, and suggest that such biases might constitute early markers of risk for socio-emotional development.

SLEEP POSITION DURING PREGNANCY: EFFECTS ON MATERNAL AND FETAL HEART RATE. M. Lucchini[1,2], J.S.C. Yang[3], J. Zavala[3], A.J. Elliott[4,5,6], and W.P. Fifer[1,3,7]. [1]Department of Psychiatry, Columbia University, New York, NY, 10032. [2]DEIB, Politecnico di Milano, Milano, Italy, 20100. [3]New York State Psychiatric Institute, Division of Developmental Neuroscience, New York, NY, 10032. [4]Department of Pediatrics, Sanford School of Medicine at the University of South Dakota, Sioux Falls, SD 57105. [5]Community & Population Health Sciences, Sanford Research, Sioux Falls, SD, 57104. [6]Department of Obstetrics & Gynecology, Sanford School of Medicine at the University of South Dakota, Sioux Falls, SD, 57105. [7]Department of Pediatrics, Columbia University, New York, NY, 10032. maristella.lucchini@polimi.it

During late pregnancy mothers could experience prolonged occlusion of major blood vessels depending on their position particularly during sleep. Recent studies on maternal sleep position showed that women who slept on their backs or right side in late pregnancy were more likely to experience a stillbirth. Stillbirths are often unexplained and thus, investigation of the etiology of these deaths is the initial step in the development of preventive strategies. Therefore, this study aims to characterize patterns of fetal and maternal heart rate (HR) depending on maternal position, during overnight recordings under normal sleep conditions in late pregnancy. Ninety-one mother-fetus dyads were analyzed. Average RR intervals (RRi), standard deviation of RRi (SDNN) and beat to beat variability (RMSSD) were calculated for each minute for the entire recording. Maternal cardiovascular activity was dramatically influenced by position. Maternal HR was significantly different for supine vs left ($p < 0.001$), supine vs right ($p < 0.005$) and right vs left ($p < 0.001$) and was highest in the supine position and lowest when on the left, with right position resulting in intermediate values. Analysis of sustained positons (>30 min), showed mothers' SDNN and RMSSD increasing while in the left position and decreasing in the right. Moreover, mothers showed clear circadian rhythms, with a significant decrease in HR through the night. In contrast, fetuses were buffered from these changes, showing no average differences by position, except for increased variabilty during sustained right-sided positions. Investigations are underway to examine the effect of alcohol and smoking on these patterns.

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SOMATOSTATIN INTERNEURONS AFFECTED IN ADULT BUT NOT ADOLESCENT VENTRAL STRIATUM AFTER METHAMPHETAMINE SELF-ADMINISTRATION IN RATS. S.J. Luikinga[1,2,*], H.B. Madsen[1,2], I.C. Zbukvic[1,2], A.J. Lawrence[1,2], and J.H. Kim[1,2]. [1]The Florey Institute of Neuroscience and Mental Health, Parkville, VIC 3052 Australia. [2]University of Melbourne, Parkville, VIC 3052 Australia. s.luikinga@florey.edu.au

Methamphetamine (Meth) abuse is a growing problem in Australia, with the rise in its purity as a main concern. Additionally, the age of Meth abusers has significantly dropped over the past few years with children as young as 10 years admitted to hospital on Meth. Therefore, we used the intravenous self-administration (IVSA) paradigm to compare Meth abuse-related behaviour in adolescent and adult rats. Rats were trained to lever press for Meth at a dose of 0.03 mg/kg/infusion. It was found that both adults and adolescents acquired Meth in a similar manner, however, adolescent rats escalated their intake when the dose was increased (0.1 mg/kg/infusion, $p < 0.05$). To test whether this escalation was due to adolescents possessing a particular affinity for 0.1 mg/kg/infusion, a new group of rats acquired at 0.1 mg/kg/infusion, and then were tested on 0.3 mg/kg/infusion. Interestingly, both age groups acquired in a similar manner and again an escalation of intake was seen in the adolescent group on the higher dose ($p < 0.05$). After this paradigm, different brain regions were stained for Parvalbumin (PV) and Somatostatin (SST), to investigate Meth-related changes in interneuron numbers. Compared to saline IVSA, there was an increase of PV interneurons in the ventral striatum in both adults and adolescents following Meth IVSA ($p < 0.05$). In the ventral striatum, there was also an increase in SST interneurons in the adults, but not in adolescents following Meth IVSA ($p < 0.05$). Taken together, Meth self-administration during adolescence leads to a markedly different behavioural and neural outcome compared to Meth self-administration during adulthood.

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DIFFERENTIAL BEHAVIORAL AND MOLECULAR CONSEQUENCES OF POSTNATAL AND JUVENILE FLUOXETINE TREATMENT. M. Maheshwari*, P. Chachra, and V.A. Vaidya. Tata Institute of Fundamental Research, Mumbai, India. meghaa.maheshwari@gmail.com

Multiple studies indicate that exposure of developing brain to exaggerated levels of serotonin adversely affects emotional development. Studies in mouse models point towards enhanced depressive- and anxiety-like behavior following postnatal administration of selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine. In contrast, adult fluoxetine induces antidepressant and anxiolytic responses in patients and animal models. These studies suggest an opposing effect of fluoxetine on emotionality based on the temporal window of administration, for which the underlying mechanisms remain unknown. In this study, we have examined paradoxical effects

of fluoxetine administration in: postnatal life, postnatal day (P) 2 to P21 and juvenile window, P28-P48. We aimed to compare behavior, and transcriptional regulation in adult animals with a history of SSRI treatment. We identified that in contrast to the anxiogenic and depressive-like effects of postnatal fluoxetine (PNFlx) treatment, juvenile fluoxetine (JFlx) treatment results in anxiolytic and antidepressant-like effects in adulthood. We showed that unlike the short-term anxiolytic and antidepressant effects of adulthood SSRI treatment, effects of juvenile fluoxetine treatment persist long after the treatment is over and are observed until at least six month of age in adult rats. Postnatal and juvenile fluoxetine treatments evoke differential and largely non-overlapping changes in the medial prefrontal cortex (mPFC) transcriptome. Further, we noted that the biological processes enriched in the mPFC transcriptome of PNFlx as against JFlx animals vary substantially. Collectively, our findings demonstrate that a history of fluoxetine exposure programs transcriptional and behavioral consequences that differ based on specific window of treatment in early-life.

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EFFECTS EARLY LIFE STRESS ON PARVALBUMIN POSITIVE NEURON MATURATION AND CIRCUIT DEVELOPMENT. G. Manzano-Nieves[1,*], and K.G. Bath[2]. [1]Department of Neuroscience, Brown University, Providence, RI 02906. [2]Department of Cognitive, Linguistic, and Psychological Sciences, Brown University, Providence, RI 02906.

Prolonged stress incurred early in life increases the risk of developing anxiety and depressive-like behaviors in both humans and animal models. However, the effect of early life stress (ELS) on neural development, and their consequences on circuit activation are not well understood. Here we suggest that ELS is inducing the accelerated maturation of specific neuronal regions in juvenile mice leading to an imbalanced pattern of network connectivity in these developing mice. First, we demonstrate how ELS alters the developmental trajectories of parvalbumin positive (PV+) neurons in a region specific manner. Specifically we present evidence suggesting that ELS is primarily accelerating subcortical (e.g., amygdala, hippocampus), but not cortical (e.g., prefrontal cortex) maturation. Furthermore, we suggest that the ELS induced accelerated maturation profiles may be impacting the functional circuitry, leading to the differential behavioral phenotypes observed between control and ELS juvenile mice. To study the circuit imbalances caused by the accelerated maturation profiles we focus specifically on the basolateral amygdala. Using behavioral, optogenetic, and anatomical methods we assess changes in the projections to and from the basolateral amygdala.

BIMANUAL ACQUISITIONS DIFFER ACCORDING TO INFANT HAND PREFERENCE GROUP. E.C. Marcinowski[1,*], J.M. Campbell[2], and G.F. Michel[3]. [1]Department of Physical Therapy, Virginia Commonwealth University. [2]Department of Psychology, Illinois State University. [3]Department of Psychology, The University of North Carolina Greensboro. ecmarcinowski@gmail.com

Infants explore much of their environment using one or both hands. Thus, how infants use their hands likely affects how they acquire information about the environment and could affect a number of related, developmental processes. We describe the differences in bimanual hand use in relation to infant hand preference. Infants (n = 380; 189 males) had their hand preference assessed across 9 monthly visits from 6–14 months of age. The hand preference assessment comprised 32 toys presented either singly (26) or in pairs (6 pairs). Coders identified from video which hand(s) the infant used to acquire the object initially (right, left, or both). For each infant at each month, a handedness index (R/(R + L)) was identified from unimanual acquisitions (left/right) and a group-based trajectory analysis was performed to identify handedness groups in the individual trajectories (average posterior probability was 0.80). Four unique handedness subgroups were found: stable right (32.2%), trending right (25.4%), left (12.2%), or no hand preference (30.2%). Using a multilevel model, the trending right-handers and no preference group increased bimanual hand use more rapidly after 10 months, than stable right-handers (β = −.297, p = .34) and left-handers (β = −.500, p = .014). As predicted, the development of bimanual acquisitions differed according to the infant's hand preference. Infants without a preference and trending right-handers increased their frequency of bimanual hand use with age in similar ways. These findings have implications for understanding how infant hand preferences and bimanual hand use affects object exploration and, in turn, knowledge of object properties.

INFANT COGNITION AND COMT GENOTYPE PREDICT EARLY CHILDHOOD EXECUTIVE FUNCTIONS. J. Markant[1], A. Hodel[2], K. Offen[1], S.J. Sherman[2], K.L. Senich[2], D. Cicchetti[2], and K.M. Thomas[2]. [1]Department of Psychology, Tulane University, New Orleans, LA 70118. [2]Institute of Child Development, University of Minnesota, Minneapolis, MN 55455. jmarkant@tulane.edu

Cognitive control requires focusing on relevant tasks (cognitive stability) while remaining sensitive to novel information (cognitive flexibility). The COMT Val[158]Met gene has been linked to individual differences in cognitive control among adults and young infants, with the Met allele associated with enhanced stability and the Val allele associated with enhanced flexibility. The present study examined contributions of COMT genotype to continuity of cognitive control from infancy into early childhood. Ninety-five 7-month-olds were genotyped for COMT Val[158]Met. Infants were tested on a spatial cueing task to assess selective attention (i.e., inhibition of return) and a habituation-dishabituation task to assess learning. At Time 1, COMT genotype was related to both infants' selective attention and learning scores. Participants returned for additional testing at 5 years of age. Tasks included a working memory task and a spatial Simon task requiring inhibitory control. Of the initial sample, thirty-four participants provided genetic data and usable data on all four tasks. COMT genotype and infant attention and learning were examined as predictors of early childhood executive functions. Results indicated that 1) COMT and infant selective attention scores were reliable predictors of inhibitory control during the Simon task in early childhood and 2) COMT and infant learning scores were reliable predictors of working memory performance in early childhood. Thus, specific measures of attention and learning at 7 months of age predicted unique aspects of early childhood executive functions over and above individual differences in a known genetic marker of cognitive control.

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ATTUNEMENT OF MATERNAL-CHILD DIURNAL CORTISOL IS MODERATED BY CHILD MALTREATMENT. C.G. McDonnell and K. Valentino. Department of Psychology, University of Notre Dame, Notre Dame, IN 46565. cmcdonne@nd.edu

Maternal physiology and behavior are salient predictors of child physiology during early childhood; however, no study has examined how maternal physiology and sensitivity affect child physiology in the context of child maltreatment. Using a sample of 102 mothers (59 maltreating and 43 nonmaltreating) and their children (3–6 years), we examined the attunement of maternal and child diurnal cortisol levels and maternal sensitivity. Mother and child cortisol was collected from dyads three times a day (waking, midday, bedtime) on 2 consecutive days to assess daily levels and diurnal decline. Maternal sensitivity was objectively coded from video-recordings of two 10 min mother-child play sessions using the Maternal Behavior Q-Sort (MBQS). The association of maternal to child cortisol levels was moderated by maltreatment; attunement was weaker in maltreating than in non-maltreating dyads. Maternal sensitivity was not related to child cortisol. Future analyses will examine maternal and child negativity variables as explanatory mechanisms.

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MINDING THE GAP: PROGRESSION OF TEMPORAL PROCESSING DEFICITS IN THE HIV-1 TRANSGENIC RAT. K.A. McLaurin*, R.M. Booze, C.F. Mactutus. Department of Psychology, University of South Carolina, Columbia SC 29208. mclaurik@email.sc.edu

Despite the success of combination antiretroviral therapy (cART) in diminishing the prevalence of progressive HIV-1 encephalopathy (PHE) in children, high rates of chronic neurological impairment are still being reported. Temporal processing, as indexed by prepulse inhibition, appears to be a fundamental neurocognitive impairment in HIV-1. A longitudinal analysis of temporal processing deficits, assessed using the gap-prepulse inhibition (gap-PPI) experimental paradigm, may provide insight into the effect of long-term HIV-1 viral protein exposure on the development of chronic neurologic impairment. Male and female Fischer HIV-1 Tg and control animals were tested at 30-day intervals from postnatal day (PD) 30 to PD 180. HIV-1 Tg rats, which express 7 of the 9 HIV-1 genes, displayed alterations in the development of temporal processing on measures of the startle response (0 and 4000 msec interstimulus intervals (ISI)) and, more profoundly, on prepulse inhibition, assessed using mean area under the amplitude curve measurements. Presence of the HIV-1 transgene was diagnosed with 87.4% accuracy using gap-PPI measures on PD 30 and PD 180. Temporal processing deficits observed in the HIV-1 Tg rat, as assessed using gap-PPI resemble sensorimotor gating deficits commonly exhibited in HIV-1 seropositive individuals. Understanding the progression of temporal processing deficits in the HIV-1 Tg rat affords an opportunity to increase our understanding of the role of long-term exposure to HIV-1 viral proteins, observed in pediatric HIV-1, in the development of chronic neurological impairment, as well as suggest an innovative point-of-care screening tool.

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ODOR-INDUCED CRAWLING LOCOMOTION IN THE NEWBORN RAT: STEPPING PATTERNS AND VARIABILITY OF INTER-LIMB COORDINATION. V. Mendez-Gallardo[1], V. Nalluri[1], and S.R. Robinson[2]. [1]Department of Psychology, Penn State University-Brandywine, Media, PA 19063. [2]Pacific Ethological Laboratories, Olympia, WA 98501. vum12@psu.edu

Amniotic fluid (AF) and milk are biologically relevant stimuli that evoke behavioral responses in perinatal mammals. Among the behavioral effects of AF and milk described in the literature on neonates are attraction toward these stimuli, mediation of the development of flavor preferences, promotion of nipple search or attachment during suckling, and reduction of behavioral responsiveness to novel chemosensory stimuli. We previously have shown that exposure to AF and milk also evokes a crawling response towards these stimuli. The present study expanded on this finding and characterized the stepping pattern of the neonatal rat during the crawling test with AF and milk. One-day-old rat pups were exposed to 0.3 mL of AF collected on day 20 of gestation or commercially available half-and-half milk. Fluids were presented inside a 1.5 mL microcentrifuge tube that was placed over the pup's snout during testing. All pups expressed crawling during odor presentation. Video recordings from a ventral camera view (through glass) were used to observe the crawling response and to characterize patterns of stepping. Although a general stepping pattern resembling typical quadrupedal walking was observed, the sequence of footfalls, timing of steps, and duration of stance and swing phases of the step cycle were extremely variable. Newborn rats are indeed capable of crawling. But actual crawling bears little resemblance to the cartoon-like depictions often reported in studies of stepping on treadmills, air-stepping, or spinal cord explants in vitro.

NEONATAL PAIN AND REDUCED MATERNAL CARE INTERACT TO IMPACT BRAIN DEVELOPMENT. S.M. Mooney-Leber* and S. Brummelte. Department of Psychology, Wayne State University, Detroit, 48202. sbrummelte@wayne.edu

Preterm infants are exposed to a multitude of stressors and painful procedures while in the neonatal intensive care unit (NICU), most of which are mandatory for survival. However, exposure to painful procedures during the neonatal period may result in impaired brain development. Further, preterm infants also experience reduced maternal care due to the constraints of the NICU which may also have a profound negative impact on biobehavioral development. Thus the current study sought to investigate the biological consequences of neonatal pain in combination with reduced maternal care using a rodent model. First, rat pups within a litter were assigned to one of 5 groups: unhandled control, tactile control, pain group, reduced maternal care group, and pain and reduced maternal care. Painful procedures consisted of needle insertion into alternating paws several times a day. Pups in the reduced maternal care groups were placed in a tea-ball infuser for 30 min immediately following administration of painful procedures or tactile stimulation. We observed maternal care during and after tea-ball encapsulation and on postnatal day 8 rat pups underwent a cardiac perfusion and brains were collected for histological analysis. Results revealed that tea-ball pups received less maternal care (as intended), but still received sufficient nursing

(no difference in body weight). Further, we hypothesize that reduced maternal care and neonatal pain individually will produce impairments in brain development and that this deleterious effect will be exacerbated in pups that experienced both stressors.

BREAKING THE 4TH WALL: USING CLOSED-CIRCUIT TV & EYE-TRACKING TO PARSE THE VIDEO DEFICIT. A. Moser[1,*], S. Olsen[1], D. Hipp[2], S. Rusnak[3], R. Barr[3], and P. Gerhardstein[1]. [1]Psychology Department, Binghamton University, Binghamton, NY 13902-6000. [2]Department of Psychology, University of Denver, Denver, CO 80208. [3]Department of Psychology, Georgetown University, Washington, D.C. 20057. Amoster1@binghamton.edu

Observational learning is highly dependent on the physical and social context in which learning takes place. This learning has shifted dramatically with the increased use of TV, touchscreens and most recently videochat (McClure et al., 2015). Multiple studies have demonstrated that toddlers learn less from video than from live interactions. This "video deficit" may be due to physical or social discrepancies between 2D and 3D demonstrations (Moser et al., 2015; Zimmermann et al., in press). However, discriminating between these accounts remains difficult using current methods, such as pre-recorded videos that lack socially contingent information shown to facilitate word learning (Roseberry et al., 2014) and object retrieval (Troseth et al., 2006). To test these competing accounts, the current study employed a closed-circuit television (CCTV) setup to investigate the effect of social contingency in a 2D learning context using a well-established puppet imitation task. Eighteen- and 24-month-olds watched a socially contingent (videochat), pre-recorded (noncontingent), or live demonstration followed by an imitation test. Both behavioral and eye-tracking data were collected to investigate the relation between visual attention and performance across differences in the social context (contingent, noncontingent) and test dimension (2D, 3D). Preliminary results suggest that social contingency may lead to differential fixation patterns during the demonstration and a trend towards improved imitation performance during test. The emerging effect of social contingency suggests that parents and teachers may be able to bridge the gap in learning involving 2D media by enhancing the social context during learning.

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UNPREDICTABLE VARIABLE PRENATAL STRESS ALTERS EXPRESSION OF GENES INVOLVED IN APPETITE CONTROL AND ENERGY EXPENDITURE. E.L. Moyer[1,*], B. Al-Shayeb[1], L.A. Baer[2], and A.E. Ronca[1,3,4,5]. [1]Space Biosciences Division, NASA Ames Research Center, Moffett Field, CA. [2]Surgical Sciences, University of Texas Medical Center, Houston, TX. [3]Obstetrics and Gynecology, [4]Program in Neuroscience, [5]Molecular Medicine & Translational Science, Wake Forest School of Medicine, Winston-Salem, NC. eric.l.moyer@nasa.gov

Exposure to stress in the womb shapes neurobiological and physiological outcomes of offspring in later life, including body weight regulation and metabolic profiles. Our previous work demonstrated significantly increased body weight in male rats exposed to Unpredictable Variable Prenatal Stress (UVPS) as compared to non-stressed controls. In this study, we examine this fetal programming effect on the appetite control and energy expenditure pathways in prenatally stressed adult (90-day-old) male Sprague-Dawley rats. Time-mated female rats were exposed throughout pregnancy to UVPS consisting of white noise, strobe light, and tube restraint individually once per day on an unpredictable schedule for 15, 30 or 60 min. To control for potential changes in postnatal maternal care, newborn pups were fostered to non-manipulated, newly parturient dams. At 90-days postnatal, we analyzed plasma concentrations of hormones involved in appetite control and energy expenditure (leptin and adiponectin), and quantified expression of key genes in epididymal fat pads harvested from adult male offspring and controls. Leptin regulates energy balance by inhibiting hunger, and adiponectin modulates glucose levels and fatty acid breakdown. Our findings indicate significantly elevated plasma leptin concentrations and reduced expression of epididymal fat leptin (OB) and adiponectin (ADIPOQ) genes compared to controls. Analyses presently underway include quantification of plasma insulin and glucose, and the expression of ghrelin, a peptide that acts on the central nervous system and the body's perception of hunger. Collectively, these findings will further understanding of the consequences of UVPS on body weight regulation and metabolism.

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PRENATAL STRESS EXPOSURE PREDICTS 6-YEAR-OLD'S STRESS REGULATION: DISENTANGLING MATERNAL DEPRESSION AND EXPOSURE TO ANTIDEPRESSANTS. R. Neuenschwander[1,*], K. Hookenson[1], U. Brain[1], R.E. Grunau[1], A. Devlin[1], J. Weinberg[2], and T.F. Oberlander[1]. [1]Department of Pediatrics, Child and Family Research Institute, University of British Columbia, Vancouver, BC, V6H 3V4. [2]Department of Cellular and Physiological Sciences, University of British Columbia, Vancouver, BC, V6T 1Z3. rneuenschwander@cfri.ca

Prenatal exposure to maternal mood shapes the hypothalamic-pituitary-adrenal (HPA) axis. Little is known, however, about how combined exposure to prenatal maternal depression and serotonin reuptake inhibitor antidepressants (SSRIs) shapes a child's HPA axis during everyday and stress challenges in middle childhood. Maternal depression (Hamilton Depression Scale) was assessed at early and late 3rd trimester, and when children were 6 years old ($N = 134$, $n = 50$ SSRI-exposed, $n = 84$ non-exposed). Children's salivary cortisol was assessed 3 times on 4 consecutive days (diurnal profile) and during a lab challenge stress procedure at 6 years. Elevated diurnal cortisol levels across the day in 6-year-olds exposed to higher levels of maternal depression in the late, but not early, 3rd trimester were observed. Prenatal SSRI exposure was not associated with daily cortisol levels. Regarding cortisol responses to the lab stressor, a quadratic main effect was found for SSRI exposure and a linear main effect for maternal depression in late, but not early, 3rd trimester. Post-hoc analyses indicated that children with exposure to high maternal depression and no SSRIs ($n = 15$) showed the greatest cortisol reactivity, whereas children exposed to SSRIs and low maternal depression ($n = 15$) showed the least stress reactivity, controlling for concurrent maternal depression and child sex. Exposure to prenatal maternal depression and SSRIs thus appear to have different impacts on child HPA function, suggesting that prenatal maternal depression is associated with overall elevated cortisol levels, whereas prenatal exposure to SSRIs is associated with blunted stress reactivity. These findings have

important implications for child cognitive and emotional development.

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PATERNAL ALCOHOL EXPOSURE ALTERS BEHAVIOR OF ADULT MALE AND FEMALE OFFSPRING. S.J. Nieto[1,*], D.A. Nielsen[2], and T.A. Kosten[1]. [1]Department of Psychology, University of Houston, Houston, Texas, 77004. [2]Department of Psychiatry and Behavioral Sciences, Baylor College of Medicine, Houston, TX 77030. takosten@UH.edu

Familial transmission of alcohol use disorders reflects genetic and environmental factors. For decades, studies in rodents demonstrated that paternal alcohol exposure produces cognitive and physiological abnormalities in offspring. The mechanisms of these effects may reflect epigenetic modifications transmitted through the male germ line. However, little research has tested this notion. We exposed male Wistar rats to a chronic intermittent ethanol (EtOH) procedure (CIE) in alcohol vapor chambers (8 hr/day; 5 days/week; 6 weeks) or to air. Eight weeks later, rats were mated with EtOH-naive females and adult offspring (F1) were tested on EtOH-induced behaviors. Separate groups were administered EtOH (1.5 g/kg; IG) or water 30-min prior to testing for anxiety-like behaviors (elevated plus maze [EPM]), locomotor activity, and motor coordination (rotorod). Female, but not male, F1 offspring of paternal-alcohol exposed sires show less anxiety behaviors at baseline (EPM) or after alcohol administration (center time in locomotor apparatus). Male, but not female, F1 offspring of paternal-alcohol exposed sires show less sensitivity to alcohol-induced decreases in locomotor activity. Paternal-alcohol exposed offspring of both sexes exhibit deficits in motor coordination that is not impaired further by alcohol. We examined global DNA methylation levels in several brain regions and in sperm of the sires (F0). Levels were significantly higher in CIE rats ($p < .05$), particularly in hippocampus ($p < .01$). Studies in the F1 generation are ongoing. Overall, these results indicate that paternal alcohol exposure affects functional responsiveness in adult offspring which, in some cases, occurs in a sex-dependent manner and may reflect alterations in the epigenome.

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A MULTIDISCIPLINARY APPROACH TO INVESTIGATING WORK-RELATED WELL-BEING, STRESS REGULATION AND QUALITY OF PEDAGOGICAL WORK AMONG EARLY CHILDHOOD PROFESSIONALS. M. Nislin. Department of Teacher Education, University of Helsinki, FI-00014 Helsinki, Finland. mari.nislin@helsinki.fi

The aim was to investigate early childhood professionals' (ECP) stress regulation, work-related well-being and pedagogical work in kindergartens, as well as to determine whether these factors were connected. The goal was to enhance knowledge of working life in the field of early childhood education by utilising an interdisciplinary approach and multiple methodologies. The study was part of two larger projects undertaken by the Department of Teacher Education at the University of Helsinki and involved in total 206 ECPs from 45 kindergartens in Helsinki metropolitan area. Data was collected in 2009–2013 through salivary cortisol and alpha-amylase measurements, observational assessments of pedagogical work and surveys measuring work-related well-being. The results indicated that the ECPs generally found their work resources to be adequate, and, on average, their stress regulation was balanced. ECPs experienced high levels of work engagement, yet there were also participants who showed moderate signs of burnout. In addition, the results demonstrated the importance of social support, especially the role of the supervisor, which proved to be one of the key factors positively enhancing well-being at work. The main findings demonstrated the close relationship between ECPs' stress regulation and the quality of pedagogical work in teams. However, no associations between different biomarkers and work engagement and burnout were found. This study is novel in that it combines approaches from different disciplines to investigate work-related well-being among ECPs. The study highlights the importance of teamwork not only as fundamental to high-quality early childhood education, but also in supporting the well-being of ECPs.

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NEWBORN AUTONOMIC MEASURES PREDICT 1-MONTH AUTONOMIC FUNCTION DURING SLEEP. M. Ordonez-Retamar[1,*], N. Burtchen[1,2], N.H. Brito[1,3,] T. Thai[1], J.D. Nugent[1], M.M. Myers[1,3,4], and W.P. Fifer[1,3,4]. [1]Division of Developmental Neuroscience, New York State Psychiatric Institute, New York, NY 10032. [2]Department of Psychosomatic Medicine and Psychotherapy, University of Freiburg, 79104 Freiburg, Germany. [3]Department of Psychiatry, Columbia University, New York, NY 10032. [4]Department of Pediatrics, Columbia University, New York, New Yor 10032. ordonez@nyspi.columbia.edu

Previous studies have shown that instability in autonomic control (ANS) is associated with risk for Sudden Infant Death Syndrome (SIDS). However, no previous study has investigated if early neonatal markers of ANS function, specifically Heart Rate (HR) and Heart Rate Variability (HRV), are related to subsequent measurements of ANS control during the vulnerable period for SIDS starting at 1-month of age. Heart rate and respiration were recorded during supine sleep in 45 healthy newborns within 72 hr of delivery, and again at 1-month of age ($n = 39$). We utilized time domain derived basal HR and HRV measures as markers of ANS functioning. Newborn average HR and beat-to-beat variability during quiet sleep (QS) predicted QS these same autonomic measures at their one-month assessment (HR $r = .517$, $p < .05$; RMSSD $r = .468$, $p = .068$,), independent of sex and gestational age at birth. ANS data were not always obtainable in both sleep states during our standard 10-min baseline condition neonatal assessments. In order to explore whether measurements obtained during either sleep state could be used to characterize early risk, we examined correlations between newborn quiet and active sleep (AS) measures ($n = 44$). HR and HRV during newborn QS were highly and positively correlated with measures obtained during AS (HR $r = 0.812$, $p < 0.001$; RMSSD $r = .835$, $p < .001$). This newly found association could facilitate risk assessment independent of sleep state, as early as the first few days of life. Ultimately, early identification of risk for ANS related disorders could lead to timely intervention and more effective prevention strategies.

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NEURAL SUBSTRATES OF ATTENTION BIASES TO THREAT IN RISK FOR PEDIATRIC ANXIETY. K. Pérez-Edgar[1], S. Morales[1], N.

Thai[1], E. Auday[1], X. Fu[1], and B. Taber-Thomas[1,2]. [1]Department of Psychology, The Pennsylvania State University, University Park PA, 16802. [2]Department of Psychology, University at Buffalo, Buffalo NY, 14260. Kxp24@psu.edu

Attention biases (AB) to threat are evident in individuals with, and at risk for, anxiety. AB may play a causal role in anxiety and researchers are examining the utility of attention-bias modification (ABM) as a novel treatment. However, recent research questions the reliability of both AB measures and ABM. We know even less concerning AB and ABM in children. Understanding accompanying biological correlates may help probe the AB-anxiety link, noting markers for early identification and targets for intervention. We will present the behavioral, psychophysiological (ERP), and neural (fMRI) correlates of attention biases to threat in a large sample of children at risk for anxiety due to temperamental behavioral inhibition (BI). Behaviorally, we will show that BI predicts social anxiety when children show stable biases towards OR away from threat across bias tasks (Morales et al, in press). Neurally, BI children show perturbations in frontolimbic functioning when presented with visible (Fu et al., in press) and subliminal (Auday et al., under review) threat faces. These functional differences are subserved by variations in resting state connectivity (Taber-Thomas et al, in press). Finally, early ERP components (particularly the P1) moderate the relation between attention bias and anxiety (Thai et al, in press). We will then present data from the ongoing ABM trial. ABM is associated with decreases in anxiety symptoms vs. placebo. In addition, the ABM group presents decreased amygdala and increased PFC activity vs. baseline when completing our AB task (Pan, Taber-Thomas et al., in prep).

NEURAL PREDICTORS OF TRAJECTORIES OF ATTENTIONAL CONTROL AND EMOTION REGULATION. N.B. Perry[1,*], M.M. Swingler[1], S.D. Calkins[1], and M. Bell[2]. [1]Human Development and Family Studies, The University of North Carolina at Greensboro, Greensboro, NC 27412. [2]Psychology, Virginia Tech, Blacksburg, VA 24061. nicoleebperry@gmail.com

Attentional control and emotion regulation are critical for adaptive functioning across a range of developmental domains (Blair, Calkins, & Kopp, 2010). Although children show dramatic improvements in their ability to regulate their attention and emotion from infancy through childhood, the etiology of individual differences in this developmental progression is poorly understood. Current biopsychosocial theoretical perspectives underscore the importance of biological mechanisms in developmental pathways to and from complex behavior (Calkins, Perry, & Dollar, 2015). Maturation of the Executive Attention Network, encompassing the anterior cingulate cortex (ACC) and other areas of the prefrontal cortex (Posner, Rothbart, Sheese, & Voelker, 2012), are particularly important for the development and deployment of attention, as well as the modulation of emotional expression and experience (Bush, Luu, & Posner, 2000). In the current study, we examine growth trajectories of emotion regulation and attentional control across 6 time points (5, 10, 24, 36, 48, and 72 m) from infancy through early childhood ($N = 388$). We utilize electroencephalogram (EEG) measures of neural activity, organization, and development from scalp locations thought to reflect activity of the ACC and the greater executive attention network. Specifically, we examine baseline measures of EEG power, asymmetry, and coherence at each time point as time-varying predictors of the developmental trajectories of emotion regulation and attentional control. We aim to identify developmental periods in which neural organization incurs the most change and has the strongest influence on the development of attention and the regulation of emotion.

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BEHAVIORAL ACTIVITY CHANGES IN THE ADULT TO MIDDLE-LIFE PERIOD IN MALE RHESUS MONKEYS WITH DIFFERENT INFANT REARING EXPERIENCES. P.J. Pierre[1], P.D. Tenpas[2], and A.J. Bennett[2]. [1]Wisconsin National Primate Research Center, Behavioral Management Unit, University of Wisconsin-Madison, [2]Department of Psychology, University of Wisconsin-Madison, Madison, WI 53715 USA.

In humans, adverse early life experiences are associated with deleterious health outcomes across the lifespan. Although many studies have evaluated the effects of differential early rearing experiences on behavior in infant and juvenile monkeys, relatively few have examined whether the early rearing effects persist into later adulthood. In this study, activity levels were measured in adult male rhesus macaques who were either mother-reared ($n = 6$) or nursery-reared ($n = 6$) for the first 6 months of life. Activity was measured at six time-points over 7 years (age 10, 12, 13, 14, 15, and 16 years). For each time-point, activity was assessed for 30 consecutive 24 hr periods by using primate collars modified to house an Actiwatch™ (AW) actimeter. Linear mixed effects models (LMEM) with rearing group serving as a between-subjects variable and age as a continuous within-subjects variable were performed for the dependent variables: Total activity, activity during the light, and during the dark, phases of the light cycle. Activity in the light phase decreased with age, $b = -21.88$, $F(1, 9.93) = 7.22$, $p < 0.05$. However, total activity levels did not change across this 7-year timespan, nor did activity levels in the dark portion of the light:dark cycle. Infant rearing experience did not significantly affect activity, nor were there interactions between rearing and age. The findings suggest that the effects of infant rearing experience on activity may not persist into later adulthood, or that previously reported differences in activity between animals from these different rearing conditions may be related to context or maturational effects.

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GONADAL HORMONES MEDIATE MATERNAL CARE-PROGRAMMING OF ETHANOL-USE BEHAVIORS. D.O. Popoola* and N.M Cameron. Department of Psychology, State University of New York, Binghamton, New York USA.

Using Long Evans rats, we investigated maternal care's influence on ethanol consumption, and sensitivity to ethanol-induced sedation-hypnosis. Litters were categorized into high or low licking/grooming (High-LG, Low-LG). In experiment 1, adolescent or adult male and female High-LG and Low-LG offspring were tested for 5% v/v ethanol consumption and preference for four weeks in a two-bottle choice paradigm. The groups were males, Sham females and ovariectomized females. In experiment 2, sensitivity to ethanol-induced hypnosis was

tested during mid-adolescence, late-adolescence, and adulthood in males and females (metestrus) using the loss of righting reflex paradigm. In experiment 1, adolescent Low-LG females consumed less total fluid (ethanol + water) compared to High-LG but consumed more ethanol and preferred it to water. In adulthood, sham High-LG females consumed more ethanol and preferred it to water compared to Sham Low-LG. Male, as well as ovariectomized female High-LG and Low-LG did not differ in consumption and preference. In experiment 2, Low-LG male and female offspring were more sensitive to ethanol-induced sedation-hypnosis than High-LG at all tested doses during late-, but not mid-adolescence. Attenuated sensitivity persisted into adulthood in males but not females. These results suggest that early-life maternal care is capable of programming ethanol-use pattern and should be given significant consideration when assessing alcohol-use behavior. Furthermore, these differences appear to emerge during puberty. In females, maternal care effects on consumption are modulated by gonadal hormones. Future studies will investigate the mechanisms involved in maternal programming of these effects and the gonadal contribution in males.

THE ASSOCIATIONS BETWEEN MATERNAL ACCULTURATIVE STRESS AND ANXIETY SYMPTOMS ON MATERNAL AND INFANT HAIR CORTISOL. A. Preciado and K. D'Anna-Hernandez. Psychology Department, California State University, San Marcos, California 92069. Preci011@cougars.csusm.edu

Over half of women report increases in anxiety symptoms while pregnant and this maybe more so in the Mexican-American population. Pregnant Mexican-American women experience high levels of psychosocial factors that could place the mother-child dyad at risk for adverse perinatal outcomes. Mexican American women also experience acculturative stress, the stress from the psychological and cultural changes when interacting between cultures, but whether this impacts prenatal anxiety levels and related biological markers in the mother/child dyad is unknown. The use of chronic stress-related biomarkers, such as hair cortisol, may contribute to the understanding of cultural stressors in the perinatal period. Mexican American pregnant women (n = 155) completed three visits during pregnancy to assess state anxiety, acculturative stress, and hair cortisol. Hair samples from a subset of newborns were also collected. Multilevel model analysis showed acculturative stress was significantly associated with trajectory of anxiety symptoms across pregnancy (b = −.046, $t(143)$ = −2.004, p = .047). No significant associations were found with maternal or infant hair cortisol. Separate trimester analysis suggests that high levels of state anxiety symptoms were associated with high levels of acculturative stress during the first (R^2 = 0.038, B = .108, SE = .044, t = 2.45, p = .015) and second trimester (R^2 = .036, B = .099., SE = .043, t = 2.319, p = .022), but not the third trimester. This study suggests culturally specific stressors are associated with maternal mental health. Further work on the potential fetal programming effects of acculturative stress is needed.

PATTERNS OF BRAIN ELECTRICAL ACTIVITY DURING COGNITIVE FLEXIBILITY PERFORMANCE IN EARLY CHILDHOOD. V. Rajan[1] and M. A. Bell[2]. [1]Department of Behavioral and Social Sciences, University of the Sciences, Philadelphia, PA, 19104, USA. [2]Department of Psychology, Virginia Tech, Blacksburg, VA, 24061, USA. v.rajan@usciences.edu

The present study examined patterns of brain electrical activity associated with cognitive flexibility performance in a sample of 4- and 6-year-old children (N = 44). Continuous electroencephalogram (EEG) measures were recorded at the 6–10 Hz frequency band during the Dimensional Change Card Sort (DCCS) Task and during a baseline phase. Children were divided into three cognitive flexibility performance groups (Group 1: Fail Post-switch; Group 2: Pass Post-switch/Fail Border; and Group 3: Pass Post-switch & Border) based on DCCS performance. Repeated measures MANOVAS revealed main effects for condition, $F(1, 41)$ = 4.762, p < .05, region, $F(7, 35)$ = 29.903, p < .001), and a performance group X condition interaction, $F(2, 41)$ = 2.910, p = .06. Children in the high performance groups (i.e., children who passed the post-switch phase of the task) exhibited an increase in EEG power from baseline to task [Group 2: $t(27)$ = −2.945, p < .01, Group 3: $t(7)$ = −2.100, p = .07]. In contrast, children in the low performance group who failed the post-switch phase (Group 1) showed no change in EEG power from baseline to task, $t(7)$ =.966, p = .366. These results suggest that patterns of task-related electrophysiology can differentiate successful and unsuccessful cognitive flexibility performance.

ENHANCED ERROR MONITORING AND ATTENTIONAL CONTROL ABILITY IN YOUTH WITH AND WITHOUT ANXIETY. M.L. Ramos[1,*], M. Bechor[1], J.W. Pettit[1], W.K. Silverman[2], and B.C. Reeb-Sutherland[1]. [1]Department of Psychology, Florida International University, Miami, FL USA. [2]Child Study Center, Yale University School of Medicine, New Haven, CT USA. mramo033@fiu.edu

Anxiety disorders are one of the most common psychological disorders observed within a pediatric population, and does not appear to be a fleeting phenomenon. Thus, understanding the neural mechanisms underlying its etiology and manifestation in childhood is imperative. The error-related negativity (ERN), has been identified as a neural correlate of anxiety, as this ERP component has been observed to be much more negative within an anxious population relative to healthy controls. It has been suggested that the enhanced ERN observed within anxious populations may be attributed to attentional control. Attentional control refers to one's ability to choose what to pay attention to and what to ignore, and this ability is suggested to be impaired. As little work as focused on attentional control and increased ERN amplitudes in youth, the current study examined the relation between this component and attention in youth with an anxiety disorder (N = 21, 14 males, 11.63 years) and non-anxious youth (N = 19, 13 males, 10.90). Youth completed the arrow version of the Eriksen flanker task while simultaneous EEG was collected. Youth completed the child version of the Attentional Control Scale, and parents completed the Parent version of the Screen for Child Anxiety Related Disorders to assess child anxiety symptoms. Finding suggest that attentional control may play a role in the increased ERN exhibited by youth with anxiety. Mean differences in attentional control ability and ERN amplitudes are significantly different, with anxious youth scoring significantly lower on the ACS-C, and expressing more negatively neural responses to error.

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COVERT ATTENTION AND GAZE DURING INFANT FREE-LOOKING. S.S. Robertson. Department of Human Development, Cornell University, Ithaca, NY 14853. ssr4@cornell.edu

We have shown that the dynamics of infant visual foraging can be probed by monitoring covert attention (CA) in real time using steady state visual evoked potentials (SSVEPs). Our results demonstrate robust inhibition of return − slower gaze shifts back to the target of CA − following short as well as long delays after the SSVEP-measured termination of CA. This suggests that facilitation of return, sometimes found after short delays in spatial cuing experiments, may actually occur only in response to events delivered during CA. Thus, in the current study of 52 3-month-olds we delivered events (brief rotation of 2 objects on opposite sides of a fixated object) during CA to one peripheral object, defined as high SSVEP amplitude driven by that object and low SSVEP amplitude driven by the other for 250 ms. The latency of gaze shifts to the target of CA was faster (882 vs. 1324 ms, $p = .013$) in response to events delivered during versus 625 ms after CA, but the effect was limited to moderate magnitudes of CA. Reduced effects on shift latency are expected when CA magnitude is small. Reduced effects when CA magnitude is large were not expected and are being investigated further. Facilitation and inhibition of return during infant free-looking may aid visual exploration by speeding the redirection of high-resolution foveal vision toward locations at which CA is currently engaged (to support information gathering), and away from locations from which CA has recently been withdrawn (to inspect other potentially more informative locations).

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AGE AND EXPERIENCE-DEPENDENT CHANGES IN EGR-1 EXPRESSION DURING THE ONTOGENY OF THE CONTEXT PREEXPOSURE FACILITATION EFFECT (CPFE). P.A. Robinson-Drummer*, T. Chakraborty, N.A. Heroux, J.B. Rosen, and M.E. Stanton. Psychological and Brain Sciences, University of Delaware, Newark, Delaware, 19716. probinson@psych.udel.edu

The context preexposure facilitation effect (CPFE) is a variant of contextual fear conditioning in which acquisition of the contextual representation, association of the retrieved contextual memory with an immediate footshock, and retrieval of the context-shock association are each separated by 24 hr. During the CPFE, learning-related expression patterns of the early growth response −1 gene (Egr-1) vary based on training phase and brain sub-region in adult and adolescent rats (Asok et al., 2013; Shreiber et al., 2014; Chakraborty et al., 2016). The current experiments extended our previous findings by examining Egr-1 expression in infant (PD17) and juvenile (PD24 rats during the CPFE. Following a 5 min preexposure, Egr-1 expression in the medial prefrontal cortex (mPFC), dorsal hippocampus (dHPC) and lateral nucleus of the amygdala (LA) was differentially increased in PD24 rats relative to PD17 rats. In contrast, increased Egr-1expression following an immediate footshock (1s, 1.5 mA) did not differ between PD17 and PD24 rats, and was not learning-related. Interestingly, increased exposure to the training chamber on the preexposure day altered training-day expression in PD24 rats such that a learning-related increase in expression was observed in the mPFC on the training day. Together, these results illustrate a clear maturation of Egr-1expression that is both age and experience dependent. In addition, the data suggest that regional activity and plasticity within the mPFC may contribute to the ontogenetic profile of the effect. Further study is necessary to elucidate the role of subregion-specific neuroplasticity in the ontogeny of the CPFE.

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ASSOCIATIONS BETWEEN NEUROBEHAVIORAL AND EEG MEASURES AT 9 AND 15 MONTHS OF AGE. D.J. Rodriguez[1,*], C. Rodriguez[1], N.H. Brito[1], T. Thai[1], P.G. Grieve[3], M.M. Myers[1,2], C. Monk[2], and W.P. Fifer[1,2]. [1]Division of Developmental Neuroscience, New York State Psychiatric Institute, New York, New York, 10032. [2]Department of Psychiatry, Columbia University, New York, New York, 10032. [3]Department of Pediatrics, Columbia University, New York, New York, 10032. drodrig@nyspi.columbia.edu

Past research has shown links between newborn electroencephalogram (EEG) and subsequent behavioral outcomes in toddlerhood, where frontal power is correlated with attention and memory. This prospective study assessed neurodevelopment of 17 healthy toddlers from 9 to 15 months of age. EEG was collected during awake "resting state" 10-min baseline while quietly sitting on the mothers lap and visually attending to an interesting toy. Neurobehavioral assessments were performed using the Visual Paired Comparison test (VPC) and Bayley Scales of Infant Development III. Performance on VPC at 9 months was highly correlated with scores at 15 months ($r = .68$, $p = .004$), as were Bayley cognitive scores ($r = .51$, $p = .039$). EEG was also correlated across ages for several frequency bands, primarily in the frontal regions. Particularly robust stable patterns across ages was found for high gamma (30–50 Hz) power in the left frontal region ($r = .61$, $p = .028$) and for theta (3–6 Hz) in left frontal regions ($r = .73$, $p = .005$). Baseline EEG and neurobehavioral measures at 9 months were not correlated and no significant associations were found between theta power and scores at either age. However, high gamma power at 15 months was positively correlated with the Bayley cognitive measure at the same age ($r = .54$, $p = .047$). These results suggest that individual differences in EEG power and neurobehavioral capacity are relatively stable across these ages and that measures of high frequency brain activity are related to cognitive developmental capacities at 15 months.

ADVERSE CHILDHOOD OUTCOMES AND RISK FOR NEGATIVE MENTAL HEALTH OUTCOMES. T.M. Rushe, P. Fletes-Houston and D. Redmond. School of Psychology, Queen's University, Belfast. Malone Road, Belfast. BT7 1NN. Northern Ireland, UK. t.rushe@qub.ac.uk

Adverse Childhood Experiences (ACEs) are associated with a range of negative neurodevelopmental outcomes in adulthood, including psychosis in its clinical and sub-clinical forms, as well as substance misuse. The purpose of the present study was to explore the link between ACEs, sub clinical psychotic symptoms (Schizotypy) and substance use in a community sample of young adults, and to further investigate whether resilience and/or attachment style are mediators of these associations. The study employed a cross-sectional survey design, using online survey methodology to recruit a Northern Irish convenience sample of normally developing young adults ($n = 106$), aged 18–25 years. Results supported previous research that a strong

positive correlation ($r = 0.55$, $p < 0.0001$) exists between total ACE-IQ score and schizotypy score and that higher ACE-IQ scores was associated with higher risk of ever using drugs (OR = 1.3, $p < .05$). Preliminary mediation analysis showed that the link between ACEs and Schizotypy scores was mediated through anxious and avoidant attachment style. If, as the data suggests, maladaptive Attachment styles are part of a process through which ACEs predict Schizotypy, then this could be a worth-while target area for intervention strategies in those at high risk for developing psychosis and related disorders.

CHILDREN'S STRESS RESPONSES, BIOLOGICAL GIVENS, COGNITIVE ABILITIES, AND FAMILY BACKGROUND AT THE BEGINNING OF DAY CARE IN TODDLERHOOD. N. Sajaniemi, E. Suhonen, M. Nislin, Department of Teacher Education, University of Helsinki, FI-00014 Helsinki, Finland. nina.sajaniemi@helsinki.fi

We aimed to investigate the diversity of stress regulation in relation to temperament, cognitive performance and SES in children who were beginning of out of home care before 2 years of age. Whilst children's stress regulatory systems are extremely vulnerable to environmental influences little is known about how temperament and family characteristics impact on stress regulation in early years. Stress regulation was assessed by measuring salivary cortisol and alpha-amylase activity during a day-care day and weekend day. Cognitive performance was assessed using Bayley-test and children temperament with ECBQ-questionnaire. Family characteristics (SES, parental stress) were assessed with surveys. There were significant individual differences between children, and on average toddlers showed higher levels of cortisol during day care day compared to weekend day. There were no associations between stress regulation and temperament or cognitive performance but there were gender differences: boys scored lower on cognitive tests and their cortisol values were lower. This suggests that boys are more vulnerable to environmental stressors and this vulnerability may impact on the development of cognition. EC educators must focus on providing emotional support to mitigate the impact of stress.

URINARY EPINEPHRINE, NOREPINEPHRINE AND MELATONIN AT 18 MONTHS IN A SAMPLE OF INFANTS WITH PRENATAL SSRI EXPOSURE. A.L. Salisbury[1], G.M. Anderson[2], J.A. Mattera, and [1]C.L. Miller-Loncar[1]. [1]Women & Infants Hospital, Alpert Medical School at Brown University, Providence, RI, USA. [2]Yale Child Study Center, New Haven, CT, USA. amy_salisbury@brown.edu

Stress and circadian systems are affected by antidepressant treatment; components of these systems, including the sympathetic nervous system, the adrenomedullary system and the pineal, can be assessed via measurement of urinary norepineprine, epinephrine and melatonin sulfate excretion. The measures might provide important biomarkers for behavioral patterns leading to later psychopathology. Long term changes in neuronal structure have been documented in animals following selective serotonin/norepineprhine reuptake inhibitor (SRI) exposure. Human studies document relations between maternal and infant norepinephrine. This study examined the diurnal pattern of urinary excretion of melatonin, norepinephrine, and epinephrine in infants exposed in-utero to SRIs and maternal depression. The current study draws from a prospective longitudinal study of pregnant women and their infants followed from the second trimester of pregnancy through 18-months post-delivery. Mothers and their infants were categorized into 3 groups based on standardized measures of current psychiatric diagnoses and treatment during pregnancy: No depression/no SRI use ("NoEXP"), Depression/no SRI use ("DEP"), and Depression/with SRI use ("SRI"). Overnight and daytime urine samples were collected from 60 18-month-old infants and melatonin, epinephrine, and norepinephrine excretion rates (expressed as per mg of creatinine) were determined. General Linear Models were used to examine group differences in excretion rates across day and night samples. Infants in the NoEXP and SRI groups showed the expected decrease from day to nighttime levels of epinephrine whereas infants in the DEP group did not show a significant change. Excretion rates and diurnal pattern of excretion for norepinephrine and for melatonin did not differ significantly across groups. These data will be discussed in the context of maternal depression and concurrent infant sleep and behavior.

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THE RELATIONSHIPS BETWEEN GESTATIONAL SRI EXPOSURE, SRI BIOEFFECT, AND INFANT NEUROBEHAVIORAL OUTCOMES. A.L. Salisbury[1], G.M. Anderson[2], C.L. Miller-Loncar[1], and J.A. Mattera[1]. [1]Women & Infants Hospital, Alpert Medical School at Brown University, Providence, RI, USA. [2]Yale Child Study Center, New Haven, CT, USA. amy_salisbury@brown.edu

Gestational exposure to selective reuptake inhibitors (SRI) contributes to alterations in newborn neurobehavior. However, there is a lack of clarity on the nature and mechanisms of these findings. Gestational SRI exposure reduces fetal platelet serotonin (5-hydroxytrptamine, 5-HT) due to SRI inhibitory bioeffect at the platelet 5-HT transporter which can be used as a proxy for CNS bioeffects. To examine relationships between infant platelet 5-HT levels, plasma drug levels, maternal prenatal SRI dosage/duration, and newborn neurobehavior, pregnant women were given standardized interviews to determine depression diagnosis and gestational SRI use, dosage, and timing. Cord blood ($N = 79$) and maternal blood samples ($N = 85$) were assayed for platelet 5-HT and plasma SRI drug levels. Standardized infant neurobehavioral assessments were completed five times across the first postpartum month. General linear models examined relationships between the variables of interest.As expected, platelet serotonin levels were significantly lower for mothers using SRIs in pregnancy and for their infants compared to unexposed mothers and infants; and significant correlations were observed between maternal and infant SRI drug levels. Mean daily dose and duration of SRI use was significantly negatively correlated with infant 5-HT levels, but not with maternal 5-HT or SRI drug levels. Lower infant 5-HT (indicating greater SRI bioeffect) predicted higher stress signs and lower attention within the first postnatal week. Longer duration of gestational SRI exposure was related to more stress signs, higher excitability and lower attention after the first 2 postnatal weeks. Assessing SRI bioeffect allowed a more precise determination of SRI exposure effects on neurobehavioral outcomes and indicated that early SRI behavioral effects are graduated depending on degree of bioeffect at the transporter.

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ADOLESCENT EXPOSURE TO METHYLMERCURY INCREASES THE RATE OF MEMORY SATURATION AND DECREASES MINIMUM RESPONSE TIME IN MICE. R.A. Sauer*, S.R. Boomhower, and M.C. Newland. Psychology Department, Auburn University, Auburn, Alabama 36849. ras0046@auburn.edu

Human exposure to methylmercury (MeHg), an environmental neurotoxicant that bioaccumulates in fish, is a significant public health issue in the United States and abroad. Adolescence may represent a period of increased susceptibility to MeHg because brain regions underlying choice and decision making mature during this time and adolescents consume more fish high in MeHg than younger populations. To assess whether adolescent MeHg exposure results in long-lasting behavioral changes, thirty-six male C57Bl/6n mice were randomly assigned to three MeHg exposure groups (n = 12 in each): 0, 0.3, and 3.0 ppm MeHg (via drinking water). Exposure lasted from postnatal day (PND) 21 to 60, the murine adolescent period. As adults (PND 300), mice were trained to press a lever for a 0.1-cc droplet of sweetened-condensed milk solution. Lever pressing was placed under a multiple fixed-ratio (FR) schedule of reinforcement in which the number of lever presses for milk delivery increased within a session (FR 1, 5, 15, 30, 60 and 120). Response rates (lever presses/sec) were analyzed using Mathematical Principles of Reinforcement, a theoretically-driven model of reinforcement-based learning. Adolescent MeHg exposure decreased estimates of minimum response time, indicating psychomotor enhancement. The highest dose of MeHg also increased saturation rate, indicating that past target responses were less likely to be strengthened by reinforcement. These findings suggest that adolescence may represent a vulnerable developmental window during which neurotoxicant exposure may have long-lasting behavioral effects.

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FATHER TESTOSTERONE ACROSS THE TRANSITION TO PARENTHOOD. D.E. Saxbe, A.B. Tsai, H.A. Lyden, G.W. Corner, S.A. Stoycos, and M. Khaled. Psychology Department, University of Southern California, Los Angeles, California, 90089. dsaxbe@usc.edu

Testosterone, a hormone that supports mating and aggression, has been associated with fathering behavior. Cross-sectionally, lower testosterone have been found in partnered human fathers and fathers with greater childcare involvement. The current study measured the salivary testosterone of first-time expectant fathers prenatally and at six months postpartum. On average, testosterone decreased from prenatal to postpartum assessments. Fathers' prenatal testosterone was negatively associated with their trait empathy, $r(32) = -.35$, $p = .05$ and partners' ratings of spouse support, $r(37) = -.42$, $p = .01$ and subsequently predicted greater parenting stress ($r(23) = .42$, $p = .04$. Paternal testosterone may be an important marker of father motivation to invest in the family.

OXYTOCIN RECEPTOR DISTRIBUTION IN THE PRAIRIE VOLE (MICROTUS OCHROGASTER) NEOCORTEX. A.M.H. Seelke[1], A. Duchemin[1,2], T.C. Simmons[1], S.M. Freeman[3], and K.L. Bales[1]. [1]Department of Psychology, University of California, Davis, Davis, CA USA 95616. [2]Department of Biology, Ecole Normale Superieure de Cachan, Cachan, France. [3]California National Primate Research Center, University of California, Davis, Davis, CA USA 95616. amseelke@ucdavis.edu

The neuropeptide oxytocin (OT) is involved in social behaviors including the formation of pair bonds in prairie voles (Microtus ochrogaster). Prairie voles are socially monogamous and biparental rodents that exhibit well-characterized complex social behaviors. The distribution of OT receptors in the prairie vole brain has been well documented in the limbic system and hypothalamus, however the distribution of OT receptors in the neocortex has never been examined. Using autoradiography, we measured the relative density of OT receptors in the nucleus accumbens (NAcc), primary somatosensory cortex (S1), primary auditory cortex (A1), primary motor cortex (M1), parietal association area (PAA), temporal association area (TAA), insular cortex (Ins), and limbic areas of the cortex (Lim). OT density was compared across areas using ANOVA. As expected, the NAcc exhibited high OT receptor density, but surprisingly, this value did not significantly differ from OT receptor density in the Ins, Lim, or Taa. The Paa and M1 exhibited significantly lower OT receptor density, and the OT receptor density in A1 was lower still. Finally, the density of OTR in S1 was significantly lower than in all other areas. These results demonstrate a non-homogenous distribution of OT receptors throughout the cortex, with the highest density in association areas and the lowest density in primary sensory and motor areas. Developmental changes in OT levels caused by differences in parental care result in altered cortical organization, and the high density of OT receptors in association cortex may be the force driving those effects.

PREVIOUS INSTITUTIONALIZATION IS FOLLOWED BY BROADER AMYGDALA-HIPPOCAMPAL-PFC NETWORK CONNECTIVITY DURING AVERSIVE LEARNING IN HUMAN DEVELOPMENT. J.A. Silvers[1], D.S. Lumian[2], L. Gabard-Durnam[3], D.G. Gee[4], B. Goff[1], D.S. Fareri[5], C. Caldera[1], J. Flannery[6], E.H. Telzer[7], K.L. Humphreys[8], and N. Tottenham[3]. [1]Department of Psychology, University of California-Los Angeles, Los Angeles, CA 90095. [2]Department of Psychology, University of Denver, Denver, CO 80208. [3]Department of Psychology, Columbia University, New York, NY 10027. [4]Sackler Institute for Developmental Psychobiology, Weill Cornell Medical College, New York, NY 10065. [6]Department of Psychology, University of Oregon, Eugene, OR 97403. [6]Gordon F. Derner Institute of Advanced Psychological Studies, Adelphi University, Garden City, NY 11530. [7]Department of Psychology, University of Illinois-Urbana-Champaign, Champaign, IL 61820. [8]Department of Psychology, Stanford, Stanford, CA 94305. silvers@ucla.edu

Early institutional care can be profoundly stressful for the human infant, and as such, can lead to significant alterations in brain development. In animal models, similar variants of early adversity have been shown to modify amygdala-hippocampal-prefrontal cortex development and associated aversive learning. The current study examined this rearing aberration in human development. Eighty-nine children and adolescents who were either previously institutionalized (PI youth) (N = 46; 33F/13M; 7–16 years) or were raised by their biological parents from birth (N = 43; 22F/21M; 7–16 years) completed an aversive learning paradigm while undergoing functional neuroimaging wherein visual cues were paired with either an aversive sound or no sound (CS+ and CS−, respectively). For the PI youth, better aversive learning was associated with higher concurrent trait anxiety. Both groups showed robust learning and amygdala activation for

CS+ versus CS− trials. However, PI youth also exhibited broader recruitment of several regions and increased hippocampal connectivity with prefrontal cortex. Stronger connectivity between the hippocampus and vmPFC predicted significant improvements in future anxiety (measured 2 years later), and this was particularly true within the PI group. These results suggest that for humans as well as other species, early adversity alters the neurobiology of aversive learning by engaging a broader prefrontal-subcortical circuit than same-aged peers. These differences are interpreted as ontogenetic adaptations and potential sources of resilience.

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NEONATAL IMITATION PREDICTS SOCIALITY IN ONE-YEAR-OLD RHESUS MACAQUES. E.A. Simpson[1], S.S.K. Kaburu[2], A. Paukner[3], SJ. Suomi[3], and P.F. Ferrari[4]. [1]Department of Psychology, University of Miami, Coral Gables, FL 33146. [2]Department of Population Health and Reproduction, University of California, Davis, CA 95616. [3]Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Dickerson, MD 20842. [4]Dipartimento di Neuroscienze, Università di Parma, 43100 Parma, Italy. simpsone@miami.edu

Accumulating evidence from animal models suggests that neonatal imitation is a marker for deficits in sociality. Infant monkeys who fail to exhibit neonatal imitation are less socially attentive and exhibit poorer social cognitive skills, such as gaze following (looking where another individual looks). Here we investigated whether newborn monkeys' capacity to imitate facial gestures is a predictive marker for the emergence of social competencies later in development, at 1 year of age. We first assessed whether infant macaques (n = 126) imitate lipsmacking—an affiliative expression—performed by a human experimenter in their first week of life. We then collected data on infants' social interactions (aggression, grooming, and play) and self-scratching (an indicator of anxiety) at 11–14 months, when infants were transferred into a new enclosure with a large social group. We found that neonatal imitators exhibited more dominant behaviors, ere less anxious, and, for males only, spent more time in play at 1 year of age. These findings suggest that neonatal imitation may be an early predictor of infant sociality. Extending this line of research—individual differences in neonatal imitation—to humans is critical to understanding neurodevelopmental disorders marked by social dysfunction, such as autism spectrum disorder.

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AN INVESTIGATION OF ATTENTIONAL BIASES TOWARDS EMOTIONAL MALE AND FEMALE FACES IN EARLY CHILDHOOD. R.N. Sims*, J.L. Burris, and S.M. Rivera. Department of Psychology, University of California, Davis, CA 95616. rnsims@ucdavis.edu

MacLeod et al.'s (1989) dot probe task (DPT) is the cornerstone research methodology employed for measuring attentional bias towards emotional stimuli in adolescence and adulthood. In the current study we administered a modified eyetracking DPT to investigate, for the first time, young children's attention biases to emotional stimuli, and to specifically explore children's attentional bias towards the gender of the faces presented in the task. We administered our task to 122 children (53 girls), ranging from 9 to 49 months of age. We found that across age groups, participants performed differently towards emotional female and male faces ($F(1,118) = 37.85$, $p < .0001$). Participants were significantly biased towards emotional female faces, yet were significantly avoidant of emotional male faces. This suggests that young children may differentially attend to gender based upon differences in early experience. Further analysis showed that age was significantly negatively correlated with bias towards emotional female faces ($r(120) = -.18$, $p < .05$), but not with emotional male faces. These data highlight the importance of examining both the age-related changes in children's attentional biases towards emotional stimuli and the underlying factors contributing to young children's differential processing of gendered stimuli using the DPT.

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PARASYMPATHETIC NERVOUS SYSTEM FUNCTIONING PREDICTS BEHAVIORAL CHANGES IN CHILDREN EXPOSED TO EARLY LIFE STRESS. K.E. Smith[1,*] and G.J. Norman[1,2,3]. [1]Department of Psychology, University of Chicago, Chicago, IL, 60637. [2]Center for Cognitive and Social Neuroscience, University of Chicago, Chicago, IL, 60637. [3]Grossman Institute for Neuroscience, University of Chicago, Chicago, IL, 60637. kelsmith@uchicago.edu

Early life stress has been associated with a host of emotional and behavioral difficulties for children later in life. There is evidence that autonomic regulation, particularly changes in parasympathetic nervous system regulation of cardiac functioning, is predictive of some of the effects of early life stress on emotional and behavioral outcomes, as well as children's susceptibility to interventions aimed at improving these outcomes. The purpose of the current study was to examine whether children's initial autonomic cardiac functioning is associated with social and emotional behavioral responses to a preschool program targeting children exposed to early life stress. The study included 26 children enrolled in the preschool program. Children's behavior and physiological functioning were assessed daily via teacher ratings and ambulatory physiological monitors. The study found that overall children's behavior improved over the course of the program. Additionally, this change was predicted by children's parasympathetic functioning at the beginning of the program, with children with low initial parasympathetic nervous system activity exhibiting more behavior regulation difficulties at the beginning of the program. However, these same children also demonstrated greater improvement in regulatory behaviors over the course of the program. This suggests that while low parasympathetic nervous system functioning is associated with initial behavioral difficulties in children exposed to early life stress, these children maintain the capacity to improve social and emotional behavioral regulation, and indeed demonstrate the most improvement during the preschool program studied.

TRANSGENERATIONAL EFFECTS OF PRECONCEPTIONAL STRESS & GESTATIONAL ANTIDEPRESSANT EXPOSURE. A.M. Suleiman* and S. Brummelte. Department of Psychology, Wayne State University, Detroit, MI, 48202. sbrummelte@wayne.edu

Recent research suggests that stress can lead to epigenetic changes that can be transmitted from parents to children and grandchildren. However, less is known about the transgenerational effects of gestational drug exposure. The current study was designed to test transgenerational effects of gestational antidepressant exposure using a rodent model of maternal depression based on

giving high levels of the stress hormone corticosterone (40 mg/kg) for 21 days before pregnancy. "Depressed" (corticosterone-treated) or healthy female rats (F0 generation) received sertraline (a selective serotonin reuptake inhibitor; SSRI; 20 mg/kg) or vehicle via oral gavage ~5 days prior to mating and continued the treatment until the end of gestation. The resulting F1 generation females were mated with new male rats in adulthood to produce the F2 generation that was investigated in this study. Male and female F2 rats were tested in the Forced Swim Test for depressive-like behavior, the Open Field Test for anxiety-like behavior, and the Restraint Stress Test for Hypothalamic-Pituitary-Adrenal axis function. Furthermore, the F2 brains will be analyzed for hippocampal neurogenesis. Preliminary results suggest a transgenerational effect of preconceptional stress hormone exposure on the F2 litter weights but surprisingly there was no strong effect on the adult behavioral outcome, nor was there any transgenerational effect of the gestational antidepressant exposure.

DOES ANKLE PROPRIOCEPTION CONTRIBUTE TO SELECTIVE RECRUITMENT OF FLEXOR MUSCLES DURING REPETITIVE LEG MOVEMENTS IN CHICK EMBRYOS? S. Sun* and N.S. Bradley. Division of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA 90089. sooyeons@usc.edu

Chick embryos spontaneously generate repetitive limb movements (RLMs) characteristic of locomotion beginning several days before hatching. During RLMs, flexor and extensor muscles are alternately active. However, flexor muscles are more consistently recruited than extensors across RLM cycles. We hypothesized that proprioceptive input generated by the flexed posture and movement in ovo contributes to the more consistent recruitment of flexor than extensor leg muscles. Embryonic day 20, ankle flexor (tibialis anterior, TA) and extensor muscle activity (lateral gastrocnemius, LG) was recorded during RLMs. Muscles were recorded bilaterally to control for postural asymmetry. EMG was recorded for 2 hr pre and post cut of the left TA or LG tendon (10 TA, 10 LG tenotomies); in 4 experiments, the right TA or LG was subsequently tenotomized, and recording continued for 2 hr. The number of TA and LG bursts was compared pre/post tenotomy in both ankles. Neither TA nor LG tenotomy altered the consistency of muscle recruitment during RLMs in either ankle. On average, TA burst counts were twice that of LG counts pre/post tenotomy. TA was consistently recruited across all cycles in 85–92% of RLMs pre/post TA or LG tenotomy. LG was consistently recruited in only 28–42% of RLMs pre/post tenotomy. Bilateral TA or LG tenotomy did not alter these trends. Results indicate that ankle proprioception does not contribute to the more consistent recruitment of flexors compared to extensors during RLMs under normal postural conditions in ovo. Our findings suggest that this bias in recruitment is centrally determined.

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MATERNAL POSTPARTUM DEPRESSIVE SYMPTOMS AFFECT INFANT ATTENTION TO SAD FACES. D. A. Swales*, L. Berger, L. Gulley, B. Hankin, and E. Davis. Department of Psychology, University of Denver, Denver 80208. danielle.swales@du.edu

Early exposure to maternal postpartum depressive symptoms is a profound and well established risk factor for the development of later internalizing forms of psychopathology. We evaluate the effect of maternal depressive symptoms on infant risk processes that may contribute to the intergenerational transmission of risk for psychopathology. The current study explores the association between maternal depressive symptoms in the postpartum period, and infant attentional biases to affective stimuli using a visual paired comparison eye-tracking task. Method: The current study recruited 32 mothers and their 6-month-old infants. Infants attentional biases were assessed using a passive viewing, paired comparison task; in which 48 facial stimuli (including happy, sad, angry, and neutral faces), were presented beside a neutral face for 5-s durations. Infant gaze was tracked using the Tobii T120 eye tracker. Maternal depressive symptoms were assessed using the Edinburgh Postnatal Depression Scale (EPDS). Results: Infants of mothers with more severe depressive symptoms displayed shorter fixation durations on sad faces, when compared to its neutral counterpart ($r = -.507$, $p < .01$); while total looking time at sad faces was not associated with maternal depression. Discussion: Findings suggest that offspring of mothers with elevated depressive symptoms display a lower tolerance of stimuli related to depressive affect, as they were less likely to sustain longer fixations on sad faces. Further, these processes of selective attention may contribute to the development of later internalizing forms of psychopathology.

ONTOGENY OF LOCOMOTION AND POSTURE IN NEWBORN RATS: A COMPARISON OF SENSORY-DEPRIVED VERSUS SENSORY-ENRICHED TESTING ENVIRONMENTS. H.E. Swann* and M.R. Brumley. Department of Psychology, Idaho State University, Pocatello, ID 83201. swanhill@isu.edu

Nearly every research article that has examined the development of locomotion in rats, or how this trajectory may be affected by experimental manipulations, bases their time points of emergence of locomotion on a study conducted over 40 years ago by Altman and Sudarshan (1975). In that study, rats were examined in what may be characterized as a sensory-deprived situation. The aim of the current study was to provide updated normative data on rat locomotion and posture development in a sensory-enriched and sensory-deprived testing environment. Rats were tested daily from P1 to P15 in a temperature-controlled incubator. Pups in the sensory-deprived condition were placed in a square, Plexiglas box for a 20-min test period. Pups in the sensory-enriched condition were placed in the same box with 3 siblings (2 M, 2 F) and bedding from the home cage to provide sensory stimulation. Findings show that pups demonstrate some locomotor and posture behaviors (i.e., pivoting, head elevation, and crawling) 1 to 3 days earlier than previously reported, across conditions. This suggests that controlling for temperature may influence the first occurrence of these behaviors. Additionally, preliminary findings suggest that subjects in the sensory-enriched condition show longer durations of locomotor behavior, possibly due to increased sensory stimulation or differences in substrate across conditions. Given that most experiments utilize an open-field test or apparatus with a stiff substrate, it is important to understand any differences in behavior that may arise from the testing environment rather than experimental manipulations.

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MOTHER-INFANT DYAD TOUCH BEHAVIOR DURING POSTURE AND LOCOMOTION IN 8- TO 16-MONTH OLD HUMAN

INFANTS. H.E. Swann[1], N. Burgett[1], N. Devine[1], M.R. Brumley[1] and H. Ramsdell-Hudock[2]. [1]Department of Psychology, Idaho State University, Pocatello, ID, 83201. [2]Department of Communication Science, Idaho State University, Pocatello, ID 83201. swanhill@isu.edu

Research has suggested that maternal sensitivity and responsiveness impacts infant motor outcomes, in that more responsive parents facilitate motor development. Also, mothers interact and touch male and female children differently, potentially impacting motor development. The aim of the current study was to longitudinally examine maternal-infant touch behavior during free play sessions at 8, 12, and 16 months of age, as well as to quantify infant locomotion and postural behaviors. Mother-infant dyads came into the laboratory and were observed for a 60-min free play session. For our purposes, the middle 20 min of the sessions were coded during video playback for touch, posture, and locomotion. Preliminary data indicates that 8-month old infants spent most of the session sitting, which decreased over the range of ages examined, with infants increasingly coming to stand, walk, and squat more often. Additionally, with increasing age infants spent more time touching at least one object. Mother-initiated touch during infant postural and locomotor behaviors were highest for 8-month olds, and gradually decreased, as did infant-initiated touch (directed to mom). This suggests that physical touch between mother and infant declines as infants become more independent motorically.

NEURAL CORRELATES OF EXECUTIVE FUNCTION IN PRESCHOOL CHILDREN: ASSOCIATIONS WITH ACADEMIC SCHOOL READINESS. M.M. Swingler[1], S.E. Halliday[2], S.D. Calkins[1,2], and E.M. Leerkes[1]. [1]Human Development and Family Studies and [2]Psychology, University of North Carolina at Greensboro, Greensboro, NC, 27402. mmswingl@uncg.edu

The development of executive function (EF) during early childhood is critical because it contributes to the acquisition of behavioral and pre-academic skills that are required for a successful transition to formal schooling (Blair & Razza, 2007; McClelland et al., 2007). Age-graded improvements in EF are assumed to reflect changes in brain development that occur during the time period of rapid growth from 3–6 years of age. During this developmental period, individual differences in performance on tasks that measure core components of EF, such as inhibitory control (IC; inhibiting a well-learned or prepotent response in favor of a subdominant one) and working memory (WM; holding information in mind for goal directed action), may be a result of underlying neural processes. In addition, neural processes contributing to EF performance may predict to other areas of functioning that rely on EF abilities, such as academic readiness. The current study utilized a large sample of 4½-year-olds (N = 275) to examine the relation between behavioral performance and neural functioning during EF (Go/No Go and Dimensional Change Card Sort) tasks, and performance on sub-scales of the Woodcock-Johnson III. Preliminary results suggest that ERP measures of neural activity predicted performance on the EF tasks, which then predicted performance on the Applied Problems sub-scale of the WJ-III. The results will be discussed in the context of the importance of neural processes supporting EF in the preschool period for both current and future functioning across multiple domains.

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SEXUALLY-DIMORHIC GENE EXPRESSION PATTERNS WITHIN THE ADULT HPA AXIS FOLLOWING UNPREDICTABLE VARIABLE PRENATAL STRESS. Y. Talyansky[1,2], E.L. Moyer[1], J. Varholick[3], J.L. Bollinger[5], C.D. Tulbert[5], L.A. Baer[4], A.E. Ronca[1,5,6,7]. [1]Space Biosciences Division, NASA Ames Research Center, Moffett Field, CA 94035. [2]San Jose State University, San Jose, CA 95192. [3]University of North Carolina at Greensboro, Greensboro, NC 27412. [4]Surgical Sciences, University of Texas Medical Center, Houston, TX 75390. [5]Obstetrics and Gynecology, [6]Program in Neuroscience, [7]Molecular Medicine & Translational Science, Wake Forest School of Medicine, Winston-Salem, NC 27157. yuli.talyansky@nasa.gov

Environmental influences experienced during gestation can produce persistent alterations in cellular function and physiology, conferring life-long vulnerability to psychopathological and disease states. Prenatal stress has been linked to numerous sex-dependent perturbations in adulthood, including increased mortality rates, neuroendocrine function, obesity/metabolic syndrome, and behavior. These enduring changes are mediated by Hypothalamic-Pituitary-Adrenal (HPA) axis activity and glucocorticoid (GC) receptor expression, programmed by the excessive induction of maternal GC's in utero. In this study, build upon our past work establishing programming effects of Unpredictable Variable Prenatal Stress (UVPS) on adult body weight and anxiety responses. We hypothesize sexually dimorphic changes in the expression of key genes in the adrenal, hypothalamus and pituitary of adult male and female rats exposed to UVPS. Time-mated Sprague-Dawley female rats were exposed throughout pregnancy to Unpredictable, Variable Prenatal Stress (UVPS). UVPS dams were exposed daily to three different stressors: (1) White Noise, (2) Strobe Light, and (3) Tube Restraint. Stressors were presented individually once per day on an unpredictable schedule (morning [0600–1200 hr]; afternoon [1200–1800 hr]; evening [1800–2400 hr]) for one of three durations (15, 30 or 60 min). Comparisons were made with Non-Stressed (NS) Control dams. To control for potential changes in postnatal maternal care, newborn pups were fostered to non-manipulated, newly parturient dams. On Postnatal day 90, we harvested pituitary, hypothalamus and adrenal glands from UVPS and NS male and female offspring. Reverse-transcriptase quantitative PCR is being used to analyze: 1) melanocortin-2 receptor (MC2R), POMC, corticotropin-releasing hormone (CRH) in the pituitary; 2) glucocorticoid receptor (NR3C1), pro-opiomelanocortin (POMC), corticotropin-releasing hormone (CRH), brain-derived neurotropic factor (BDNF), in the hypothalamus; and 3) MC2R, tyrosine hydroxylase (TH), steroidogenic acute regulatory protein (STAR), cytochrome P450scc enzyme (CYP) in the adrenal. These gene expression studies will further understanding of how early life experience differentially programs the stress axis in male and female offspring.

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DEVELOPMENTAL DIFFERENCES IN CHILDREN'S SELF-RECOGNITION OF OPTIC FLOW. M.A. Taylor[1] and M. Jaime[2], [1]Psychology, Florida International University Miami, FL 33199. [2]Psychology, Indiana University- Purdue University Columbus, IN 47203. mtayl090@fiu.edu

Self-generated motion creates visual feedback in the form of optic flow—or the perceived movement of surfaces in the visual array. Prior work indicates that children make postural and locomotive adjustments in response to changes in optic flow. However, children's memory of optic flow information has never been examined. Here we explored this issue via a self-recognition task for first-person-perspective videos. Fifty-five 2- to 8-year-olds and 13 adults were tested. Subjects jumped and/or walked in the same location during the recording of a first-person-perspective video of their movements via a small chest-mounted camera. After a 10 min delay each subject's video recording and a recording of a different subject's first-person perspective movements was replayed to the subject on two side-by-side monitors across 10 consecutive trials. After each trial subjects were asked to identify their self-recording. In Condition 1, the actions during video playback were the same between monitors (e.g., walk vs. walk). In Condition 2, the actions during video playback differed between monitors (e.g., jump vs. walk). An analysis of the proportion of correct self-recognition trials revealed an overall age-related improvement in self-recognition, with a marked improvement from age five to adulthood. Children's self-recognition performance was also better in Condition 2 relative to Condition 1. These results suggests that children may have an explicit knowledge of optic flow information for differing action types but cannot detect idiosyncratic differences between self- and other-related optic flow information when the action types are the same. Adults can however detect these idiosyncratic differences.

INFANT EXPERIENCE AND ADULTHOOD ENGAGEMENT: DIFFERENTIALLY-REARED RHESUS MACAQUES' USE OF A COMPUTER-BASED VIDEOGAME SYSTEM. P.D. Tenpas[1], P.J. Pierre[2], and A.J. Bennett[1]. [1]Department of Psychology, University of Wisconsin-Madison, Madison, WI 53715. [2]Behavioral Management Research Unit, Wisconsin National Primate Research Center. Allyson.J.Bennett@wisc.edu

Numerous factors, including early life experience, play a role in individual differences in behavior that emerge across development. In humans and other animals, early adverse experiences influence aspects of cognitive and affective behavior and processing. In a monkey model of early life adversity, infants reared in a nursery demonstrate alterations in each of these domains. There is little research however, on rearing group differences in specific aspects of performance, motivation, and attention that contribute to engagement with a cognitive task. The present study examined monkeys' engagement with a joystick-controlled testing system and compared middle-aged monkeys who were either nursery-reared (NR) or mother-reared (MR) in infancy. All animals were given 2, 5-hr sessions of free access to a testing system with the opportunity to play two games with which they had extensive experience. One task required animals to move a circular cursor to a square target presented randomly across the four sides of the screen, the other task required animals to "chase" a target moving across the screen. Successful trials resulted in delivery of a 0.94 mg grain-based pellet. Following each trial there was a 5-s inter-trial interval after which latency to engage with the system was automatically recorded. All animals interacted with the system across the 5-hr period and completed an average of 1,198 trials (SD = 535.42). We then ran a linear mixed-effects model (LMEM) fit by restricted maximum likelihood using R, where latency to engage was regressed on the cluster-mean centered within-subject trial number and between-subject rearing experience. A significant effect of trial number was observed, indicating that as the session progressed, animals waited longer to engage with the system, $b = .006$, $p < .005$, $F(1, 8.32) = 16.58$. The trial by rearing interaction trended near significance, $b = -0.007$, $p = 0.06$, $F(1, 7.89) = 4.66$, suggesting that the observed decrease in latency to engage across trials was greater in MR animals. These findings demonstrate the feasibility of applying LMEMs to assess patterns of engagement. Furthermore, they provide preliminary evidence that infant experience may be a predictor of engagement with such systems in adulthood. From an applied perspective, while use of these systems decreased across the 5-hr period, all animals engaged with the system across the 5-hr session. In turn, these results add to two decades of empirical studies that demonstrate videogame testing systems can be effectively used to provide cognitive enrichment for primates in captive settings.

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MECHANISMS FOR A DEVELOPMENTAL CRITICAL PERIOD OF HIPPOCAMPAL LEARNING. A. Travaglia[1], R. Bisaz[1], E.S. Sweet[2, 3], R.D. Blitzer[2, 4], and C.M. Alberini[1]. [1]Center for Neural Science, New York University, New York, 10003 NY, USA. [2] Department of Pharmacological Sciences, [3] Department of Neurology, [4] Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, New York 10029. ca60@nyu.edu

Episodic memories formed during the first postnatal period are rapidly forgotten, a phenomenon known as infantile amnesia. Infantile amnesia is conserved throughout evolution, as it has been described in rodents as well as humans. It remains to be understood whether this amnesia is the result of immaturity of the infant brain, impaired memory retrieval, or failure in memory storage. Furthermore, in spite of this apparent memory loss, early life experiences influence brain development and predispose to psychopathologies, raising the question of which mechanisms underlie infantile memories. Using contextual fear-based task inhibitory avoidance (IA) in infant rats, we found that early life experiences are stored as latent memory traces for a long time: later reminders reinstate a robust, context-specific and long-lasting memory. The formation and storage of this latent memory requires the hippocampus and employs mechanisms typical of developmental critical periods, including a BDNF- and mGluR5-dependent expression switch of NMDA receptor subunits from 2B to 2A. Moreover, BDNF administration after training rescues the infantile amnesia, hence closing the critical period. We suggest that the hippocampus, like sensory systems, undergoes a developmental critical period to become functionally competent.

THE ROLE OF NEUROENDOCRINE ALTERATIONS IN WHITE MATTER IN HUMAN ADOLESCENTS WITH FETAL ALCOHOL SPECTRUM DISORDER: SEX MATTERS. K. Uban. Children's Hospital, Los Angeles, CA. Kuban@chla.usc.edu

Despite accumulating evidence from animal models demonstrating that prenatal alcohol exposure (PAE) results in life-long

neuroendocrine dysregulation, very little is known on this topic among humans with fetal alcohol spectrum disorders (FASD). Our research aims to characterize neuroendocrine alterations in human adolescents with FASD. We hypothesize that this prolonged altered hormonal context, in which the brain continues to mature, may continue to impact the already altered human FASD brain. Understanding neuroendocrine alterations among humans affected by PAE is essential for advancing our understanding of key mechanisms underlying brain alterations observed in individuals with FASDs. It is possible that, through increased understanding of persistent neuroendocrine alterations, novel interventions targeting these systems could be developed in hopes of improving on-going brain development among children and adolescents with FASD.

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SOCIOECONOMIC STATUS, HAIR CORTISOL, AND INTERNALIZING SYMPTOMS IN PARENTS AND CHILDREN. A. Ursache[1],*, E. Merz[2], and K.G. Noble[3]. [1]Gertrude H. Sergievsky Center, Columbia University, New York, NY, 11550. [2]Department of Epidemiology, Columbia University, New York, NY, 11550. [3]Teachers College, Columbia University, New York, NY, 10027. amu2116@cumc.columbia.edu

Several studies demonstrate socioeconomic disparities in internalizing problems, and stress is likely one important pathway of these disparities. Studies examining socioeconomic differences in physiological measures of stress such as salivary cortisol, however, have produced mixed results, and few studies have examined socioeconomic differences in hair cortisol, a novel marker of chronic stress. Moreover, no studies have incorporated hair cortisol to understand socioeconomic disparities in internalizing problems. To address these gaps, we first examine relations of family income and parental education to variation in both parents' and children's hair cortisol concentrations (HCC) and then test whether HCC and perceptions of stress mediate relations of SES to parents' anxiety and depression. Regression analyses (n = 35 adults, 26 children) demonstrated that parental education was inversely linearly related to both parent (β = −.602, p = .004) and child HCC (β = −.675, p = .009), even controlling for parent HCC. Family income was inversely related to parent, but not child, HCC in a logarithmic pattern (β = −.445, p = .025) such that the relation between HCC and income was strongest at the lowest income levels. Furthermore, associations of income and education with anxiety were significantly mediated by parental perceptions of stress 95% CI: [−7.199, −.958], 95% CI: [−2.832, −.307], respectively and marginally mediated by parent HCC 90% CI: [−4.126, −.051], 90% CI:[−1.537, −.024], respectively. Thus, results suggest that both perceived and biological markers of stress capture important facets of the experiences that underlie socioeconomic disparities in anxiety.

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THE EFFECTS OF EARLY ADVERSITY ON AMYGDALA-PREFRONTAL CIRCUITRY DURING EMOTIONAL FACE PROCESSING IN CHILDREN AND ADOLESCENTS. M. VanTieghem[1,*], E. Telzer[2], L. Gabard-Durnam[1], L.J. Flannery[3], B. Goff[4], D.G. Gee[5], K. Humphreys[6], C. Caldera[4], M. Shapiro[4], J. Louie[7], and N. Tottenham[1]. [1]Psychology Department, Columbia University, New York, NY 10027. [2]Department of Psychology, University of Illinois at Urbana-Champaign, Champaign, IL, 61801. [3]Department of Psychology, University of Oregon, Eugene, OR, 97403. [4]Department of Psychology, University of California, Los Angeles, Los Angeles, CA, 90095. [5]Department of Psychology, Yale University, New Haven CT, 06520. [6]Department of Psychology, Stanford University, Palo Alto, 94305. [7]Kaiser Permanente, Santa Clara, CA, 95051. mrv2115@columbia.edu

Early adverse caregiving represents a potent stressor that has been associated with heightened emotional reactivity and risk for internalizing problems. Previous research shows that previously institutionalized (PI) youth with a history of institutional care show heightened amygdala reactivity and altered amygdala-mPFC connectivity when viewing negative stimuli (e.g., fearful faces). However, the effect of early adversity on neuro-affective processing across positive, negative and neutral stimuli has not been well delineated. In the current study, 37 PI children and adolescents (ages 6–18) and 39 comparisons completed an emotion matching fMRI task designed to probe the neural discrimination of happy, angry and neutral facial expressions. Participants viewed a target facial expression (e.g., angry) and chose which of the two following facial expressions (e.g., angry, neutral) matched the emotion of the target. Results showed that PI youth had greater amygdala reactivity relative to comparisons regardless of valence. PPI analyses at the whole-brain level revealed a significant Group x age interaction, such that the PI group showed altered age-related changes in amygdala-vmPFC connectivity to Happy faces relative to comparisons. Importantly, amygdala-vmPFC connectivity to Happy faces is associated internalizing symptoms within the PI group, with stronger positive connectivity predicting fewer internalizing problems. The current results highlight the role of amygdala-prefrontal circuitry in predicting risk versus resilience for internalizing problems following early adversity.

ROBOTIC HENS: MOVEMENT INFLUENCES BOBWHITE QUAIL CHICKS' SOCIAL PREFERENCES (COLINUS VIRGINIANUS). P. Velasquez*, S.C. Belnap, and R. Lickliter. Department of Psychology, Florida International University, Miami, FL, 33199. vela014@fiu.edu

Few studies of early social preferences in precocial birds have investigated the effects of motion on the development of maternal preference. In the current study, we tested the preference of bobwhite quail chicks at 48 hr and 72 hr following hatching for robotic bobwhite quail hen models in two exposure conditions. In the first condition, chicks were presented with a simultaneous choice test between a motionless robotic hen model paired with a bobwhite maternal call (Audio/Visual) vs. the identical maternal call presented alone (Auditory Only). In the second condition, chicks were presented with two robotic hen models, each paired with an identical bobwhite quail maternal call. One robotic model was not moving (Still Condition), the second robotic model exhibited re-occurring head bobs during the testing trial (Movement Condition). Results indicated that chicks preferred the still hen model paired with the maternal call over the maternal call alone at both 48 hr and 72 hr following hatching. Chicks showed no preference for the moving hen model over the still model at 48 hr; however, chicks tested at 72 hr preferred the moving hen model over the still hen

model, suggesting that movement can influence early social preferences in young quail chicks. The use of robotic hens provides an opportunity to manipulate both the type and timing of movement available to young chicks, allowing more detailed investigation of the contributions of maternal behavior to neonatal social responsiveness.

RELATION BETWEEN SPATIAL REORIENTATION AND HIPPOCAMPAL-DEPENDENT LEARNING AND MEMORY IN YOUNG CHILDREN. V.Vieites, S.Pruden, and B.C. Reeb-Sutherland. Department of Psychology, Florida International University, Miami, FL 33199. vviei001@fiu.edu

After losing a sense of position in the environment, organisms use a variety of processes to reestablish their orientation and find their way. Consequently, forming links between goals and cues in the environment facilitates navigation-an important, everyday skill. One area of the human brain known to support the formation of spatial and episodic memories is the hippocampus, which continues to develop after birth. Compared to school-aged children, pre-school children tend to perform poorly on episodic memory tests and certain large-scale spatial tasks (e.g., spatial reorientation), suggesting that the hippocampi of young children are not yet fully developed. One common, non-invasive technique used to study associative learning and memory processes in adult and pediatric populations is Pavlovian eyeblink conditioning (EBC), which entails learning the association between pairs of auditory and tactile stimuli. Furthermore, the neural substrates of EBC, including the hippocampus, have been well defined. The current study employs a hippocampal-dependent EBC paradigm (i.e., trace conditioning) to determine whether children's abilities to use a salient landmark to locate a hidden object after being disoriented reflect developmental and/or individual changes in their hippocampal-dependent learning and memory skills. Three- and six-year-old children participated in a trace conditioning paradigm, a spatial reorientation task, and a picture sequence episodic memory test. Pilot analyses revealed moderately high, positive correlations between: correct choices on the spatial reorientation task and scores on the episodic memory test, EBC and age, and episodic memory ability and age. Additionally, we found within-age variation in spatial reorientation performance, suggesting a potential for finding individual differences in the relation between hippocampal-dependent learning skills and spatial reorientation.

PRENATAL MATERNAL TESTOSTERONE AND INFANT BIOBEHAVIORAL REGULATION DURING THE STILL FACE PARADIGM. K.M. Voegtline[1], G.A. Moore[2], and J.A. DiPietro[3]. [1]Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD 21287. [2]Department of Psychology, Pennsylvania State University, University Park, PA 16802. [3]Department of Population, Family and Reproductive Health, Johns Hopkins University, Bloomberg School of Public Health, Baltimore, MD 21205. kvoegtl1@jhu.edu

Maternal sex steroids target the developing fetal brain binding optimally to receptors in the limbic system. To this end, prenatal testosterone exposure has been linked to greater behavioral reactivity in infancy. Drawing from a cohort of 166 women and infants, associations between prenatal maternal salivary testosterone and infant cardiac and behavioral regulation at 6-months during the Still Face paradigm are explored. Findings indicate higher prenatal testosterone is associated with lower heart rate variability in response to the still face and greater negative affect in infants during the reunion episode. Implications of altered infant stress response and recovery on maternal engagement and mother-infant attunement will be discussed.

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NEURODEVELOPMENTAL CORRELATES OF FEAR EXTINCTION: AN FMRI INVESTIGATION IN HUMAN ADOLESCENTS AND ADULTS. S.L. Whittle[1], D.E. Ganella[2], E. Ganella[1], and J.H. Kim[2]. [1]Melbourne Neuropsychiatry Centre, Department of Psychiatry, The University of Melbourne, Carlton, Victoria, Australia, 3053. [2]Florey Department of Neuroscience, Florey Institute of Neuroscience and Mental Health, Melbourne, Victoria, Australia, 3052. swhittle@unimelb.edu.au

Compromised fear extinction may contribute to increased risk for anxiety during adolescence. While rodent research suggests that deficits in adolescent fear extinction may be caused by abnormal ventromedial prefrontal cortical (vmPFC) function, no similar work has been done in human adolescents. Using a novel fear learning paradigm, we investigated the neural correlates of fear conditioning, and extinction learning and recall, in adolescent and adult humans using functional magnetic resonance imaging. Compared to adults, adolescents evidenced reduced vmPFC and increased dorsal anterior cingulate cortex activation during extinction learning and recall. Further, sex differences were found such that male adolescents showed reduced vmPFC activity during extinction learning, as compared to females. When tested for fear recall, however, the pattern reversed, such that female adolescents showed reduced vmPFC activity compared to males. These findings suggest that in females, vmPFC deficits may not appear until after the initial extinction learning phase. These findings have implications for understanding risk factors and treatments for male and female adolescent anxiety.

STRESS DURING THE PUBERTAL PERIOD EXERTS SEX-SPECIFIC EFFECTS ON BEHAVIOR IN ADULT RATS. J. Willing[1,*], L.R. Cortes[1], C.M. Drzewiecki[2], and J.M. Juraska[1,2]. [1]Psychology Department, University of Illinois at Urbana-Champaign, Champaign, IL, USA. [2]Program in Neuroscience, University of Illinois at Urbana-Champaign, Champaign, IL, USA. jwillin@illinois.edu

The adolescent period is characterized by many neuroanatomical changes that coincide with changes in behavior. We have previously shown that the period of pubertal onset, specifically, is associated with neuronal and synaptic pruning in the medial prefrontal cortex (mPFC), and an increase in performance on a PFC-dependent task. This collectively suggests that puberty might result in a heightened susceptibility to external stressors. In the present study, we use an isolation and restraint stress paradigm in male and female rats during the period of pubertal onset (females: P32-38, males: P41-47) and compared them with post-pubertally stressed rats (females: P40-46, males: P49-55) and unstressed controls. In adulthood, they were tested in the elevated plus maze, forced swim test, pre-pulse inhibition (PPI) task and novel object recognition task. While there were no effects of stress in either sex on object recognition performance, females stressed during pubertal onset displayed an increased latency to enter an open arm in the elevated plus maze and displayed increased immobility time during the forced swim test. Additionally, males stressed during the

pubertal period showed a deficit in PPI compared to controls and animals stressed after puberty. These results show sex-specific effects of stress during, but not after, pubertal onset, suggesting sex-specific effects of vulnerability during the hormonal changes of puberty.

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CHARACTERIZING THE EMERGENCE OF OBJECT RECOGNITION IN THE NEWBORN BRAIN. S.M.W. Wood and J.N. Wood. Department of Psychology, University of Southern California, Los Angeles, CA 90089. samantha.waters@usc.edu

A central goal in psychology and neuroscience is to understand how the brain learns to recognize objects. Although researchers have made significant progress in this endeavor, the majority of work has focused on the object recognition abilities of adult animals. Thus, we know relatively little about how object recognition emerges in the newborn brain. Here, we describe an approach for characterizing the origins of object recognition, by linking controlled-rearing studies of newborn animals to biologically-inspired computational models. We raised newborn chicks in controlled-rearing chambers that provided complete control over all visual object experiences. The chambers tracked the chicks' behavior 24/7, providing precise behavioral measurements of the chicks' object recognition abilities. Across experiments, we systematically manipulated the visual input provided to the chicks and examined the effects of those manipulations on the chicks' emerging object recognition abilities. We found that the development of object recognition requires visual experience with objects that move smoothly and slowly over time. Without slow and smooth visual object input, newborn chicks are impaired at recognizing objects. These findings place significant constraints on computational models of newborn object recognition. While most computer vision models cannot account for these behavioral findings, this developmental pattern does accord with a class of unsupervised temporal learning models in computational neuroscience. These models contain no explicit, hardwired object features, but quickly learn about the world by extracting slowly varying features from the visual environment. This approach opens experimental avenues for constructing formal models of how high-level vision emerges in the newborn brain.

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NEUROLOGIC AND PHYSIOLOGIC RESPONSE TO ODORS IN THE HUMAN NEWBORN DURING ACTIVE AND QUIET SLEEP. J.S. Yang,[1] J. R. Isler,[3,4] M. Ordonez-Retamar,[1] T. Thai,[1] N. Brito,[1] D. A. Wilson,[5] M. M. Myers,[1,2,3] and W. P. Fifer[1,2,3]. [1]New York State Psychiatric Institute, Division of Developmental Neuroscience, New York, NY, 10032. [2]Department of Psychiatry, Columbia University, New York, NY, 10032. [3]Department of Pediatrics, Columbia University, New York, NY, 10032. [4]Department of Biomedical Engineering, Columbia University, New York, NY, 10032. [5]Department of Child & Adolescent Psychiatry and Neuroscience & Physiology, New York University Langone School of Medicine, New York, NY 10016. jsy2116@cumc.columbia.edu

Newborn infants react to a wide range of sensory stimulation during sleep, showing physiological responses to tactile, proprioceptive, auditory, and visual stimuli. The newborn olfactory system is also functional and, in animal models, neonatal chemosensory reactivity during sleep is well documented. We investigated if sleeping newborn infants respond to different odors. We presented four odors; infant formula, banana, orange, and rose, to 10 healthy full-term infants within 48 hr of birth during sleep. High-density electroencephalogram (EEG), heart rate, and respiration rate were recorded. The stimuli were presented in 10 blocks of 4 min duration, each block comprising 8 contiguous pseudorandomized 30s presentations of alternating room air and scent. Constant airflow was delivered to the nostrils to eliminate changes in tactile stimulation with each odor presentation. A decrease from baseline in alpha (7–9 Hz) power was observed upon banana and orange odor presentation ($p < 0.05$) during active sleep. A similar decrease was seen upon orange and rose odor presentation ($p < 0.005$) during quiet sleep. No significant responses were observed in heart rate or respiration rate to any of the odorants in either sleep state. Though robust physiological responses were not detected, infants did respond neurologically and the responses to different odorants may be sleep state dependent. The capacity to discriminate odors while asleep may be critical to adaptive functioning in the extra-uterine environment. This paradigm has potential utility as a non-invasive means to assess the salience of various odors and, in turn, their potential role in learning and memory formation in sleeping newborns.

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DAMPENED BOLD ACTIVATION TO LIFE THREAT FEAR IN PRAIRIE VOLE FATHERS. J.R. Yee[1,2,*], W.M. Kenkel[1,2], A.M. Perkeybile[2], K. Moore[1], P.Kulkarni[1], S.W. Porges[2], C.S. Carter[2], and C.F. Ferris[1]. [1]Center for Translational NeuroImaging, Northeastern University, Boston, MA 02141. [2]The Kinsey Institute, Indiana University, Bloomington, IN 47405. jsn.r.yee@gmail.com

In cooperatively breeding species, the father, unencumbered by direct infant care while the mother is on nest, is poised to fulfill many of the protective functions of parenthood. However, a lack of laboratory animal models in which fathers take part in parental care has led to a gap in understanding whether parental fathers experience a transformation in fear regulation that would support protective functions of fatherhood. This research seeks to better understand potential changes in fear regulation that accompany fatherhood by studying neural responses to fearful stimuli in the socially monogamous prairie vole (Microtus ochrogaster). Prairie voles were presented with the scent of a predator (i.e., a live sable ferret) while immobilized for awake functional neuroimaging in order to assess the neural response to life threat fear. Contrary to expectations, experienced fathers showed a dramatically dampened blood oxygen level-dependent (BOLD) response to the scent of the predator as compared to virgin males. Dampened neural responses were observed in areas of the brain associated with fear, olfaction, and pain. While previous work has led to the recent conclusion that parenthood may not have pronounced effects on stress responsiveness or emotionality in fathers, our preliminary findings using high-resolution functional neuroimaging of the entire brain in awake animals, has shown that the transition to fatherhood may be accompanied by dramatic changes in the regulation of fear.

CHARACTERIZING FEAR EXTINCTION LEARNING ACROSS ADOLESCENCE: ROLE OF DOPAMINE IN THE PREFRONTAL

CORTEX. I.C. Zbukvic[1,2,*], J. Park[1,2], D.E. Ganella[1,2], A.J. Lawrence[1,2], and J.H. Kim[1]. [1]The Florey Institute of Neuroscience & Mental Health, Melbourne, Australia, 3052. [2]University of Melbourne, Parkville, Australia, 3010. isabelzbukvic@gmail.com

Extinction learning involves dopamine signaling in the prefrontal cortex (PFC), a system undergoing dramatic alterations during adolescence. Developmental changes in the infralimbic cortex (IL) of the PFC are implicated in adolescent extinction deficits, however the role of IL dopamine in extinction learning across adolescence is not known. In the present study, adolescent (postnatal[P]35 and P53) and adult (P70 and P88) rats were fear conditioned using 3 tone-footshock pairings. The next day, rats underwent a single extinction session consisting of 30 tone presentations alone. On testing the next day, long-term extinction was most effective in P88 rats and least effective in P35 rats. In separate subjects, changes in PFC dopamine 1 receptor (D1R) and dopamine 2 receptor (D2R) gene expression were measured following extinction. At age P35, PFC D1R/D2R ratio was lower for rats that received cue extinction ($p < 0.05$), while at age P88 PFC D1R/D2R ratio was higher for rats that received cue extinction compared to handled controls ($p < 0.05$). In a second study, age P35 and P88 rats underwent conditioning then received a bilateral intra-IL infusion of vehicle, the D1R agonist SKF-81297 (0.1 µg/hemisphere), or the D2R agonist quinpirole (1.0ug/hemisphere) immediately prior to extinction. Acutely enhancing D1R signaling in the IL at the time of extinction had no effect on extinction learning in either age group. In contrast, acutely enhancing IL D2R signaling significantly enhanced long term extinction in adolescents ($p < 0.05$) but not adults. Results highlight a differential role for PFC D2R signaling for extinction across adolescent maturation.

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