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2019 Poster Abstracts

Day 1, Friday, August 30

1-A-1 Neural basis of functional fixedness during creative idea generation: An EEG study

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The present study aimed at investigating the neural bases of the processes involved in overcoming fixation effects during creative idea generation. Using the AU task adapted for EEG recording, we examined whether participant's ability to provide original ideas was related to alpha power changes in both the frontal and temporo-parietal regions. Critically, for half of the presented objects, the classical use of the object was primed orally, and a picture of the classical use was presented visually to increase functional fixedness (Fixation Priming condition). For the other half, only the name of the object and a picture of the object was provided to the participants (control condition). As expected, priming the classical use of an object before the generation of creative alternative uses of the object impeded participants' performances in terms of remoteness. In the control condition, while the frontal alpha synchronization was maintained across all successive time windows in participants with high remoteness scores, the frontal alpha synchronization decreased in participants with low remoteness scores. In the Fixation Priming condition, in which functional fixedness was maximal, both participants with high and low remoteness scores maintained frontal alpha synchronization throughout the period preceding their answer. Whereas participants with high remoteness scores maintained alpha synchronization in the temporo-parietal regions throughout the creative idea generation period, participants with low remoteness scores displayed alpha desynchronization in the same regions during this period. We speculate that individuals with high remoteness scores might rely more on internal semantic association and selection processes.

1-A-2 Neonatal Brain Structural Connectivity Underlies Links between Social Adversity and Executive Function in Very Preterm Children

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Objective: Children born very preterm (VPT, <30 weeks gestation) show impairments in executive function (EF) compared to full-term children. Exposure to social adversity predicts deficits in EF, but the extent that infant brain structural connectivity underlies links between social adversity and EF in VPT children is unclear. Methods: Diffusion MRI data was obtained for 75 VPT and 58 FT neonates with white matter tracts analyzed using probabilistic tractography. Social adversity at birth was defined with a maternal index score based upon age at delivery, race, education, public health insurance and single parent household. At age 5-years, the Differential Abilities Scale assessed working memory. The Shape School evaluated cognitive inhibition and shifting. Principal component analysis was used to calculate a global EF score. Links between social adversity, brain connectivity and EF were examined using multivariate regression adjusted for postmenstrual age at scan and clinical factors. Results: VPT infants had higher mean diffusivity (MD) in the bilateral cingulum (p=.001), right uncinate (p=.003), left ALIC (p=.01) and corpus callosum (p<.001) than FT infants. VPT infants also had lower fractional anisotropy (FA) in the bilateral uncinate (p=.001), left ALIC (p=.03) and corpus callosum (p<.001). At age 5, VPT children obtained lower EF (p<.001), working memory (p=.002), shifting (p=.002) and inhibition (p=.01) scores

than FT children. In the VPT group, greater social adversity was related to poorer EF (p=.01), working memory (p=.03) and shifting (p=.02). Links between social adversity and EF were explained by MD in the corpus callosum (p=.02) and left ALIC (p=.004). The link between social adversity and shifting was explained by MD in the left ALIC (p=.001). Conclusions: VPT infants had altered white matter microstructure in the cingulum, uncinate, ALIC and corpus callosum. Neonatal white matter microstructure underlies deficits in EF in high-risk VPT children

1-A-3 Age-related oculomotor prediction and corresponding pupil responses in healthy individuals ages 6-24

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Introduction: The ability to flexibly execute motor commands to either synchronously match a temporal event, or react to an irregular event is fundamental to daily human life. This ability can be tested using the Predict/React oculomotor task (Lee et al., 2016), where participants are instructed to look at a target, which alternates between two fixed locations at either a specific interstimulus interval (ISI) or a randomly selected ISI, thereby predicting or reacting to its appearance. Methods: To test sensorimotor prediction in healthy individuals (ages 6-24; N=106), we measured saccade metrics (saccadic reaction time (SRT), velocity, amplitude) and pupil responses using the predict/react oculomotor task. Saccades generated (predictive (SRT<90 ms), express (SRT: 91-140 ms), reactive (SRT>140 ms)) per ISI condition (predict: 500, 750, 1000, 1250, 1500 ms; react: random ISI for each target step) were analyzed in each task, with a total of 96 target steps per ISI condition. Results: Amplitude and absolute pupil size were significantly smaller for predictive saccades versus reactive, $p < .001$, with post-hoc tests revealing smaller pupil size during fast ISI conditions. The 1500 ISI condition produced significantly more predictive saccades in older participants (ages 15-18; 19-24) compared to younger (ages 6-10; 11-14), $p = .001$. Children aged 6-10 produced significantly fewer predictive saccades than other groups, $p = .03$. In the react condition, individuals aged 19-24 generated the highest percentage of express saccades, $p= 0.04$. Conclusion: Our findings of poor oculomotor prediction in young children indicates immature circuitry corresponding to predictive saccades. Increased express saccades in adults is supported by considerable literature demonstrating greatest oculomotor control at this developmental stage. Smaller pupil responses during predictive saccades indicate physiological de-arousal and may serve as a biomarker of temporal prediction worth exploring.

1-B-4 The neural correlates of giving under different social contexts in adolescence

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Giving is essential for forming and maintaining social relationships, which is an important challenge for adolescents. This behavior is often characterized by the conflicting decision whether to forego self-interest to benefit others, and as such is highly context-dependent. There is currently little understanding of the mechanisms that drive context-dependent giving and how they develop in adolescence. Understanding the neural components of giving in different social contexts may shed light on these mechanisms. In this preregistered study, we studied giving and its neural correlates in different social contexts across adolescence. Specifically, we manipulated the extent to which self-interest outweighed benefits for others (i.e., donations were small instead of large), whether adolescents gave to a friend or unfamiliar other, and whether they were being observed by others or made anonymous choices. Participants (N = 140, ages 9 - 18) performed a novel giving fMRI paradigm, in which they divided coins between themselves and someone else in the aforementioned different social contexts. In line with our expectations, results showed that regardless of age, adolescents gave more i. when self-interest outweighed benefits for others, ii. when the beneficiary was a friend, and iii. when being observed. On a neural level, we found medial prefrontal cortex activity for small compared to large donations, and bilateral postcentral gyrus activation for the reverse contrast. Playing for a friend compared to an unfamiliar other elicited activity in the lateral and medial prefrontal cortex, as well as the right precentral gyrus, and the right inferior and left superior parietal

lobules. These findings provide insights into the modulation of neural processes that underlie giving decisions as a function of the social context, highlighting the role of prefrontal areas and social brain regions.

1-B-5 Social Status Differentially Affects Rejection Response in Adolescents: An Event-Related Potential Study

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This study examined the role of social status in adolescence using an experimental bargaining design. To manipulate social status, participants of three age groups (9-12-yrs; 13-15-yrs; 17-22-yrs; n=129) performed a reaction time task with two peers to induce high and low status. Next, participants played an iterative Ultimatum Game as proposer with the opposite status player, dividing coins between themselves and the opposite status player (responder) by making fair and unfair offers. Participants made fewer unfair offers (7/3) when the alternative was fair (5/5), but more unfair offers (7/3) when the alternative was hyperfair (3/7). Rejection of fair offers was associated with a larger Medial Frontal Negativity (MFN) compared to acceptance of fair offers. An interaction between age and status group revealed that low status mid-adolescents showed a larger MFN after rejection of fair offers. Our findings highlight mid-adolescence as a period in which social status plays an important role when fair offers are rejected, especially for low status adolescents, suggesting that the MFN reacts as a neural alarm system to social prediction errors, which is influenced by social status during mid-adolescence.

1-B-6 Motivation to engage with negative stimuli varies across development: Evidence from a valenced choice task

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It is commonly assumed that individuals are motivated to seek out positively valenced information and avoid negative information. However, previous research has shown there are situations in which people choose to experience negative information. In the current study, we characterize this tendency from childhood to young adulthood. 192 participants aged 4-25 completed a behavioral task assessing motivation to engage with material typically considered aversive. On each trial, participants viewed two small images side by side and selected one image to view at a larger size for up to 10s. Trials were organized into three valence conditions: negative versus positive images (matched on arousal), negative versus neutral images, and positive versus neutral images. Dependent measures included which valence participants chose and the subsequent looking time. Null, linear and thin-plate smoothing spline age regression models were used to identify linear and nonlinear age patterns. Overall, participants chose to view negative images over positive images for 28% of trials and chose to view negative images over neutral images for 42% of trials. They also viewed negative images for longer durations than positive and neutral images. Spline regressions showed that the tendency to choose to view negative images decreased across childhood and stabilized to low levels around age 11. By contrast, the tendency to choose neutral images did not vary across age. Spline regressions also revealed that at younger ages, image viewing time was elevated for positive and negative, but not neutral, images and declined at older ages. Together, these results provide insight into how emotional decision-making varies across childhood, adolescence, and early adulthood. These results suggest that motivation to engage with material typically assumed to be aversive varies across development and cautions against assuming that these stimuli elicit the same motivational states in individuals of all ages.

1-B-7 Sex Differences in Behavioral and Neural Response to Social Interaction in Middle Childhood and Early Adolescence

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Pre- and early adolescence is a time of increased responsiveness to peer interactions. Adolescents, especially female adolescents, have heighted neural response to anticipated peer feedback in the ventral striatum, a key brain region in reward processing (Guyer et al., 2009). Here we investigate the effects of self-reported pubertal status and gender on neural and behavioral sensitivity to reciprocal feedback from a peer in a real-time social interaction. Forty-four children (8-14 years old; 25 male) participated in an interactive chat task during an fMRI scan. Participants sent messages about themselves to a perceived peer and received responses that were engaged ("Me too!") or unengaged ("I'm away"). Participants also sent messages to and received messages from a computer ("Matched!"/"Disconnected"). Following the scan, participants reported how much they enjoyed interacting with the peer and the computer. There was a significant interaction between gender and pubertal status on differential enjoyment of peer minus computer interaction ($F(1, 40)=9.54$, $p<0.01$), such that girls at any pubertal stage and boys who were earlier in puberty had greater liking for the peer relative to the computer than boys later in puberty. Participants had increased ventral striatum response in both hemispheres to peer relative to computer messages ($p<0.01$) and to engaged relative to unengaged messages ($p<0.01$). Furthermore, there was a significant interaction between puberty, gender, and partner type for right hemisphere ventral striatum response ($F(1, 40)=4.29$, $p<0.05$), such that girls later in puberty showed increased response to peer relative to computer messages than girls earlier in puberty. Conversely, boys later in puberty had decreased response to peer relative to computer messages compared to boys earlier in puberty. These findings suggest that puberty may have inverse effects on developing neural responsivity to online feedback from a social partner for males and females.

1-B-8 The Role of Self-Control in Depressive Symptomology across the Transition to Adolescence

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Executive functioning (EF) skills, or goal directed behaviors, play a critical role in mental health during adolescence, a time when affective, biological, and cognitive factors are known to increase vulnerability to depression. Even in the absence of diagnosed depression, depressive symptoms such as negative mood and low self-esteem may impair youth wellbeing. High levels of particular EF skills like self-control, which allow youth to moderate their own emotions and behaviors, may protect against the emergence of depressive symptoms. This study aims to examine the prospective, longitudinal relationship between self-control and depressive symptomology across the transition to adolescence. The sample includes 1364 youth from the Study of Early Child Care and Youth Development (SECCYD), followed from age 10 (baseline) to age 15. Self-control was measured using a subscale from the Social Skills Rating System and depressive symptomology was measured by the Child Depression Inventory (CDI) and the Internalizing subscale from the Child Behavior Checklist (CBCL). All measures were averaged across parent, teacher, and caregiver reports, as previously done in the SECCYD. Multiple regression analysis showed that self-control was a significant predictor of depressive symptoms at age 10 (CDI, $\beta = -0.1$, $t(650) = -3.14$, $p = 0.01$; CBCL, $\beta = -0.97532$, $t(658) = -7.979$ $p=0.001$), controlling for gender, race, family income, and parent depression. In the longitudinal model, baseline self-control predicted depressive symptoms at age 15 (CDI, $\beta = -0.08$, $t(599) = -1.98$, $p=0.05$; CBCL, $\beta = -0.25$ $t(620) = -1.98$, $p=0.05$), controlling for the full set of covariates. This work suggests a protective effect of self-control for depressive symptomology that persists from childhood through the transition to adolescence. Future research should examine additional EF skills, like working memory or attention, as they relate to depressive symptomology.

1-C-9 Cognitive correlates of non-linguistic audio-visual associative learning in preschoolers

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Objective: Audio-visual associative learning - at least when linguistic stimuli are employed - is known to rely on core linguistic skills such as phonological awareness. Here we ask whether this would remain the case in a task that does not manipulate linguistic information, and if executive skills, often found to support associative learning, would play a role. Methods: We designed a new task that measures the learning of non-linguistic audio-visual associations. Importantly, while our novel task shares with linguistic processes such as reading acquisition the need to associate sounds with arbitrary visual shapes, it uses novel environmental sounds - thus limiting direct reliance on linguistic abilities - and unfamiliar visual shapes. 107 children were recruited from preschools around Paris, 76 of whom were included in the final sample (mean age: 68 months, sd: 4 months; 39 girls). None of them were readers. Children were assessed individually in the audio-visual associative task, as well as in a number of linguistic abilities and executive functions. In addition, a subset of these participants were tested again a year later, in the middle of first grade, to also assess their reading skills. Results and conclusions: Despite the absence of linguistic stimuli in the audio-visual associative task, we found phonological awareness and oral comprehension to be related to learning in our novel task, while no contribution of executive functions was observed. These results underscore the key relation between foundational language competencies and audio-visual associative learning, even in the absence of linguistic material.

1-C-10 Causal information-seeking strategies change through adolescence

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We rely on our understanding of causal relations to select adaptive actions across myriad domains. It is unclear, however, how our ability to strategically seek causal information changes through late childhood and adolescence as prospective control and model-based reasoning improve. Here, we investigated whether the ability to make informative causal interventions similarly changes through these developmental periods. Ninety participants between the ages of 7 and 25 completed 40 different puzzles in which they had to intervene on causal systems to determine their underlying structures. Each puzzle comprised a 3- or 4-node computer chip with hidden wires. The arrangement of the wires determined whether activation of one node would cause others to turn on. On each trial, participants viewed two possible arrangements of the chip's hidden wires and had to select a single node upon which to intervene to determine the chip's underlying structure. After observing the outcome of their intervention, participants selected the wire arrangement they believe reflected the chip's structure and rated their confidence in their selection. We characterized participant choices with a Bayesian measurement model that indexed the extent to which participants used a discriminatory strategy by selecting nodes that could disambiguate the two possible causal structures vs. a confirmatory strategy by selecting nodes that elicited evidence in favor of one causal hypothesis, but did not necessarily discriminate between them. Our model estimates revealed that the use of discriminatory strategies increased through adolescence and plateaued into adulthood. Further, developmental improvements in intervention strategy were supported by the ability to accurately judge the strength of evidence that interventions revealed, as indexed by participants' confidence in their selections. Our results quantify clear developmental improvements in causal reasoning through adolescence.

1-C-11 Contingency learning and value-guided decision-making in adolescents

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Objective: Learning the causal relationships between choice and outcome and making fine-grained value comparison judgements rely on distinct subregions of the orbitofrontal cortex (OFC). When these brain regions are damaged in the adult choices appear irrational with the decision maker adopting alternative decision strategies. Here we investigated

whether the underdeveloped state of these brain regions in adolescence result in the adoption of similar alternative decision strategies. We focused on two learning mechanisms: "Credit assignment" and "Spread of Effect". The former mechanism describes how normal behaviour is guided by precise predictions of causality between choices and outcomes while the latter spreads the reinforcing properties of the outcome to all temporally proximate choices, including choices that did not actually cause the outcome. Methods: Participants aged 11 to 35 performed an online probabilistic 3-choice decision-making task in which the expected value of each option varied and reversed over the course of the task and could be learned through trial-and-error. In addition to age and gender, we collected impulsivity and risk-taking metrics with the impulsivity scale for children and RT18 risk-taking questionnaire. Results: Multiple logistic regression analysis revealed that, relative to adults (aged 24-35), older adolescents (aged 18-23) showed an expected reduction in the influence of credit assignment mechanisms on choice. In addition, impulsivity scores correlated with age, risk-taking, and key learning and decision variables, including credit assignment. Conclusion: This study provides evidence that compared to adults older adolescents behaviour is erroneously less guided by the causal relationship between choice and reward suggesting an age-dependent shift towards a credit assignment mechanism. Understanding the behavioural impact of OFC development in distinct decision contexts is key in explaining age-dependent decision-making.

1-C-12 Associations between play, brain development, and creativity in early childhood

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Early childhood represents a time of incredible creativity. However, little is known about how neural network dynamics support creativity in early childhood, or how individual differences in experience shape these networks. In adults, creativity has been consistently linked to interactions between the default mode network (DMN) and the ventral attention network (VAN). These networks are typically anticorrelated, but during the creative process, they become more correlated, connecting imaginative processes with attention and problem solving processes. In early childhood, the DMN and VAN are more interconnected, perhaps supporting children's high levels of creativity. Here, we collected data on play experiences, resting state fMRI, and creativity in children (n=44, ages 4-7) to examine how individual differences in play experiences relate to DMN-VAN connectivity, and how DMN-VAN connectivity supports creativity. Parents reported on the frequency of children's play in 5 domains: spatial, number, music, art, and pretend. Children completed a nonlinguistic creativity task, the creative foraging game (CFG), in which they arranged virtual blocks to make novel shapes (Hart et al., 2017). DMN and VAN networks were defined based on Yeo et al., 2011. DMN-VAN connectivity was negatively related to age ($t(40)=-2.74$, $p=.009$). Controlling for age, frequency of play in all domains positively related to DMN-VAN connectivity (spatial: $t(33)=2.28$, $p=.03$, number: $t(33)=2.19$, $p=.04$, music: $t(33)=2.06$, $p=.05$, art: $t(33)=2.46$, $p=.02$, pretend: $t(33)=2.33$, $p=.03$). DMN-VAN connectivity was positively associated with CFG performance ($t(35)=2.55$, $p=.02$), controlling for age, motion in the scanner, and mean between network connectivity ($t(34)=2.45$, $p=.02$). In sum, play was positively related to DMN-VAN connectivity, which in turn was positively related to performance on the CFG. These results suggest that play may slow down the maturation of DMN-VAN interactions, with benefits for creativity.

1-D-13 Resistance to Peer Influence: Associations between Self-Report, Experimental Manipulation, and Neural Activation in Adolescents

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Adolescence is considered a sensitive period for socioemotional development (Blakemore & Mills, 2013). Adolescents spend more time with their peers compared to other age groups (Fuligni & Eccles, 1993), make riskier decisions when they are in the presence of their peers (Gardner & Steinberg, 2005), and recruit neural circuitry associated with reward when making these decisions (Chein et al., 2011). Adolescents typically modify their behavior in an effort to conform with

their peers (Allen et al., 2006), as they find peer acceptance rewarding (Guyer et al., 2012). While these phenomena have been examined in isolation, to our knowledge, researchers have not demonstrated whether adolescents who recruit more reward circuitry upon receiving peer feedback are also more likely to be susceptible to peer influence. The goal of this study was to determine whether there was an association between neural activation to peer feedback, self-reported resistance to peer influence (RPI), and experimentally manipulated peer influence. To address this, we asked participants to complete the Friendship Feedback task (Breiner & Galvan, under review), the RPI, and a risk taking and decision-making survey. They also experienced an experimental manipulation of peer influence which required them to complete the same surveys a second time--after viewing what appeared to be another peer's responses. Adolescents who were susceptible to peer influence modified their responses with regard to substance use during the experimental manipulation. Additionally, those who recruited the ventral striatum when they received the feedback they expected from friends also reported being more eager to fit in with peers. Taken together, this work suggests adolescents who are more concerned about fitting in with peers are more likely to modify their behavior to do so, and recruit reward circuitry when they receive validation.

1-D-14 Comprehensive Characterization of Individuals with a Family History of Alcohol Use Disorder

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Meta-analyses of family, twin, and adoption studies suggest that Alcohol Use Disorder (AUD) is approximately 30%-50% heritable, and a family history of AUD is one of the most important risk factors for AUD development. As extant studies in the literature tend to focus on a small number of phenotypes, this study aims to comprehensively examine group differences between adolescents (13-18 years of age) with a family history of AUD (family history positive - FHP) and those without such history (family history negative - FHN). Compared to age- and gender-matched FHN participants, individuals in the FHP group with little-to-no substance use showed abnormalities on a variety of cognitive and personality domains. FHP individuals tended to value immediate, smaller monetary rewards over delayed, larger rewards (Delay Discounting Task). On separate reward-related decision-making task (the Cups Task), they also made more disadvantageous risky choices and failed to take advantageous risks. In other cognitive domains, FHP showed lower IQ scores and worse performance on a spatial memory task than FHN. Lastly, on self-report personality scales, FHP showed heightened attentional impulsivity (Barratt Impulsiveness Scale) and negative affect-driven impulsivity (UPPS). They also showed higher Neuroticism (NEO-FFI) than the FHN group. In summary, we find evidence for a complex and varied phenotype (heightened impulsivity and negative affect, abnormal reward sensitivity, and cognitive deficits) associated with family history status.

1-D-15 Exergaming and Executive Functioning in Young Adulthood: Positive Associations between Cognition and Physical Activity

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Executive functioning (EF) skills continue to develop during young adulthood. Although EF is traditionally measured with decontextualized tasks (e.g., cold EF), recent research suggests that the cognitive processes invoked in emotional or motivational situations (e.g., hot EF) may be equally important predictors of wellbeing. Exergaming - active video gaming - increases cold EF skills, but no research has examined how exergaming affects hot EF skills. The current study evaluated the effects of exergaming on EF skills. Given prior research, we hypothesized that exergaming would increase both hot and cold EF skills. Thirty college students (16 females; Mage = 19.78) completed a sedentary videogame and exergame condition over two separate visits. During each session, participants completed several cognitive tasks measuring hot (e.g., Balloon Analogue Risk Task) and cold (e.g., Stroop Color-Word task) EF. Participants then played one of the games and completed a second round of EF testing. Repeated measures ANCOVAs were used to examine differences in hot and

cold EF, controlling for age, sex, race, heart rate, BMI and pre-test scores. Results suggested that the exergame condition raised performance on the cold EF tasks (e.g., Stroop: $F(2, 28) = 4.83$, $p = 0.001$) but lowered performance on the hot EF tasks (e.g., Balloon Analogue Risk Task: $F(2, 28) = -2.13$, $p = 0.001$). The findings from this study suggest that exergaming is associated with improvements in cold EF skills. However, the hot EF results suggest that exercise may increase risk-taking behavior. Importantly, risk-taking is not always negative - it also promotes prosocial and adaptive behavior that exposes young adults to exciting and new environments that may benefit their wellbeing. Further research, with more diverse samples, should investigate how exercise may be used to promote cognitive health outcomes among young adults as well as how exercise affects hot EF skills across the transition to adulthood.

1-D-16 Peer presence increases adolescents' prosocial behavior by speeding the evaluation of rewards for others

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The presence of peers is commonly recognized to elicit maladaptive, reward-seeking adolescent behavior. Depending on the context, however, peer presence can also promote adaptive, prosocial decisions. Here, we combine social utility modeling and real-time motor measures of an incentive-compatible dictator game task in order to characterize how peer presence alters adolescents' altruistic and selfish decision-making. We found that adolescents behaved selfishly when privately allocating rewards between themselves and a peer. When watched by a peer, however, they became more altruistic and showed lower tolerance for advantageous inequity. By tracking the trajectory of computer mouse movements during the decision process, we found that altruistic behavior was associated with faster reward processing speeds for peers relative to the self, and individual differences in processing speed explained a significant proportion of variance in prosocial behavior. Moreover, the presence of a peer significantly increased the speed with which adolescents processed rewards for that peer, providing a causal mechanistic explanation for peer influence on prosocial behavior. Our results indicate that peer presence can prompt greater prosocial behavior by altering the processes by which adolescents consider outcomes for others.

1-D-17 Like my status?: Validation of a novel social decision-making task

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Relative to adults, adolescents have increased sensitivity to peer acceptance and rejection. Less is known about how peer social status and likelihood of acceptance influence teen interactions. In a novel task building upon reward/effort expenditure literature, participants chose to exert small vs. large amounts of motoric effort to receive peer feedback. Participants were led to believe that peers would be unlikely, somewhat likely or very likely to give positive feedback, and that peers had either low, medium or high social status. 76 (38F) adolescents (13-17 years) and adults (18-24 years) completed the task, and 9 adults (6F) completed an adapted version during fMRI. As expected, participants chose to exert more effort when the probability of positive feedback was high ($F=12.7$, $p<.001$) and when feedback was from high status peers ($F=25.9$, $p<.001$). A trend emerged that adolescents chose to exert more effort than adults to receive feedback across all trials ($t=1.86$, $p=.067$). Males chose to exert more effort for feedback than females ($t=3.68$, $p<.001$), with no interaction with age ($p=.95$). Participants who reported higher social anxiety on the Liebowitz Social Anxiety Scale chose to expend more effort for feedback from low status peers and less effort for feedback from high status peers compared to those who reported lower social anxiety ($F=4.06$, $p=.019$), and there was no interaction with age or gender (p's>.38). Preliminary fMRI data demonstrated activation of the bilateral dorsal anterior cingulate cortex and anterior insula, regions previously implicated during social decision making, when participants chose to exert effort. The findings illustrate the utility of the task to study how social status and probability of positive feedback influence social decision

making. Findings also suggest individuals with higher social anxiety may demonstrate maladaptive decision making. Future work will collect data in a larger sample and from adolescents during fMRI.

1-D-18 How Emotion Regulation Affects Decision-Making as Assessed by the Cups Task in Adolescents

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Background: Research has demonstrated a relation between emotion regulation and decision-making, both in the lab with decision-making tasks and by self-report of decisions outside of the lab (Figner et al., 2008; Panno et al., 2013). The brain continues to develop in adolescence, allowing for more effective emotion regulation which may lead to improved decision making in adolescence (e.g., Steinberg, 2014). This study assessed emotion regulation across informants (teen and parent) and levels (behavior and self-report) to assess whether better emotion regulation is associated with adaptive decision-making. Methods: 115 adolescents aged 10-15 (56% female) participated. Emotion regulation was assessed by adolescent self-report and parents' report of their adolescents' emotion regulation strategy use (both adaptive and dysfunctional across internal and external strategies). Adolescent emotion regulation was assessed behaviorally using an emotion interference task. Decision-making was assessed with a modified version of the Cups Task (Levin et al., 2007). Risks were considered maladaptive and adaptive based on expected value. Linear regression was used to assess associations between risk-taking and emotion regulation. Verbal intelligence and numeracy were covaried. Results: Parents who reported their adolescents used less dysfunctional internalizing strategies and older age both significantly predicted less maladaptive risk taking, whereas females took more maladaptive risks than males. When numeracy and verbal intelligence were added to the model, only parent-reported emotion regulation and numeracy were significant negative predictors of maladaptive risk-taking. Neither adolescent reported strategy use nor behavioral emotion regulation were associated with maladaptive risk-taking. Overall, these findings suggest a unique and robust role of parent perceptions of adolescent emotion regulation for decision making which could be useful for screening at-risk adolescents.

1-D-19 Examining How Context and Affect Influence Motivated Cognitive Control Across Development

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The impact of contextual factors, including positive and negative stressors, on motivated cognitive control across development is important for our understanding of risk-taking behaviors, but remains poorly understood. Here, we present preliminary data from a within-person, cross sectional, repeated measures, eye tracking study in which a community sample of adults (ages 25-40), adolescents (ages 11-16), and children (ages 7-10), performed multiple iterations of a rewarded antisaccade task under different social and emotional experimental contexts. These contexts included a 'baseline' rewarded antisaccade task, as well as rewarded anti tasks played 1) with a virtual peer, 2) after peer rejection, and 3) while anticipating a social stressor. Behavioral eye tracking measures (reaction times and correct response rates) within each manipulation will be presented. Preliminary evidence indicates a significant main effect of age, such that higher age was associated with better performance ($b = -0.09$, $t = -2.67$, $p < 0.05$). Interestingly, for adolescents and adults, but not children, a significant interaction effect (adults: $b = -0.03$, $t = -3.10$, $p < 0.05$; adolescents: $b = -0.04$, $t = -2.47$, $p < 0.05$) was found among contextual manipulations, indicating that accuracy was influenced across each rewarded antisaccade run. Moreover, autonomic arousal (via electrodermal recordings) was concurrently monitored throughout all manipulations, and these data will also be presented. Eye tracking results will be presented along with results from self-reported affect questionnaires and physiological arousal measurements as a means to better understand individual and contextual differences in behavior. Our results will be discussed in terms of how individual differences in "context lability", defined as the degree to which contextual factors enhance or degrade behavior, may be related to risk taking, particularly during adolescence

1-D-20 Perseverance in adolescents and young adults is related to neural response to performance feedback

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Although performance feedback itself has no extrinsic value, it can produce subjective feelings similar to rewards and punishments (Eisenberger, 2012). When perceived as motivational, performance feedback provides valuable information that can help guide learning (Tricomi et al., 2016). The present study examines whether neural response to feedback is related to intrinsic motivation to engage in an effortful cognitive task despite prior failure (i.e., perseverance). Adolescents and young adults were tested to examine age-related development in neural response and behavioral perseverance. During functional magnetic resonance imaging, 100 adolescents and young adults ages 13-30 (61 female; Mage=18.33) completed a novel perseverance task. Participants first completed a series of mental rotations during which they received quasi-manipulated feedback that their responses were either correct or incorrect (40% of trials received incorrect feedback regardless of performance, 60% received accurate feedback). Participants then made decisions to continue on a path requiring more mental rotations (persevere) or quit for an easier path. Perseverance decisions increased with age, $t(98)=-2.27$ $p=.026$. Negative feedback (manipulated and accurate collapsed) elicited activation of anterior insula (AI) and dorsal anterior cingulate whereas positive feedback elicited activation in ventral striatum and medial prefrontal cortex, $Z>3.1$ $p<.05$ corrected. Individuals who persevered exhibited reduced AI activation to negative feedback and lower behavioral inhibition scores (BIS scale, Carver & White, 1994), measuring tendency to avoid aversive experiences, compared to individuals who quit. Results expand understanding of the neural systems associated with motivation and perseverance during adolescence and early adulthood. Additional results controlling for prediction error during manipulated feedback and examining how feedback relates to subsequent performance will be presented.

1-D-21 Brain and behavioral asymmetries for gain and loss learning emerge with age during adolescence

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Adolescence is a period of the lifespan accompanied by normative shifts in motivated behavior, and the ability to learn from gain and loss incentives matures with age. However, it remains unclear whether adolescents exhibit value prioritization during gain and loss learning, a process that allows individuals to enhance learning for high-value outcomes in a goal-directed fashion. To test this question, N=84 participants age 13-20 completed a value-modulated probabilistic reinforcement learning task with low and high stakes gain and loss learning contexts during functional neuroimaging. Value prioritization was indexed by comparing learning performance, as measured by proportion optimal choice, between high and low stakes conditions when participants learned to approach gains or avoid losses. Older adolescents exhibited value prioritization in the gain domain, a behavioral profile that emerged with age during late adolescence. In contrast, younger adolescents exhibited value prioritization in the loss domain, and this effect attenuated with age. These age-related differences in learning could not be explained by differences in self-reported subjective value of the monetary incentives. Age-related asymmetries in value-prioritization were mirrored in functional recruitment of the ventral striatum during feedback. Younger adolescents exhibited value-based differentiation in the striatum during loss learning. However, with age, individuals were more likely to increase ventral striatal activity for high relative to low value gain outcomes. Moreover, gain value-tracking in the ventral striatum was associated with enhanced value prioritization during gain learning. Together, these findings reveal age-related asymmetries in brain and behavioral signatures of value-prioritization during gain and loss learning.

1-D-22 What Cognitive Processes Change during the IGT Across Adolescence?

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Background: Previous work has demonstrated cross-sectional and longitudinal age-related improvements in decision-making as assessed by the Iowa Gambling Task (IGT). However, longitudinal changes in strategies used to approach IGT-based decision-making have rarely been tested. Developmental longitudinal findings may yield crucial insights as to the cognitive processes that underlie improvement on the IGT and can inform adolescent decision-making interventions. Methods: This study investigated healthy adolescents' IGT performance across a ten-year span. 181 individuals (ages 9-23) completed a baseline session and were followed at two-year intervals yielding five assessments. A 100-trial version of the IGT was used. Individuals could select freely from each deck. At each timepoint, adolescents' trial-by-trial decisions were used to estimate parameters from the Outcome Representation Learning Model (Haines et al., 2018), a computational approach that has yielded insights about decision-making strategies in adult and clinical samples. This model yields five parameters that correspond to reward learning, punishment learning, memory, a tendency to prefer decks that yield frequent wins and a tendency to stay with recently chosen decks (vs. shifting/exploring). Analyses: Analyses of the baseline session indicate age-related increases in learning from punishment and increased tendencies to stay on recently chosen decks during the IGT. The longitudinal trajectory of each model parameter is being assessed to determine concordance with cross-sectional findings. Using linear mixed effects models, all five parameters will then be simultaneously modeled to assesses how between-subject differences and within-subject differences (i.e., parameter changes over age) are associated with age-related changes in overall performance, controlling for gender and intelligence. Implications for our understanding of adolescent risk-taking behavior will be discussed.

1-E-23 Testing the Contributions of Motor Proficiency and Physical Activity as Predictors of Executive Function Skills in Early Childhood ? A Within-Child Analysis

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Objective: Moderate to vigorous physical activity (MVPA) has been consistently associated with improved executive function (EF) skills in middle childhood and adulthood. Few studies have tested whether MVPA contributes to EF skills in early childhood. We tested the contributions of MVPA and motor proficiency to the development of EF skills in early childhood. Method: The KALS study included 280 preschool-aged children who were assessed three times across a single academic year. Data from the first cohort of children (N = 124) are fully collected. Data from second cohort (N = 157) are being collected now. Analyses presented here are based on Cohort 1 data. Analyses presented at Flux will include combined Cohort 1 and 2 data. Measures included performance-based assessments of EF skills, motor proficiency, and up to 5-days of accelerometry to define MVPA. Results: Hierarchical linear models (HLMs) were used to test within-child associations between motor proficiency and MVPA as predictors of EF skills. Our approach accommodates the hierarchical data structure and includes standard covariate adjustment (e.g., demographics; preschool setting type). Bivariate correlations indicated that EF skills were more strongly associated with motor proficiency (rs = .69, .62, and .55 at fall, winter, spring assessments, respectively, ps < .001) than with MVPA (rs = .10, .13, and .02, all ps > .15). Results from HLMs indicated that motor proficiency exerted a unique effect on EF skills (b = .23, p = .02) but MVPA did not (b = .32, p = .92). Conclusion: These results suggest that efforts to improve motor proficiency, but not MVPA, may be an important component of early educational efforts. These results also provoke broader questions about the development of EF (e.g., why would MVPA matter more for older than younger children; what are the neural mechanisms that relate motor proficiency to EF).

1-E-24 Brain Dynamics and Temporal Trajectories of Decoding Expressive and Neutral Faces in Children

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From a young age, establishing socio-emotional competences is critical to navigate through increasingly complex social interactions. Electrophysiological markers of face processing provide insight into mechanisms underlying the typical and

atypical development of these competences. We focused on emotion perception as one crucial facet of socio-emotional development. Within an EEG paradigm for children, we manipulated emotional valence and repetition of expressive stimuli. We hypothesized that early (P1, N170) and late ERP (P3) amplitudes associated with emotion perception would be (1) larger for expressive compared to neutral faces and (2) smaller for repeated compared to novel stimuli, indicative of facilitated emotion categorization processes. EEG was collected while typically-developing children (N= 24, M = 5.3, SD = 0.6 years) saw two successive faces displaying the same or a different emotion (happy, neutral, angry). Participants were asked to indicate whether the presented emotions were identical. P1 and P3 amplitudes were significantly larger for angry compared to happy or neutral faces A significant emotion x hemisphere interaction for the N170 indicated that angry faces elicited smaller amplitudes compared to happy and neutral faces within the right hemisphere; no effect was found for the left hemisphere. No ERP effect of emotion repetition was found. Emotion matching performance was positively correlated with P1 amplitude differences between angry and neutral faces. Emotional faces elicited larger amplitudes than neutral faces, likely indicating higher saliency of emotional faces. Reasons for missing repetition suppression results might include design specifics and competing initial encoding efforts with subsequent activations of stable stimulus' representations. Task performance was related to P1 amplitude differences between angry and neutral faces indicating an influence of early neural encoding of emotions on successive behavior.

1-F-26 Magnetoencephalographic signatures of hierarchical rule learning in newborns

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Fetal magnetoencephalography (fMEG) allows to non-invasively measure fetal and neonatal brain activity. With fMEG, auditory event-related responses to tones as well as auditory mismatch responses can be reliably recorded in the last trimester of pregnancy as well as shortly after birth, which demonstrates auditory discrimination on a neuronal level. To differentiate conscious perception and learning from automated sensory processing, a complex - hierarchical - oddball paradigm was used. The auditory "local-global" mismatch paradigm establishes a global rule, whose violation causes a global mismatch response, in addition to the mismatch response caused by a local oddball. After an initial rule-learning phase, this globally deviant sequence appears in one fourth of trials. Depending on the rule, the local oddball can be within either the standard or the deviant sequence. The sequence without oddball can be standard or global deviant respectively. All subjects were stimulated with both rules, resulting in four stimulus conditions. fMEG measurements were performed in 21 newborns between 13 and 55 days (M=31). Stimuli were sequences of 500Hz as well as 750Hz tones. Newborns showed mismatch responses towards local as well as global rule violations. The local oddball within the globally deviating sequence elicited the strongest mismatch response. A weaker mismatch response was observed for the oddball within the standard sequence. Comparison of both sequences with or without oddball (role of global standard or deviant) revealed in both cases an early and a late global mismatch response (peaking at 350ms & 1010ms; 380ms & 920ms respectively). These findings give a strong indication for learning of the presented rule. Within the framework of the "local-global" paradigm, learning of the global rule is seen as a neuronal correlate of conscious processing. Investigating this correlate can be a valuable contribution to the research on early cognitive development.

1-F-27 The role of semantic elaboration and perceptual binding for episodic encoding: ERP and oscillatory subsequent memory effects in children, adolescents and young adults

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Age-related differences in episodic memory are often attributed to retrieval difficulties, as the developmental trajectory of successful encoding is poorly understood. Specifically, during development the role of elaborative semantic processing employed intensively in young adults remains unclear, as young children spontaneously recall more perceptual details,

but often at the expense of fewer overall item numbers. Here, we investigated subsequent memory effects in children (aged 9-10 years), adolescents (aged 11-13 years) and young adults using both neural oscillations and event-related potentials (ERPs). Participants decided whether the objects represented by colored line-drawings occurred more frequently indoors or outdoors while explicitly encoding the items. Behavioral performance - including the differentiation between items repeated in identical or changed format during test - was high in all groups. In line with prior results, EEG data revealed that two processes are critical for later retrieval success in young adults: ERPs indicated an N400-like subsequent memory effect over central electrodes, followed by a right parietal positivity. Similarly, oscillations increased in the alpha and lower theta frequency bands, associated with semantic elaboration und feature-binding, respectively. By contrast, oscillations in the alpha band were observed inconsistently for adolescents and absent in children. Increases in lower theta as index of perceptual encoding were observed for both subsequent feature hits and misses, suggesting an active, but inefficient encoding strategy. Together, these results point to qualitative rather than quantitative changes in the cognitive processes employed during encoding. Given the ubiquity of learning during childhood and adolescence, these findings have important implications on how much and which type of information can later be retrieved from memory, and the mechanisms that may enhance memory performance in each age group.

1-G-28 Neighborhood racial demographics predict infants' motor system activation toward racial out-group individuals

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Objective: The human tendency to view the social world in terms of "us" and "them" emerges early in ontogeny yet the mechanism behind this tendency remains unclear. One candidate mechanism for this tendency is the action processing and mirroring mechanism. This study examined whether infants' perception of others' actions as reflected in neural motor activation is affected by the racial demographics of the neighborhood they live in. Methods: Forty-three 8- to 12-month-old White infants' EEG data across three studies were combined for secondary analyses. In all studies, infants observed either a White or Asian female actor grasp an object. Baseline-corrected mu power (6-9 Hz for infants) averaged across the C3 and C4 electrode clusters was extracted locked to the observed reach-to-grasp movement. This neural correlate of motor activity was examined in relation to neighborhood demographics based on zip code using a mixed model approach. Results: There was a significant interaction of mu power between the proportion of non-White population in the zip code and the racial group (White vs. Asian) of the presenter, = -7.965, SE = 2.348, t = -3.392, p = .002. Specifically, when White infants viewed an Asian presenter (n = 24), those from a neighborhood with greater proportion of non-White population showed greater mu desynchronization (i.e., greater motor activity), adjusting for variety of racial groups, proportion of Asian population, median income, and population density of the neighborhood, = -5.757, SE = 2.047, t = -2.812, p = .012. However, when White infants viewed a White presenter (n = 19), none of the neighborhood demographic variables predicted mu desynchronization. Conclusions: White infants showed greater motor activation toward a racial out-group individual if they have more exposure to racial out-group individuals in their neighborhood, suggesting motor system activation related to action understanding and mirroring is sensitive to neighborhood context.

1-G-29 Cumulative socioeconomic risk and child maltreatment as predictors of individual differences in neural systems underlying inhibitory control in adulthood

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Childhood adversities, such as poverty and maltreatment, place youth at increased risk for socioemotional and adjustment problems that can persist throughout the lifespan (Evans & Whipple, 2013). Alterations in higher-order neurocognitive processes such as inhibitory control may be one mechanism by which experiences of deprivation and

threat influence later adjustment outcomes (McLaughlin & Sheridan, 2016), but findings remain inconsistent due in part to difficulties disentangling these dimensions (e.g., Rosen et al., 2018). The current study examines the extent to which cumulative socioeconomic (SES) risk (as indexed by low income-to-needs ratio at 3 timepoints and low maternal and adult respondent educational attainment) operates independently of and interactively with child maltreatment history to predict individual differences in neural systems underlying inhibitory control. 72 adult participants were recruited from a prospective longitudinal study (Jedd et al., 2015) beginning at 6-9 years of age. Half of the participants had a history of childhood maltreatment. fMRI data were collected during an inhibitory control paradigm containing positively- and negatively-valenced images. We found a positive association between cumulative SES risk and activation in the anterior cingulate cortex ($p<.005$, 316 voxels) and medial prefrontal cortex ($p<.005$, 145 voxels) during the negative blocks. We also found an interaction between cumulative SES risk and maltreatment status in the bilateral caudate ($p<.005$, 62 voxels) during negative blocks. The comparison group showed increasing caudate activation with increasing SES risk, whereas the maltreated group exhibited similar activation across all levels of SES risk. No main effects were found for maltreatment status, or for either type of adversity during positive blocks. These data provide new insights into the neurodevelopmental impacts of specific dimensions of adversity that underlie a wide-range of individual outcomes.

1-G-30 Executive functioning is impacted by chronic stress hormones in early childhood

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Chronic stress during childhood negatively impacts cognition including executive function (EF), as well as physical and mental health. Exposure to stressors over time can cause hypothalamic-pituitary-adrenal (HPA) axis dysregulation, leading to abnormal stress hormone levels, which can be reflected in hair cortisol concentration (HCC) and hair dehydroepiandrosterone (DHEA) concentration. The use of HCC and DHEA to measure chronic stress in children is increasing, however the obvious question of whether these measures are associated with cognitive abilities has not been examined to date. Accordingly, the aim of the study was to investigate the associations of HCC, DHEA, and their ratio with measures of EF (cognitive flexibility and working memory [WM]) in a sample of kindergarten children (N=100). We tested 2 competing hypotheses: 1) There is a negative and linear correlation between hair biomarkers and EF, if chronic stress detrimentally affects cognitive performance and hair biomarkers are a sensitive measure of chronic stress; or 2) The relationship between hair biomarkers and EF performance should show an inverted U-shaped curve such that EF performance will be poor when HCC is on either of the two extremes, assuming similar impact of chronic stress on performance as acute stress. Unexpectedly, our results did not provide support for either hypothesis. Although we found that the negative association between HCC and WM approached significance, we also found that DHEA was significantly positively related to cognitive flexibility. Further, we did not find evidence for the U-shaped curve between HCC and EF. These findings suggest areas for future investigation, such as relationships between HCC, DHEA, and other measures of EF and encourage further exploration into hair concentrations of hormones as measures of chronic stress.

1-G-31 Developmental trajectories of executive functions in seven countries

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Executive functions (EFs) undergird important goal-directed behaviors, including logical reasoning, and are associated with academic, employment, and psychological outcomes. Because improvements in EFs are consistently associated with neurological development (e.g., of the prefrontal cortex), there is an implicit universality to their development. However, little research has explored the development of EFs cross culturally. Thus, the field knows little about how cultural context impacts the trajectory of EFs. The current study will address this gap by modeling the development of EFs in a longitudinal, cross-cultural sample of youth from age 10 to 16. Participants will be drawn from Colombia, Italy, Jordan,

Kenya, the Philippines, Sweden, and the U.S. Participants completed a battery of computerized tasks at age 10 , age 13, and age 16. At the time of submission, the sample size in each country ranges from 74 (Kenya) to 207 (U.S.) (M = 114.57). We will examine three tasks of EF: (1) Digit Span (2) a working memory interference task; (3) a verbal fluency task. Research shows that many EFs develop quickly from childhood into early adolescence, then change more gradually thereafter. To model this nonlinear change, we will use piecewise analyses. Specifically, we will estimate two slopes: one from age 10 to age 13, and one from age 13 to age 16. This analysis permits us to test whether the developmental change from 10 to 13 differs significantly from 13 to 16. Further, using a multigroup analysis framework, we will test whether developmental change from 10 to 13 and from 13 to 16 varies across countries. We hypothesize a similar general pattern that there will be dramatic increases from 10 to 13 and more modest changes thereafter across countries. We anticipate variation in the magnitude of change across countries but make no specific hypotheses regarding which countries will demonstrate the largest increases in EFs in the absence of prior research.

1-G-32 Early Caregiving Instability and Incremental Learning Strategies

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Theoretical work suggests that 'model-based' strategies confer the most advantage over 'model free' learning under conditions of low environmental uncertainty (Simon & Daw, 2011; Kool et al., 2016). Here, in a developmental context, we ask whether variations in environmental uncertainty predict children's tendency to construct and iteratively draw from cognitive maps of the environment to choose actions. Specifically, we test the association between early caregiving instability and the use of model-based strategies with a sample of school-aged children (Anticipated N ≈ 200, 7-13 years old) with a large number of caregiving transitions. Model-based learning is measured on a trial-by-trial basis using a 'gamified' sequential learning task adapted from Daw et al. (2011) and Decker et al. (2016). Data collection is currently in progress. We will construct and validate both hierarchical reinforcement learning and logistic regression models to estimate the association between number of caregiver switches and recruitment of model-based strategies. We hypothesize that higher caregiving instability, as operationalized by the number of caregiver switches, will predict decreased use of model-based strategies. This work will bridge reinforcement learning approaches with adversity-impacted behavioral outcomes to better inform understanding of mechanisms of incremental learning across development.

1-G-33 Peer victimization and dysfunctional reward processing: ERP and behavioral responses to social and monetary rewards

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Peer victimization (or bullying) is a known risk factor for depression, especially among youth. However the mechanisms connecting victimization experience to depression symptoms remain unknown. Aberrant responsiveness to social rewards may be a key deficit connecting socially stressful experiences with later depression. We therefore sought to determine whether experiences with social stress would predict response to social rewards over monetary rewards. Neural responses to monetary and social rewards were measured using event-related potentials (ERPs) to peer acceptance and rejection feedback (Island Getaway task) and to monetary reward and loss feedback (Doors task) in an adolescent sample followed longitudinally since preschool. In the Island Getaway task, participants voted whether to "keep" or "kick out" each co-player, providing an index of prosocial behavior, and then received feedback about how

each player voted for the participant. Analyses tested whether early and recent peer victimization (measured using the Health and Behavior Questionnaire) predicted response to rewards (peer acceptance or monetary gains), residualized for responses to losses (peer rejection or monetary losses). Findings indicated that both experiencing greater early and recent peer victimization were significantly associated with participants casting fewer votes to accept other adolescents ("Keep" votes) and that early and recent peer victimization were significantly more associated with neural response to social than monetary rewards. These findings show that early victimization is associated with later reduced response to peer acceptance, and with later tendency to reject peers. Findings suggest specificity to reward processing of different types, thus future research should take a more nuanced approach to paradigms that test reward response.

1-H-34 Developmental brain correlates of psychosis vulnerability and early onset cannabis use

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Background: Investigating the neural correlates of adolescents reporting a mild form of psychotic symptoms (i.e., psychotic-like experiences - PLE) provides a unique opportunity to explore whether brain abnormalities can be observed at an early developmental stage of a psychosis vulnerability. Following on previous findings by our team of a limbic hyperactivity associated with emerging psychotic symptoms during adolescence, this prospective study tested whether youth reporting PLE show altered developmental changes of hippocampus and amygdala volumes specifically and whole brain cortical thickness (CTh). This study also examined whether the hypothesized pathogenic process is moderated by early onset cannabis use. Methods: Thirty adolescents reporting elevated PLE selected from a population-based cohort were compared to 102 same-age healthy controls following two sessions of structural neuroimaging. Subcortical volume-based reconstruction was done using FreeSurfer while whole brain CTh was extracted with Civet 2.0. Linear mixed effect models were implemented using R (volume analyses) and Surfstat (CTh analyses). Results: Youth with elevated PLE showed smaller amygdala volumes at both time points (standardized coefficient: -0.18) and a modest decrease of hippocampal volume over time (standardized coefficient: -0.03). Cannabis use in the whole sample was associated with thicker cortices in the right parahippocampal gyrus and the right inferior temporal and occipital gyri. A modest cannabis by PLE group interaction was observed in the left parahippocampal gyrus (standardized coefficient: 0.02). Conclusions: Smaller volumes of both the hippocampus and the amygdala may represent important early vulnerability markers for psychosis. Further research is needed to investigate the temporal relationship between structural and functional deficits within the limbic network of vulnerable youth.

1-H-35 Neural Mechanisms Associated with Neonatal Reflexes

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Objective: Neonatal reflexes function in cognitive development as predispositions that provide opportunities for babies to interact with the world. Between 4-6 months of age many reflexes begin to disappear as volitional actions emerge. A longstanding model posits that this transition is mediated by a shift from subcortical to cortical control, with subcortically-mediated reflexes declining as cortical control develops. This project tests this hypothesis by mapping developmental trajectories of lower extremity reflexes and of the pyramidal tract (PT) from 0-6 months in the same infants. Methods: Diffusion MRI and reflex data (assessed using the NICU Network Neurobehavioral Scale (NNNS)) were collected at up to 3 and 14 time points, respectively, before 6 months in N=10 infants. The PT was partitioned at the corpus callosum to delineate portions of the tract that extend largely through subcortical or cortical structures. Fractional anisotropy (FA) values were used to measure tract maturity. Trajectories were fit using functional principal components analysis. Results: Placing, stepping, Babinski, and plantar grasp reflexes began to decline at 0, 1, 2, and 3 weeks, respectively, with average change rates of -.055, -.044, -.039, and -.013 scaled NNNS scores per week. Both divisions of

the PT matured most rapidly in the first 14 weeks. FA was greater in subcortical compared to cortical PT at all time points, suggesting earlier maturation in areas of the PT that extend to subcortical structures. Conclusions: This project provides the first test of hypothesized brain-behavior transitions using densely-sampled prospective, longitudinal measures of brain and behavior collected in the same infants. Preliminary results show that lower extremity reflexes begin to decline in the first month of life, paralleled by rapid PT maturation. Further analyses (with an additional N=20 infants; total N=30) will test for correlational time-varying associations between these trajectories.

1-H-36 The link between Morphological Profiles and Cognitive Performance in Childhood

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We are starting to observe how changes in cognition and behavior are linked to changes in the network organization of the brain. We can construct a structural connectome during aging and examine which mechanisms shape the developing organization of the connectome. The classical approach is to define groups using a behavioural phenotype and compare brain measurements across these groups. But many of behavioral measurements involved a degree of subjectivity, and we may be grouping individuals with diverse underlying etiologies. We have become interested in whether we use neural data itself to create profiles, and then test how these neural groups relate to behavioural and cognitive measures. This approach holds the potential to identify groups of children with more homogenous underlying brain organization. Morphological brain measures are quite variable between individual subjects, so a big sample size is necessary to get a robust and reproducible result. We expect to find gray mater patterns (networks) specific to different cognitive profiles. We will use data from a large-scale study of cognitive difficulties in childhood, called CALM (Center for Attention, Learning and Memory), which contains cognitive, behavioural, learning and neural measures. We will use surface-based morphometry measurements, including thickness, gyrification and sulci depth extracted from anatomicaly-defined regions. These measures will be introduced to a clustering pipeline, including multidimensional scaling and subsequent density based clustering. We will use a density based clustering algorithm like HDBSCAN. We will perform a Silhouette analysis for internal validation and cross validation for generalizability dividing the data set in training and testing subsets. If we can establish that there are different groups of children, who are distinguishable at a level of cortical morphology, then we will examine how they differ on our other measures.

1-H-37 The relationship between social experiences and adolescent brain development

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Adolescence is a period associated with extensive changes in social behavior, social environments and social experiences. Neuroimaging studies have shown that the brain regions critical for navigating complex social interactions undergo significant structural and functional development during this life period. This 'social brain' network includes the medial prefrontal cortex (mPFC), temporoparietal junction (TPJ), and posterior superior temporal sulcus (pSTS). However, it remains largely unknown how the developmental changes in this brain network relate to intra- and inter-individual changes in social development and to variations in social environmental experiences. To address these questions, we are currently following up a sample of 142 adolescents, aged 9-18 years old who all underwent MRI scanning and will be scanned again 1 year later. In between these scanning sessions, every 2 months (total 5 times) participants receive a set of questionnaires on daily life (including prosocial) experiences to be filled in online. We plan to relate changes in grey matter volume, cortical thickness and surface area of regions of interest within the social brain network (mPFC, TPJ, pSTS) to individual differences in life experiences, prosocial behavior, and attachment with parents and friends, in the period between scanning sessions. The regular assessments of these variables allow us to examine how changes and stability in social behavior and experiences relate to structural social brain development. We expect accelerated volume loss and cortical thinning of regions in the social brain network compared to control regions in visual and motor cortex, in

adolescents high in prosocial behavior and social experiences across repeated assessments. At the time of the Flux conference we will start collecting data of the second MRI time point. We will therefore present a detailed preregistration summary of the project to receive feedback on the rationale, hypothesis and analysis plan.

1-H-38 How interindividual differences in IPS sulcal morphology shape symbolic number fluency in children

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While most studies have focused on characterizing the brain activation in numerical abilities, this study aims to investigate a complementary issue whether individual differences in neuroanatomy may have an influence on symbolic number abilities. To do so it is important to examine neuroanatomical characteristics not affected by brain maturation nor learning. We focused on sulcal morphology as it is determined in utero and is not affected by brain maturation or learning (Cachia et al., 2016). We have shown that sulcal pattern contributes to inhibitory control and reading abilities (Borst et al., 2016; Cachia et al., 2017). In this study we investigated whether differences in a key region for number processing, the intra-parietal sulcus (IPS) may explain part of the variability observed in symbolic number abilities. Two measures of symbolic number ability (number comparison task & number ordering task) were completed by 55 children. The left and right IPS sulcal pattern was categorized as sectioned vs not sectioned by a perpendicular branch. Children with a sectioned IPS had greater symbolic number accuracy compared to children with not sectioned IPS. We found a different effect of IPS sulcal pattern for the two specific symbolic number abilities. Both left ($F(1, 34) = 5.05$, $p = .03$) and right ($F(1, 46) = 4.55$, $p = .04$) IPS sulcal pattern had an effect on number comparison abilities whilst only right IPS sulcal pattern ($F(1, 34) = 5.02$, $p = .01$) had an effect on number ordering abilities. These anatomical findings mirror the functional results reported by Matejko and Ansari (2017) on the same participants. We also investigated whether IPS sulcal pattern had an effect on brain areas distant from the IPS using a Voxel-Based Morphometry analysis of grey matter (GM) volume. The IPS sulcal pattern was found to modulate the relationship between number comparison abilities and GM volume in the right middle frontal gyrus ($F = 32.55$, $pFWE = 0.035$).

1-H-39 Cortical thickness differences in children with dyscalculia when compared to those with dyslexia and those with combined dyslexia and dyscalculia

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The reading disability developmental dyslexia has been associated with less gray matter volume (GMV) and cortical thickness (CT), typically in left hemisphere regions that subserve reading ability. To date, there have been few studies that apply these GMV or CT approaches to the math disability developmental dyscalculia; studies in children comorbid for reading and math disability are even rarer, although the information gained would provide important insights into these common learning disabilities. In the current study, we investigated GMV and CT differences in a sample of children (ages 6-16 years) with dyslexia (N = 14), dyscalculia (N = 21), comorbid dyslexia and dyscalculia (N = 26), as well as typically developing children (N = 27). T1-weighted scans from each participant were preprocessed and analyzed in the SPM-based Computational Anatomy Toolbox (CAT12). Specifically, images were normalized and segmented into gray matter, white matter, and CSF. For GMV analyses, the gray matter images were smoothed using an 8 mm FWHM Gaussian kernel. For CT analyses, segmented images were converted into a surface-based mesh and smoothed using a 15 mm FWHM Gaussian kernel. We conducted whole-brain one-way ANCOVAs (using age and IQ as covariates) to determine differences in GMV and CT between the four groups. Although there were no significant differences observed in the GMV analyses, there were significant differences in CT in bilateral insulae ($p < 0.05$, FDR cluster corrected). Post-hoc analyses revealed that the difference in left insula was driven by greater CT in the group with dyscalculia as compared to the group with dyslexia and the comorbid group. In the right insula, the group with dyscalculia had greater CT compared to all other

groups. These findings implicate insulae structural anomalies in dyscalculia (identified with measures of CT but not GMV), setting this group apart not only from those with dyslexia, but also those with comorbid dyslexia and dyscalculia.

1-H-40 Relations between Hippocampal Volume and Sleep in Early Childhood

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Introduction: During sleep, memories undergo consolidation, the off-line process that stabilizes them leaving them less vulnerable to interference. This process is thought to reflect hippocampal-neocortical transfer of memories. Memories are consolidated with sleep in early childhood: learning is protected following a nap while memories decay when children stay awake. This memory benefit is specifically associated with sleep spindles density. Although previous research has linked the development of memory to the hippocampus and to sleep, the relation between hippocampal development and sleep spindles is not understood. The purpose of this investigation is to examine relations between hippocampal subregion volumes and sleep spindle density. Methods: Participants are part of an ongoing longitudinal study of sleep, memory and the brain in early childhood (3-5 years). Preliminary analyses include neuroimaging data from 11 participants (Mage=3.96 years, 6 female). Participants completed a visuospatial memory task once before a nap and then again after the nap. Sleep physiology was assessed via polysomnography (a montage of EEG, EMG, and EOG) during the nap. T1-weighted scans (.9mm3) were used to extract hippocampal subregions volumes and intracranial volume (ICV) using a rigorous combination of automated and manual processing tools. Results: Preliminary analysis showed negative relations between sleep spindle density and both left (β=-9.1x10^2, p=0.01) and right hippocampal body volume (β=-8.5x10^2, p=0.04) when controlling for ICV. This is consistent with prior work that suggests sleep spindle density decreases across early childhood and is therefore associated with more a more mature brain. Discussion: This is the first investigation to show relations between sleep spindles and the hippocampus in early childhood. Future analyses will examine relations between memory, sleep, and hippocampal volume in a larger sample.

1-H-41 Influence of Neighbourhood on Brain and Mental Health: A large scale MRI study of 4523 children

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Various studies have shown that neighbourhood socioeconomic disparities expose children to stressful situations that influences many aspects of children's behaviour (Cutrona et al. 2006; O'Campo et al. 2009; Meyer et al. 2014). However, neural correlates underlying this association are not well understood. Evidence from animal and human studies (Tottenham and Sheridan 2009) suggest that stress has negative effects on the amygdala and the hippocampus, which are critical for socioemotional processing (Gianaros et al. 2007) and development of memory (McEwen & Gianaros 2010), respectively. We investigated whether there are any volumetric differences in these structures in children from different SES neighbourhoods that could explain the behavioural differences. We used the Adolescent Brain and Cognitive Development, ABCD data (Casey et al. 2018) that consisted of MRI scans from 4523 children aged 9-10 years with neighbourhood SES measures, Child Behaviour Checklist (CBCL) scores and performance on various cognitive tasks. General linear models were used to look at the association between i) neighbourhood SES and behavioural scores, ii) SES with amygdala and hippocampal volume, iii) amygdala and hippocampal volume with behavioural scores. In all analyses, age, gender, race, site, family SES, and intracranial volume were put as covariates. We observed that children from lower SES neighbourhoods had higher internalizing and externalizing CBCL scores suggesting greater socioemotional problems and had poor performance on working memory tasks, as compared to those from higher SES neighbourhoods. We also observed that children from lower SES neighbourhoods had smaller amygdala and hippocampal volumes which were in turn associated with lower performance on working memory tasks and higher socioemotional problems. The amygdala

and the hippocampus might be the possible neuroanatomical correlates that relate neighbourhood disparities with cognitive and socioemotional processing.

1-H-42 Fine-Particle Air Pollution and Severity of Early Life Stress Interact to Predict Adolescent Structural Brain Development

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Air pollution is currently the greatest environmental threat to public health; we know little, however, about its effects on the brain during key developmental windows such as adolescence. In addition, it is important to recognize that exposure to air pollution co-occurs, and could interact, with social factors that also affect adolescent brain development, such as the experience of early life stress (ELS). In this study, we tested whether ELS moderates the link between neighborhood-level fine-particle air pollution (particulate matter 2.5; PM2.5) and adolescent brain development. In a sample of 116 adolescents (mean age=11.50 years at study entry) in Northern California, we conducted longitudinal tensor-based morphometry (TBM) over a two-year period to assess patterns of volumetric expansion and contraction across the brain that were associated with the interaction of ELS and PM2.5. Participants completed interviews assessing different types of stressful experiences, which were coded and aggregated by a panel of raters to form a measure of cumulative ELS severity. PM2.5 concentrations at the census-tract level were assessed using publicly available air monitoring station data. We found significant ELS by PM2.5 interaction effects on volumetric changes in a number of brain regions involved in cognitive and affective functioning, including prefrontal, thalamic, and superior longitudinal fasciculus regions. For most of these regions, the effect of PM2.5 on structural change was significant only for those adolescents who had experienced less severe ELS. Furthermore, adolescents who experienced less severe ELS but who lived in neighborhoods with higher levels of air pollution had patterns of brain development similar to those of adolescents with a history of exposure to more severe ELS. Thus, living in communities with higher levels of PM2.5 may adversely affect adolescent brain structural development in ways that are comparable to the experience of more severe ELS.

1-H-43 Experiences of Abuse and not Neglect are Associated with Decreased Amygdala Gray Matter Volumes in Depressed Adolescents

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Adolescents experiencing early life stress (ELS) are at an increased risk for depression. While evidence indicates that ELS affects gray matter volumes (GMV) of subcortical regions involved in threat regulation, including the amygdala, it is unclear if these effects are due to ELS more generally or if they are specific to experiences characterized by abuse (as opposed to neglect). Here, we recruited a sample of depressed adolescents that varied in their history of ELS to examine associations between amygdala GMV and severity of abuse as well as neglect. A community samples of 38 depressed adolescents (27 female; mean age: 16.19 ± 1.32 years) completed a T1-weighted MRI scan, from which we automatically segmented subcortical structures and estimated amygdala GMV using FreeSurfer 6.0. We administered the Child Trauma Questionnaire (CTQ) to assess severity of experiences of abuse and neglect , and the Reynolds Adolescent Depression Scale (RADS) to assess severity of depression. Linear regression models were conducted to test associations between bilateral amygdala GMV and experiences of abuse and neglect, with intracranial volume, age, and sex as covariates. Mediation models were conducted to estimate the indirect effect of amygdala GMV in explaining associations between CTQ and RADS. Higher severity of abuse was associated with smaller amygdala GMV when accounting for severity of neglect (B=-0.13; t(21)=-2.13; p=0.045), but severity of neglect was not associated with amygdala GMV when we accounted for severity of abuse (p=0.423). Further, the indirect effect of amygdala GMV on abuse and depression was trending (95% CI: 0-0.465) but was non-significant for neglect and depression. ELS characterized specifically by abuse, as

opposed to neglect, influence amygdala GMV in depressed adolescents. Future longitudinal research is needed to elucidate the effects of ELS (including type and timing) on neurodevelopment more broadly.

1-H-44 Early environmental factors associated with brain morphology in school-aged youth

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Early experiences confer risk and resilience for cognitive and socioemotional development, with profound effects on long-term behavior. Although neurobiological correlates of specific environmental factors have been assessed in multiple neuroimaging studies, precise environmental influences on brain development remain to be more comprehensively evaluated, particularly in a large developmental cohort. The present work examined the association between brain structure and a rich characterization of early environment (including caregiving, family conflict, neighborhood, academic engagement, peer relationships, trauma exposure, and culture) using the Adolescent Brain Cognitive Development (ABCD) data. Our study selected 584 youth (9-10 years old) based on availability of phenotypic data and MRI quality assessment. We performed an exploratory factor analysis to identify meaningful clusters of environmental factors, resulting in 6 factors, controlling for age, sex, and site. Individual scores extracted from these factors were then correlated with three MRI-based morphometric measures of cortical thickness, myelin, and surface area based on a partial least squares analysis. The analysis revealed latent variables showing a significant brain-phenotype correlation ($r=0.28$, $p<10\text{-}5$). Specifically, increased exposure to trauma, less positive parental and school environment, and lower access to substances were associated with higher cortical thickness across the whole brain, which could reflect differential cortical pruning processes. Diffuse (both positive and negative) associations were also observed in the surface area and myelin features, indicating potential global effects of early environments on structural brain development. By leveraging a large dataset of school-aged youth with broad environmental phenotyping, our findings lay the groundwork to better understand systems-level neural substrates that may link early experiences and long-term behavioral outcomes.

1-H-45 Healthy early-life family functioning is associated with white matter microstructural development in late childhood in a population-based neuroimaging birth cohort.

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Objective: Poor early-life social environments may cause challenges in many child developmental domains, while enriched environments may promote healthy development beyond the mere absence of such challenges. The family environment is among the most impactful domains of an early-life social environment, but research investigating white matter neurodevelopmental pathways linking the family environment to behavior remains limited. This study aimed to test our hypothesis that higher levels of early-life family functioning (FF) would predict higher levels of global fractional anisotropy (FA) and lower levels of global mean diffusivity (MD) in late childhood, which have been linked previously to lower levels of rule-breaking behavior. Methods: We analyzed data from 2681 children in the Generation R birth cohort in Rotterdam, the Netherlands. The study measured maternal-report, prenatal FF with the 12-item McMaster Family Assessment Device at mean gestational age 24 weeks (FF score range 1-4). The study collected diffusion-weighted scans in late childhood (mean age 10). We computed standardized global mean FA and MD values by averaging metrics from 15 major white matter tracts delineated by the FSL AutoPtx plugin. We multiply imputed missing data and constructed inverse probability weights for sample attrition. We used OLS models accounting for child sex, age, race / ethnicity, household income, in utero smoking exposure, and parental education, psychosis history, and psychopathology symptoms. Results: In fully-adjusted and weighted models, a one unit increase in prenatal FF was associated with a 0.12 standard deviation increase in global FA (95% CI 0.00, 0.23) and a 0.15 standard deviation decrease in global MD (95% CI -0.27, -0.02). Tract-specific analyses supported these global findings. Conclusion: Healthy early-life family functioning may

induce white matter microstructural differences in late childhood that have been linked previously to reduced problem behaviors.

1-H-46 Sex effects on the relationship between economic stress and neurocognitive function on subcortical gray matter volume in the Adolescent Brain Cognitive Development Study

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Objective: Economics stress has a significant impact on the developing brain, including reductions in gray matter volume (Blair, 2016). This analysis is attempting to determine the role of sex on the relationship between economic stress and neurocognitive function on subcortical gray matter volume in a large sample of preadolescent youth. Methods: Economic stress was measured using the data from the ABCD demographics survey (Barch et al., 2018), retrieved from the NIMH ABCD Data Archives (https://dx.doi.org/10.15154/1412097), summed, and log transformed to normalize the distribution. Fluid intelligence standardized, age-corrected composite scores (NIH Toolbox, Luciana et al., 2018). Generalized Additive Mixed Models (GAMM4, R) were run using the Data Exploration and Analysis Portal on the ABCD Interim Annual Release 1.1. The analysis included 699 youth ages 9-11 years with usable structural data and a fluid intelligence score, grouped by sex, controlled for fixed effect covariates (race/ethnicity, education, parental income, and marital status) and random effects (family and site). Results: Economic stress significantly predicts right amygdala volume (R2=0.18, F=9.57, p<.01, 14.92%); as well as left amygdala volume (R2=0.20, F=4.57, p=.03) and right nucleus accumbens volumes (R2=0.10, F=4.45, p=.04) over and above fluid intelligence. There was a significant interaction between sex and gray matter volume, such as that higher rates of stress predicted decreased gray matter volume in the right amygdala (F=4.87, p=.03), right accumbens (F=6.04, p=.01), bilateral caudate (right, F=7.25, p<.01; left, F=9.02, p<.01) in females only. Conclusion: Economic stress accounted for a significant amount of variance in subcortical gray matter volume above and beyond fluid intelligence in females. Interestingly, in males, there is little change in gray matter volume as economic stress increases. These findings demonstrate a role of economic stress in female cognitive development.

1-H-47 Neighborhood-level adversity as a unique predictor of hippocampal volume and neuropsychological function in children

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Extensive research has demonstrated the effects of early-life adversity-such as poverty, neglect, and physical trauma-on unfavorable outcomes. To date, the majority of brain research has focused on outcomes related to adversity at the individual-household-level(SES, parent education, etc.). The current study aimed to determine whether neighborhood characteristics explain additional variation in brain maturation and cognitive-behavioral performance, above and beyond what can be explained by household-level predictors alone. Data was acquired from the Adolescent Brain and Cognitive Development Study(ABCD; Release 2.0). Several variables across domains were used to assess neighborhood-level adversity(NA), including local physical, educational, and economic characteristics. Individual household income and parent reported financial adversity data were used as household adversity(HA) predictors. Outcome variables included prefrontal cortex volume and thickness, hippocampal volume, and NIH Toolbox fluid and crystalized cognition composites. A general linear mixed model approach was used to account for dependencies in the data due to nesting within site and family. NA and HA were entered simultaneously to determine unique variance. Follow-up model-based causal mediation analysis was performed. ND and HD each independently predicted hippocampal volume(ps<.001, B>.2), superior frontal volume(ps<.01, B>.15), fluid cognition(ps<.01, B>.21), and crystalized cognition(ps<.001, B>.5). Mediation analyses indicated that hippocampal volume partially mediated the relationship between ND and NIH Toolbox composites(ACME=.21, p=.01). The data demonstrate unique effects of neighborhood and individual-household adversity

on brain volume and cognitive function. These findings suggest that neighborhood-level characteristics provide a more comprehensive understanding of the multifaceted relationship between early life adversity and differential outcomes.

1-I-48 Individual variation in fronto-parietal control network topography supports executive function in youth

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Recent evidence has established that the spatial topography of functional brain networks differs markedly among individuals, with the frontoparietal control network (FPN) being the most variable. However, it remains unknown how this topography evolves during youth or relates to individual differences in executive function. Here, we capitalized upon a sample of 713 participants ages 8-22 who were imaged as part of the Philadelphia Neurodevelopmental Cohort and had over 27 minutes of high-quality fMRI data. We used a recently developed single-subject brain parcellation method based on non-negative matrix factorization to identify 17 individualized networks for each participant. Consistent with prior reports, we found that across-subject variability of network topography was highest in FPN and lower in visual and motor networks. Notably, the proportion of cortex devoted to the FPN increased with development (P(FDR) = 0.01) and was positively associated with executive functioning (P(FDR) < 0.001) while controlling for age. Using machine learning techniques, we found that this individualized functional topography could accurately predict both an individual's age ($r = 0.72$, $p < 0.001$) and executive performance ($r = 0.45$, $p < 0.001$) in unseen data. Critically, elements of the FPN were the most important features for predicting both age and executive performance. Finally, the spatial distribution of these predictive features within the FPN aligned with fundamental properties of brain organization, including evolutionary expansion, areal scaling, myelin content, functional role, and cerebral blood flow. Together, these results delineate a process whereby specific functional network topography in the FPN matures during youth to support executive function.

1-I-49 Pre-school performance monitoring is associated with development of OCD and brain networks implicated in executive control and emotion regulation

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While performance monitoring and self-control are adaptive processes, heightened childhood performance monitoring may contribute to aberrant development of brain networks responsible for error monitoring and top-down control. We assessed performance monitoring in 292 children (age 3-6 M(SD)=4.49(0.80)) completing a videotaped and coded Impossibly Perfect Circles task as part of the Laboratory Temperament Assessment Battery. Briefly, the experimenter instructed the child to draw a 'perfect' circle and repeatedly criticized the drawn circle's imperfections. Performance monitoring was coded based on frustration, diligence, intensity, and child self-criticism (Gilbert et al. 2018 JAMA Psychiatry). Compulsive behaviors and resting state-functional MRI data were collected in adolescence (age 14-19 M(SD)=15.93(0.96)) acquired on a 3T Siemens PRISMA scanner (TR/TE=720/32ms; voxels 2.4 isotropic). Network level associations with childhood performance monitoring were assessed in 79 adolescents with at least 5 minutes of low-motion rs-fMRI data (FD<.2mm), adjusting for preschool age, sex, compulsions, income to needs, depression, and medication. Network level significance was assessed using permutations of correlation values between childhood performance monitoring and adolescent functional connectivity (FC) and previously published methods for over expression analysis (Wheelock et al. 2019 DCN). Children who exhibited increased performance monitoring were twice as likely to develop obsessive compulsive disorder. Further, children with increased performance monitoring demonstrated greater FC between the frontoparietal network and the basal ganglia as well as between default mode and emotion networks (including bilateral amygdala) ($p<.05$ FWE corrected). These results highlight the neurodevelopmental

contribution of early-observed childhood performance monitoring to brain networks responsible for control and emotion regulation, and increased risk for psychopathology.

1-I-50 SOCIAL AND LIFE-THREATENING STRESSORS IN EARLY ADOLESCENCE PREDICT INCREASED NEURAL RESPONSE TO ERRORS IN EMERGING ADULTHOOD

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Stressful environments demand heightened vigilance during performance monitoring, as errors may be more costly in such settings. Consistent with this, stressors like negative social evaluation, combat experiences, and threat of shock have been associated with an enhanced error-related negativity (ERN), an event-related potential component generated by the anterior cingulate cortex, which measures neural response to error commission. However, it is unclear whether there are sensitive periods in the development of error monitoring networks that might render individuals more susceptible to stress. The aim of this study was to examine how severity of stress exposure during different stages of development predicted ERN magnitude. A sample of 203 undergraduate students (Mean age = 18.14, SD = 0.39) performed an arrow flanker task to elicit the ERN and completed the Stress and Adversity Inventory for Adults, which assesses stressful life events and chronic difficulties occurring in multiple life domains. Exposure to severe social evaluative and life-threatening stressors during early adolescence (8 to 12 years of age) - but not during childhood (7 years or younger), mid-adolescence (13 to 15 years of age), or over the past year - significantly predicted an enhanced ERN magnitude. Total lifetime stress exposure severity did not significantly predict ERN magnitude. These results suggest that early adolescence may represent a sensitive period during which time stress exposure might more meaningfully impact the functioning of neural performance monitoring networks.

1-I-51 Trajectories of group and individual-level structural brain network organization from birth to childhood and their cognitive relevance

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The most dramatic changes in cognitive and brain development occur during the first decade of life. During this time, cognitive processes become more specialized and separable; subsequently, aspects of higher-order cognition emerge that integrate across these distinct cognitive processes. Brain network organization is thought to develop similarly during early development - a strengthening of within network connections, followed by a shift toward integration across networks. However, this model of early brain development has yet to be empirically tested, especially at the individual level using longitudinal methods. Here, we use cortical thickness measures from a densely-sampled longitudinal cohort with anatomical MRI scans from birth to 6 years (N=50) to construct group-level structural covariance and subject-based maturational coupling networks. We calculated metrics of network segregation (modularity [Q]) and integration (global efficiency [GE]) at the group and individual level across timepoints. Motor learning using the Serial Reaction Time task and working memory using the N-back task were assessed at age 9. At the group level, Q and GE demonstrated changes across time (one-way ANOVAs: $p<0.001$). Specifically, Q increased and GE decreased beyond year 2, and then Q decreased and GE increased from year 5 to year 6. At the individual level, maturational coupling was defined as similarity in the trajectory of cortical thickness across time points between any two regions. Increased Q of the maturational coupling across the first two years was associated with decreased motor learning ($p<.05$), and increased GE across the first six years was positively correlated with working memory performance ($p<.05$). These results support models of brain network development that describe increasing segregation and eventual integration, and are consistent with previous work in adults demonstrating that different patterns of network organization underlie different cognitive processes.

1-J-52 Baseline respiratory sinus arrhythmia as a moderator in the development of effortful control in children of parents high in authoritarian traits

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Effortful control (EC), the ability to inhibit a dominant response and perform a subdominant response, develops through a combination of internal and external factors (Fox & Calkins, 2003), and is a predictor of socioemotional functioning (Rothbart & Bates, 2006; Rothbart et al., 2000). Parental discipline and parenting style is one external factor known to relate to effortful control (Eisenberg et al., 2009; Hofer et al., 2010; Lee et al., 2013), where harsh parental control, or authoritarian parenting style (low warmth and high control), is associated with lower EC (Taylor et al., 2013). Respiratory sinus arrhythmia (RSA) is a biological factor also linked to aspects of EC which may contribute to children's flexible regulation in the context of emotional situations (Gyurak & Ayduk, 2008), and children's overall biological sensitivity to context (Skowron et al., 2014), including exposure to authoritarian parenting. For this study, we recruited a community sample of children (N=118, Mage=6.08, SDage=0.77) and their parents. Child measures include baseline RSA, and parents completed the CBQ (Child Behavior Questionnaire), and PSQ (Parenting Style Questionnaire). For our analyses, we ran three separate regressions, looking at the effects of three parenting styles (authoritarian, authoritative, and permissive) and children's baseline RSA on parent-reported effortful control from the CBQ. We found that children with authoritarian parents and high baseline RSA (+1SD) have higher EC (b=.36, t=2.11, p=.04), while children with authoritarian parents and low baseline RSA (-1SD) have lower EC (b=-.30, t=-1.80, p=.08). Despite exposure to authoritarian parenting, which typically predicts low EC, children with higher baseline RSA still scored higher on EC.

1-J-53 Neurophysiological Markers of Anxiety in Early Childhood: An Intervention Target?

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An enlarged error-related negativity (ERN) has been found in adolescents and adults with anxiety disorders. Conflicting theories suggest that the anterior cingulate cortex-based ERN may index error-signaling to recruit cognitive control (CC) or, alternatively, the emotional reactivity to errors as threatening. Anxiety often begins in early childhood and yet empirical study of the relations among ERN, CC and anxiety in children is lacking. In the context of strong capacity for CC, an enlarged ERN could index an adaptive response, with greater error-signaling recruiting CC to adapt behavior and yield better performance which, in turn, might reduce emotional reactivity to errors (e.g., errors as threat) and lower anxious symptoms. In contrast, with low capacity for CC, an enlarged ERN could reflect unchecked error-signaling, corresponding to greater threat sensitivity and anxiety. We examined individual differences on CC related to ERN-anxiety associations in preschoolers. Methods: 64 children aged 4 - 6 (31 boys) were studied during an ERN-eliciting, Go/No-Go task. CC capacity was indexed using the parent-report Child Behavior Questionnaire (i.e., inhibitory control and attentional focusing subscales) and snack delay task. Anxiety symptoms were assessed via parent-report on the Child Behavior Checklist during baseline (T1) and 1-year follow-up (T2). Results: CC and gender moderated the relation between ERN and anxiety symptoms at T1 ($B = 1.11$, $p < .05$) and T2 ($B = 1.19$, $p < .05$). Specifically, for girls with lower CC, larger ERN associated with higher T1-and-T2 anxiety symptoms. In contrast, for girls with higher CC, larger ERN associated with lower T1-and-T2 anxiety. Conclusions: Findings suggest that for girls with higher CC, an enlarged ERN could index an adaptive response that signals greater recruitment of CC to reduce error-related threat and lower anxiety. Ongoing CC training intervention targeting ERN and anxiety among preschoolers are discussed.

1-J-54 Biological markers of prosocial decision-making: A test of brain activation and the dual-hormone hypothesis

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Background: The dual hormone hypothesis posits that high testosterone is associated with aggression when coupled with low cortisol, but is associated with prosociality when coupled with high cortisol (Mehta & Prasad, 2015). Adolescence is characterized by increased orientation to others that is related to prosocial behavior and susceptibility to prosocial (PS) and antisocial (AS) peer influences. Hormone concentrations may contribute to individual differences in these characteristics. Objective: The proposed study will examine 2 questions: Are relative hair concentrations of cortisol (HCC) and testosterone (HTC) associated with adolescents' PS decision-making and their susceptibility to PS/AS influences? Are HCC and HTC associated with neural activation during PS decision-making? Methods: 146 adolescents (50.7% female) 11-14 years (M=12.32, SD=.597) from diverse racial/ethnic groups (30.8% White, 29.5% Black, 30.1% Hispanic, 9.6% other/mixed) completed a PS decision-making task during fMRI. Participants (Pts) donated their time to 10 charities. In Run 1, Pts decided how many minutes to donate to each charity. In Run 2, Pts watched and mimicked the donation decisions of PS and AS hypothetical peers. In Run 3, Pts decided again how many minutes to donate to each charity. Hair samples were collected from the scalp (see Gao et al., 2013) and indicate cumulative hormone secretions and are less susceptible to daily fluctuations than saliva samples. Analyses will examine the interaction between HCC and HTC as a predictor of PS decision-making, susceptibility to PS/AS peer influence, and neural activation during PS decision-making. Significance: Associations among hormone concentrations, adolescent behavior, and neural sensitivity are poorly understood. Results from this analysis may yield insight into biological mechanisms contributing to individual differences in adolescent behavior.

1-J-55 Early-life scarcity-adversity negatively impacts social development via a hypocortisolism-dependent mechanism

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Social skills facilitate learning and are an important component to academic achievement. It is well established that children of low income families are at increased risk of disrupted social development, and in turn academic achievement. However, the biological mechanisms by which poverty can "get under the skin" to influence social behavior are poorly understood and cannot be easily ascertained using human research methodology alone. The present study utilized a rodent model of "scarcity-adversity" to explore how home resource scarcity causally influences social behavior outcomes via disruption of developing stress physiology. To create conditions of scarcity-adversity, rodent mothers and her pups were randomly assigned into home cages with insufficient wood shavings materials, so they could not build a proper nest for their pups. Following scarcity-adversity rearing, social motivation levels of peri-adolescent offspring were assessed using a two-chamber social interaction test. Hypothalamic-pituitary-adrenal (HPA) neuro-axis activity was also assessed via circulating corticosterone (CORT) and glucocorticoid receptor levels in the dorsal hippocampus and medial prefrontal cortex. Results showed that early-life scarcity-adversity exposure reduced social motivation when offspring were tested in peri-adolescence. Furthermore, early-life scarcity-adversity led to blunted HPA-axis activity as measured via CORT reactivity following the social motivation test. Glucocorticoid receptor levels in the dorsal hippocampus and medial prefrontal cortex were significantly upregulated in scarcity-adversity reared rats following the social motivation test in peri-adolescence. Finally, pharmacological repletion of CORT via intraperitoneal injections in scarcity-adversity reared peri-adolescents rescued social motivation levels. Our findings provide causal support that early-life scarcity-adversity negatively impacts social development via a hypocortisolism-dependent mechanism.

1-K-56 Can this data be saved? Techniques for high motion in resting state scans of first grade children

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Motion remains a significant technical hurdle in fMRI studies of young children. Our aim was to examine a straightforward but innovative approach to obtaining and preprocessing resting state data from a high-motion pediatric

cohort enrolled in a math intervention study (Project MAP - Clarke PI). Resting state fMRI scans were completed on first-graders at two time points. Out of the 104 who consented to the study, 83 completed resting and anatomical scans at both time points, with a mean session duration of 31 minutes. They underwent mock scanning prior to each scanning session and were instructed on the importance of holding still. Subject motion was monitored during MRI using Framewise Integrated Real-time MRI Monitoring (FIRMM, https://firmm.io/). FIRMM provides continuous feedback on the degree of head motion during a scan and was used to ensure that an adequate volume of relatively low-motion data was collected over the course of several scans. These scans were combined into longer 4D volumes for further preprocessing. Before combining the scans, we broke the data into blocks of time at points when the framewise displacement (FD) exceeded a given value and discarded any blocks of duration less than 30 seconds. The stitched data was motion and slice-timing corrected and further denoised using FSL's FIX and a custom training data set hand labeled by JS. We investigated the effect of imposing this "block-based stitching" method and of using different FD thresholds for the blocks, using quality control-resting state functional connectivity (QC-RSFC) correlations (Power et al, Neuroimage 2015). We show that this method reduces QC-RSFC correlations compared to FIX cleanup alone and eliminates the dependence of QC-RSFC correlations on internodal distance. Ultimately, we were able to obtain usable data from over 80% of participants who complete both time points.

1-K-57 The functional random forest: an approach to overcome the heterogeneity problem in developmental studies

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Current longitudinal developmental studies fail to characterize child developmental trajectories and how such trajectories pertain to relevant health outcomes, such as Attention Deficit Hyperactivity Disorder (ADHD). One perennial issue relates to the 'heterogeneity problem', which comprises two tenets. First, any human mental health syndrome or outcome, from cognitive functions to clinical disorders, will not necessarily be 'caused' by a single mechanism. Second, outcomes related to single individual are vast and depend on the domain of interest, which change the relevant heterogeneity parameters for that individual. Here, we use simple clinical examples to illustrate this 'heterogeneity problem' and discuss approaches that may help identify subtypes that better characterize trajectory heterogeneity. We discuss supervised and unsupervised approaches to characterize heterogeneity by identifying putative trajectory subtypes within a given population. However, we emphasize that identification of trajectories should be linked to a particular outcome or question. Though supervised approaches can confirm known trajectory subtypes, they are limited in identifying unknown trajectories tied to an outcome. Unsupervised approaches can discover unknown trajectories, but they are not necessarily linked to a given outcome. To address this limitation, we developed a novel hybrid approach, the functional random forest (FRF), that can identify trajectories that are tied to questions of interest. We then present our novel hybrid approach, the functional random forest (FRF). We applied the FRF to identify clinical subtypes in 8-14 year-old children (N=92) with measured ADHD symptom trajectories. Using the FRF we identified three subgroups, a regressive, progressive, and a stable subgroup. Our work demonstrates the utility of the FRF to identify child developmental trajectories and help overcome the heterogeneity problem in developmental studies.

1-K-58 An integrative approach to the development of motor problem solving

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Problem solving is integral to goal-directed action--how to navigate an obstacle, open a latch, or grasp the handle of a tool. Traditional research on problem solving is based on an outcome-oriented approach that identifies ages at which children solve particular problems. What is missing are the behavioral and neural mechanisms of how children solve problems in real time--that is, how perceptual, cognitive, and motoric events unfold moment to moment to enable

efficient solutions. We adopted a unique, integrated approach to examine whether children's inefficiency compared to adults is due to lack of perceptual information, neural processing, and/or lack of motor dexterity. We tested preschoolers (3-5 years) and adults in a hammering task with simultaneous head-mounted eye tracking, EEG, motion tracking, and video. When the handle points toward their non-dominant hand, problem solvers must use an atypical, underhand position for the initial grip to implement the tool efficiently. We found that some children ("Inefficient-planners") used a habitual overhand grip that interfered with wielding the hammer, whereas other children ("Efficient-planners") used an adult-like underhand grip. Inefficient- and efficient-planners differed in where they directed visual attention when the handle direction was revealed, neural processing prior to movement (readiness potential), and the straightness of hand path as they initiated the reach. Formulation of a plan before acting (reaction time prior to movement) in inefficient-planners was slower, showing that coordination among planning components improves with age. Finally, we used machine learning to predict efficiency based on the neural and behavioral components of planning. Findings indicate that for inefficient-planners, a real-time planning cascade goes awry from the first glimpse of the tool, and errors propagate through the system. The breakdown in planning results in inefficient problem-solving.

1-K-59 Convergence of individual variability in patterns of maturational coupling of cortical thickness and white matter connectivity, and its relation to cognition

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Introduction: In this study, we intend to investigate the correspondence between subject-based maturational coupling of cortical thickness and longitudinal changes in white matter connectivity, and examine their relations to cognitive development. More specifically, we seek to identify coordinated within-subject changes in cortical thickness across brain regions, based on longitudinal structural MRI scans, and relate them to developmental changes in white matter connectivity assessed with diffusion tensor imaging (DTI). Further, we seek to determine whether age-related changes in cortical coupling and white matter connectivity can help to explain the development of reasoning ability. Data and Methods: We will combine two longitudinal developmental datasets (the 'Neurodevelopment of Reasoning Ability' (NORA), and the 'Hippocampal Investigation of Pediatric Populations over Time' (HippoTime) study) with behavioural and neuroimaging data (MRI and DTI) from 404 children and adolescents with age range from 6 to 21 years. First, structural MRI scans will be processed using the CIVET pipeline and measures of cortical thickness will be obtained. Cortical thickness measures from longitudinal MRI scans of each subject will then be used to construct subject-based maturational coupling matrices. Second, DTI scans will be processed using a validated pipeline to get estimates of white matter connectivity. Planned Analyses: We will perform whole-brain comparative analyses between the thickness-based maturational coupling matrix and white matter connectivity matrix. Additionally, we will explore i) comparison of graph-theoretic measures for thickness-based maturational coupling matrix and white matter connectivity matrix; ii) association of individual variability in maturational coupling and reasoning ability; and iii) multivariate associations between thickness-based maturational coupling, white matter connectivity and reasoning ability.

1-K-60 Evaluating Accuracy of Basal Ganglia Segmentation Pipelines for Pediatric Samples

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Background: While computing packages for automated segmentation of brain regions for volumetric quantification are widely utilized, many rely on templates derived from adult brains with few systematic examinations of the validity of these templates in pediatric populations. Therefore, we compared the accuracy of basal ganglia (BG) volumes derived

from FreeSurfer (FS) versus a multi-atlas large deformation diffeomorphic metric mapping (LDDMM) pipeline based on a pediatric template. Methods: Participants, ages 4-12 years, included 68 children with Attention-Deficit/Hyperactivity Disorder, 44 children with Autism Spectrum Disorder, and 123 typically developing children. Masks of the left (L) and right (R) caudate (C), putamen (P), and globus pallidus (GP), were derived from high resolution T1-weighted images using the two automated pipelines. Spatial correspondence and volumetric differences were computed using manual segmentations (MS) as the gold-standard. Results: For all BG structures, LDDMM showed better overlap with the MS than did FS (all p's <.001). Mean dice coefficients were: LC and RC (LDDMM: 0.90; FS: 0.82), LP (LDDMM: 0.92; FS: 0.85), RP (LDDMM: 0.92; FS: 0.84), LGP (LDDMM: 0.90; FS: 0.81), and RGP (LDDMM: 0.89; FS: 0.78). No effects of age were observed (i.e., preschool ages 4-6 vs. school ages 8-12). Consistent with the dice coefficient, LDDMM showed lower percent volume difference with MS than did FS (all p's <.001). Both automated methods showed underestimation of the LC (LDDMM: 8.79; FS: 17.89) and RC (LDDMM: 7.74; FS: 11.01), and overestimation of the LP (LDDMM: -1.73; FS: -15.24), RP (LDDMM: -0.9; FS: -14.62), LGP (LDDMM: -4.12; FS: -4.89), and RGP (LDDMM: -3.30; FS: -4.72). Conclusion: Results revealed better correspondence with MS for LDDMM than for FS. LDDMM used a pediatric template, suggesting the importance of accounting for development stage; alternatively, findings could be explained by superior segmentation algorithms.

1-K-61 Is it ADHD or just motion? How motion and outliers can bias brain tissue microstructure metrics derived from diffusion tensor imaging

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Objectives: Diffusion tensor imaging (DTI) has been widely used to characterize white matter microstructure in neurodevelopmental disorders such as ADHD. However, DTI metrics are particularly sensitive to motion, which can bias results if not carefully addressed. Studies have reported differences between children with ADHD and typically developing children (TD) on DTI-derived metrics such as fractional anisotropy (FA) and mean diffusivity (MD). However, it is also well-known that children with ADHD tend to move more than TD peers. The current study examines the effects of motion on FA and MD in children with and without ADHD. Methods: This study includes 243 children (132 ADHD). DTI data processing and motion parameter estimation were conducted using FSL's FDT. FA and MD were calculated for 9 major white matter tracts and average frame-wise displacement was examined as a predictor of these metrics. Results: Regression analyses revealed that motion was a significant predictor of FA in the Superior Frontal Lobe ($p<.05$), the Superior Longitudinal Fasciculus ($p<.05$ TD, $p<.01$ ADHD), and Corpus Callosum ($p<.01$) for both ADHD and TD groups. Conclusion: While frame-wise displacement significantly predicts FA in several major white matter tracts in both ADHD and TD children, future research will aim at dissecting the effects of motion by individual indices such as translation and rotation as well as the effect of outliers on metrics. This could have implications for the interpretation of findings in FA and MD which are commonly used to characterize disorders such as ADHD.

1-K-62 Utilizing GIMME to Examine Network Integration in Adolescents with and without Obesity

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Understanding the between- and within- integration of the brain's network structure is key in understanding maladaptive health behaviors such as continual overeating and subsequently, the development of obesity. The integration of the Salience (SN), Central Executive (CEN), and Default Mode (DMN) Networks are critical as their integration is key for incentive processing and cognitive control. Group Iterative Multiple Model Estimation (GIMME; Gates & Molenaar, 2012) is one of the only methods that can reliably obtain the presence and direction of connectivity, and patterns are obtained at both the group and individual levels. The aim of this study is to examine differences in SN, CEN, and DMN integration by weight status, and to examine how these patterns of integration relate to food intake behavior. To examine this, seven

minutes of resting state data were acquired from 26 adolescents (13 obese/overweight (OW), 13 healthy weight (HW)). Food intake behavior was measured with a 30 minute ad libitum test meal. A combination of GIMME models and network matrices (e.g., density) will be used to examine differences in effective connectivity and overall network integrations. It is hypothesized that increased integration of the SN and CEN networks and decreased CEN and DMN will be observed in adolescents with OW relative to HW. Second, it is hypothesized that these patterns will correlate with increased food consumption. As an exploratory aim, the grouping option in GIMME will be used to examine how participants are grouped based on the data (i.e., the data will not be grouped by weight status prior to model implementation). Understanding network integration is critical in order to better understand the development of obesity. As the environment helps to sculpt patterns of evoked coactivation and thus fine-tunes intrinsic brain architecture, it is crucial to understand how overeating in adolescence relates to differences in network integration.

1-L-63 Intact Habituation in the Preterm Infant

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Objective To determine whether there are group or individual habituation differences in preterm versus term infants, using two habituation metrics. Method We recruited 82 preterm and 69 term infants (gestational age (GA) mean (SD) 28.8 (2.4), 39.9 (1.4) weeks respectively) with ethical approval from the UK National Research Ethics Service. Eye-tracking was used to capture looking behaviour during a 20 second animated display. Habituation was calculated across 12 trials using two metrics: 1. Time to Habituate (TTH): Time taken for infant to make two fixations less than 50% of the duration of their own mean fixation duration. Shorter TTH indicates faster habituation. 2. Looking Ratio (LR): Ratio of time infant spends fixating the stimulus in the first compared to the second half of the stimulus presentation period. A higher ratio indicates faster habituation. Group differences in TTH and LR were tested using Wilcoxon rank sum tests. Individual differences were tested using Spearman's correlation to investigate relations between habituation and GA. Results There was no significant difference in median TTH between preterm and term infants: 6s (IQR = 9.2-4) versus 7s (IQR=9.8-4), W=2528, p=0.66. Median LR was significantly higher in the preterm versus term group: 1.24 (IQR=1.35-1.17) versus 1.18 (IQR=1.28-1.12), W=3356, p=0.014, indicating faster habituation in the preterm group. In the preterm group, we found no significant correlation between TTH and GA (rs = -0.07, p=0.55), or between LR and GA (rs = -0.18, p= 0.11). Conclusion Contrary to previous findings reporting a preterm disadvantage in habituation, we found evidence for faster habituation in the preterm group, using a more sensitive metric. This may be attributed to methodological differences between ours and older studies, which traditionally use behaviourally coded looking paradigms. Alternatively, advances in clinical care, may be reflected in improved cognitive outcome.

1-L-64 Longitudinal relations between stress reactivity and anxiety symptoms from 5 to 12 years

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Anxiety disorders often emerge during early adolescence, with about one in ten children meeting diagnostic criteria. It is important to study the mechanisms underlying the development of anxiety disorders, to improve early detection and preventive interventions. The goal of the current study is to investigate the role of stress reactivity in the development of anxiety, by assessing bidirectional associations between stress reactivity and anxiety symptoms, cross-sectionally and longitudinally within a panel design. This study is part of a longitudinal study on behaviorally inhibited temperament and early childhood reticence. Children from two different samples were included: one selected to have high negative, high positive or non-extreme temperaments at four months (n=291), and one randomly recruited from the community at age 2 (n=384). Anxiety symptoms were measured using the Child Behavior Checklist in 437 children at age 5, 349 children at age 9, and 313 children at age 12. Stress reactivity was measured as observed anxious behavior during a stressful speech task (composite of verbal anxiety, physical anxiety, total length of speech, total time talking, and speech content), in 421

children at age 5, 313 children at age 9, and 212 children at age 12. Anxiety symptoms were significantly autocorrelated across all time points, rs>0.22, ps<0.001. At age 12, anxious behavior during the speech was related to concurrent anxiety, r=0.13, p=0.027. Cross-lagged structural equation modeling will be used to determine if and how stress reactivity and anxiety symptoms predict one another over time. Based on the preliminary results, we expect that anxiety symptoms are relatively stable and that observed anxious behavior is related to anxiety symptoms across childhood development. These and additional results will provide insight into stress reactivity as an underlying mechanism of the development of anxiety symptoms.

1-L-65 Developmental trajectories of white matter integrity in children with Williams syndrome

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Williams syndrome (WS), a rare condition caused by hemideletion of ~26 genes at chromosomal location 7q11.23, is characterized by hypersociability, non-social anxiety, and visuospatial construction deficits. Previous cross-sectional neuroimaging studies in adults and children with WS have reported alterations in microstructural integrity of white matter that may contribute to this phenotype, but little is known about the developmental trajectories of these alterations. Here, we examined white matter development in a longitudinal study of children with WS and typically developing (TD) children. Diffusion data were acquired approximately every two years for 21 children with WS (mean age=13.27 ± 4.37, 14 females) and 26 TD children (mean age=14.40 ± 3.93, 18 females), collectively spanning ages 5-22. After pre-processing with TORTOISE, fractional anisotropy (FA) maps were computed and spatially normalized to a study-specific template using TBSS. A penalized-spline model from R's gamm4 package was used to estimate trajectories of FA on a voxelwise basis for each group and to test for group differences (p<.00001). Throughout development, children with WS had lower FA in bilateral corticospinal tract and higher FA in the right inferior longitudinal and superior longitudinal fasciculi, with FA for both groups increasing over time. Group differences in FA in the splenium of the corpus callosum emerged with development: the trajectory for FA was steeper for the TD group than the WS group in this region. This longitudinal study characterizes white matter development in children with WS. Future work will examine other diffusion measures across development and explore how these findings relate to developmental changes in behavior.

1-L-66 Exploring the Neurophysiological Basis of Behavioral Flexibility Deficits in Individuals with Fragile-X Syndrome

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Behavioral flexibility is highly impaired in Fragile X Syndrome (FXS), the most common inherited monogentic cause of intellectual disability and autism. Still the neural processes underlying these deficits remain unclear. With limited mechanistic understanding, treatment development and symptom relief is stalled. The objective of this study is to identify neurophysiological biomarkers of behavioral inflexibility in FXS to advance disease understanding and treatment development. 17 FXS and 16 typically-developing (TD) participants completed a reversal learning task during high-density EEG recording. Unexpected reversals in behavioral response preference randomly were required after 3-5 consecutive correct responses. All data have been collected. Data analysis is ongoing. We will compute EEG variables separately following trials in which reversal in behavioral response is needed and when it is not. We will examine: 1) Evoked-response potentials, including N1, P3a, and P3b; 2) Fronto-parietal coherence; and 3) Single-trial power. We expect increased amplitudes of perceptual response (N1, P3a) but attenuated processing (P3b) of non-reinforcement of a learned behavioral preference in FXS compared to TD. We also predict reduced fronto-parietal coherence and exaggerated frontal gamma power following feedback indicating a behavioral reversal is required in FXS. Our study will yield important information regarding the feasibility of this approach and the neural bases of behavioral rigidity in FXS.

This study can provide insight into whether cortical hyperexcitability previously identified in sensory and association cortices also is present in fronto-parietal circuitry responsible for flexible behaviors. Insights gained will inform our understanding of disturbances in regional neural oscillations and their integrations in widely distributed brain networks in FXS, and identify potential biomarkers for future therapeutic interventions in FXS patient and animal models.

1-L-67 Behavioral inflexibility and inattention in Autism Spectrum Disorder and Attention-Deficit/Hyperactivity Disorders: more similarities than differences

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Autism Spectrum Disorder (ASD) and Attention Deficit/Hyperactivity Disorder (ADHD) are the two most frequently diagnosed childhood-onset developmental disorders. While intuitively these disorders seem to be on the extremes of a spectrum, symptoms of ASD and ADHD often co-occur. The current study aimed to provide an in-depth characterization of behavioral inflexibility in a large, partially longitudinal, sample of children with and without ASD and/or ADHD. In total, 692 measurements of 484 children between 6-18 years with ADHD (N=155) or ASD (N=141), and typically developing (TD) children (N=188) were included. Parents completed the Child Behavior Checklist (CBCL) and the Repetitive Behavior Scale - Revised (RBS-R). Linear mixed effects models were used to test for group differences between diagnostic groups and a latent-profile analysis (LPA) was performed to investigate patterns of symptom clustering related to inattention and behavioral inflexibility. Diagnostic groups differed on all subscales of the CBCL and RBS-R (all $p<.001$). Children with ASD and comorbid ADHD showed increased attention problems and behavioral inflexibility compared to children with ASD or ADHD alone. Interestingly, children with only ASD or ADHD did not differ on mean attention problems, and children with ADHD showed elevated behavioral inflexibility compared to TD children. The LPA on all participants, irrespective of primary diagnosis, yielded four symptom profiles (no symptoms, only ADHD symptoms, ADHD and sensorimotor behaviors, comorbid ADHD and ASD). As expected, children with comorbid ASD and ADHD showed the most severe symptom profile. However, the LPA suggests that clinical diagnosis does not necessarily relate to the presence or severity of core symptoms in children with or without ASD or ADHD. This finding highlights the problem of using diagnostic categories as a grouping factor in analyses, because of heterogeneity within- and symptomatic overlap between diagnostic categories.

1-L-68 Age-related differences in social evaluation learning and depressive symptoms during adolescence

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Objective: During adolescence, there is a large increase in the incidence of depression, particularly in girls. Learning whether the self is liked or disliked is associated with depressive symptoms in adulthood but is poorly understood in adolescence. Peer relationships become increasingly important in adolescence and learning about social evaluation may be associated with the onset of depression. We will investigate whether biases in social evaluation learning are associated with depressive symptoms in adolescence. Methods: We will conduct a cross-sectional study including early and mid-adolescents (10-11 and 14-15 years old) recruited from secondary schools in England (target n=640). Social evaluation learning will be measured using a computerised cognitive task, in which participants learn whether a computer character likes or dislikes them or another person. Depressive symptoms will be measured using the Mood and Feelings Questionnaire (short version). Analysis: We will use multilevel linear regressions to test associations between social evaluation learning and depressive symptoms, and the effect of age and gender. We hypothesise that older adolescents will demonstrate a positive bias in learning social evaluation about the self, as found in adults, showing superior learning that they are liked versus disliked. This positive bias will be reduced in depression, meaning that positive responses will be negatively associated with depressive symptoms. We will also investigate whether biases in social evaluation learning mediate the association between gender and depressive symptoms. Implications: Our study will

provide evidence on the cognitive processes underpinning social relationships across adolescence. Our findings could provide targets for imaging or longitudinal studies and the development of more effective interventions for depression. We can only develop more effective interventions when we better understand the aetiology of depression.

1-L-69 Using a Neuroscience Approach to Explore Social Deficits in Autism: Neural Synchronization in Autistic Children and their Parents is linked with Social Impairments

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Difficulties in reciprocal social behaviors are a hallmark symptom of Autism Spectrum Disorder (ASD). Although difficulties with social interactions in ASD often emerge early in life, we still do not know much about the neural underpinnings of these social difficulties in childhood. The goal of the current study was to investigate brain-to-brain neural synchrony as a biological marker of difficulties in reciprocal social behavior in ASD children. To do this, we used functional near-infrared spectroscopy (fNIRS) to examine parent-child neural synchronization. A total of 40 children (20 ASD, 20 controls; 5-12-years-old) were recruited for the study. Parent-child dyads were given a short time to complete puzzles that were too difficult for the child's age. fNIRS data was collected during the task from the prefrontal cortex (PFC) and the tempo-parietal junction (TPJ) for both parent and child. Parents completed the Social Responsiveness Scale (SRS-2) to assess children's social difficulties in naturalistic settings. Results showed that control subjects and their parents showed more neural synchrony in the left PFC compared to the ASD group. To further test neural synchrony as an index of social deficit, we extracted synchrony values from the peak connection and used this to assess associations between the SRS-2 total impairment score and neural synchrony. As expected, ASD children showed greater social deficits compared to controls, $t(39)$, 10.794, $p < .001$. When looking at the association between social deficits and neural synchrony, we found that more impaired social functioning was associated with less neural synchrony for the entire sample, $r(40)= -.517$, $p= .001$. But, as expected, this was driven by the ASD group ($r(20)= -.407$, $p= .075$). Our findings offer novel insight into the neural underpinnings of social impairments in ASD and offer support for the use of measures of neural synchrony as a biomarker for social difficulties in this group.

1-L-70 The Role of Sleep in Emotional Adaptation in Anxious and Healthy Youth

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Background: Anxious individuals show impairment in emotional adaptation, defined as reduction in reactivity to emotional stimuli across multiple exposures. Sleep is especially linked to anxiety in early adolescence and has been found to enhance emotional adaptation, but research on its role in clinical youth populations is scarce. Current Study: The current study examined the impact of anxiety and sleep on the neural bases of emotional adaptation, operationalized by reduction in basolateral amygdala (BLA) activation in response to emotional stimuli. We hypothesized (1) greater BLA reduction for youth in the sleep vs. wake condition, and (2) anxiety symptom severity would dampen sleep's effects on the BLA. Methods: 34 participants (16 F; M = 11.41 years, SD = 1.96) across a wide spectrum of anxious symptoms (measured by Pediatric Rating Scale; PARS) completed two fMRI sessions in which they were presented with images (Scan 1: 98 emotional, 47 neutral; Scan 2: 188 emotional, 96 neutral). Sessions were separated by 12 hours that included nocturnal sleep or diurnal wake. BLA activation for images was regressed on time (scan 1 vs. scan 2), condition (sleep vs. wake), image valence (neutral or emotional), and PARS score. Results: The sleep condition showed greater reductions in BLA activation over time (time*condition interaction: $F(1,31) = 9.17$, $p = .005$) in response to images. In separate post-hoc analyses, a trend was observed where PARS score moderated the time*condition relationship for negative ($F(1,30) = 3.73$, $p = .063$) but not positive ($p = .85$) images. That is, participants with higher PARS scores showed weakened sleep-induced reductions in BLA activation for negative images. Conclusions: These findings are the first to identify differences

in the impact of sleep, relative to wake, on emotional adaptation in a clinical youth population. Specifically, these findings suggest that the role of sleep in emotional adaptation is blunted among youth with anxiety.

1-L-71 Development of Internal Performance Monitoring Circuitry in Adolescents with and without Subclinical Psychosis Symptoms

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Background: Self-directed performance monitoring increases across development, contributes to cognitive performance, and relates to psychiatric symptoms. We previously found that ventral striatum (VS) responds more strongly to correct than incorrect responses during cognitive tasks without explicit feedback and that this "intrinsic reinforcement" response is reduced in schizophrenia. Here we examined this imaging phenotype and a behavioral measure of performance monitoring in adolescents with and without subclinical psychosis symptoms (PS). We hypothesized that behavioral and imaging measures would increase with age and decrease with PS. Methods: We examined 3T fMRI BOLD data from 817 adolescents ages 11-21 (177 typically developing, TD; 277 PS), comparing fMRI response to correct and incorrect trials in a working memory task without feedback. Behavioral performance monitoring was assessed by correlating item-wise reaction time and difficulty in an out-of-scanner task without feedback. Results: Despite the lack of accuracy feedback, VS showed robust correct>incorrect responses, while dorsal anterior cingulate cortex (ACC) and anterior insula (AI) showed the opposite pattern with robust incorrect>correct responses (peak Z's>10). Older adolescents had greater VS activation and performance monitoring, but not ACC or AI activation. Adolescents with PS had reduced behavioral performance monitoring and less activation in VS, AI, and ACC. Discussion: Internally generated error monitoring and correctness monitoring processes involve distinct brain regions and different developmental trajectories. These processes likely relate to individual differences that can impact academic, occupational, and psychiatric outcomes, such as low motivation or impulsivity. Better understanding the development of these internal monitoring processes can lead to improved educational outcomes for all students as well as better risk assessments and early interventions to prevent mental illness.

1-L-72 Subtle Motor Signs as a Biomarker for Effective Mindful Movement Intervention in Children with ADHD

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Movement-based mindfulness practice has garnered recent recognition, with reported benefits for behavioral and emotional regulation. Relatedly, our group and others have posited a motor-based orientation as useful in understanding the basis of Attention Deficit Hyperactivity Disorder (ADHD). Preliminary evidence supports the potential benefit of mindful movement interventions for ADHD. However, these studies, which were principally with adults, focused on changes in subjective ratings of behavior. More rigorous trials require reliable, objective measures as biomarkers. We therefore implemented a Tai Chi-based mindfulness practice for children with ADHD, hypothesizing that a measure of motor control could serve as predictive biomarker of improvement in ADHD symptoms. Children with ADHD aged 8-12 years were recruited for an 8-week Tai Chi intervention. Parent-completed questionnaires were collected to index improvement of ADHD symptoms in conjunction with three candidate motor system measures that demonstrate population correlation with ADHD symptoms, including the Physical and Neurological Examination for Subtle Signs (PANESS). Motor measures were examined for improvement following training and for correlation with improvements in parent-reported ADHD symptoms. Parent surveys indicated a broad and significant reduction in ADHD symptoms following Tai Chi training ($p<.02$ for all subscales). Of the three candidate motor measures, we found significant improvement on the PANESS ($p<.002$, with a Bonferroni corrected threshold of .01). Critically, improvements in PANESS were significantly correlated with the improvements in ADHD symptoms ($r=.48$, $p<0.05$). Our results provide further evidence for a beneficial effect of mindful movement training for children with ADHD, observing these effects in a

younger cohort than previously reported. We extend previous findings by proposing the PANESS as a candidate motor biomarker for future trials of mindful movement interventions.

1-L-73 Associations between childhood trauma, anxiety, and safety cue learning during development

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Anxiety disorders are characterized by unremitting fear in the absence of threat. Youth exposed to trauma are at increased risk for anxiety, particularly during adolescence. Given cross-species evidence for diminished fear extinction during adolescence, youth with trauma exposure may benefit from novel approaches to fear reduction, such as safety cues, that could augment prefrontal inhibition of the amygdala. The present fMRI study examined safety cue learning from ages 6-30 (N=60). The conditioned inhibition paradigm included phases for acquisition and testing, during which the CS and CS- were paired (i.e., safety compound), and the CS was paired with a novel CS as a control condition. Childhood trauma and anxiety were assessed using the Childhood Trauma Questionnaire and Anxiety Disorders Interview for DSM-5, respectively. A GLM tested the main effects and interactions of childhood trauma, anxiety, and age on activation in hippocampal-frontoamygdala circuitry during safety learning. Analyses revealed a three-way interaction between childhood trauma, anxiety diagnosis, and age on prefrontal activation to the safety compound ($F(1,48)=5.42$, $p=.024$). Within the control group (but not anxiety group), individuals with lower childhood trauma exposure showed an age-related increase in rostral anterior cingulate cortex (rACC) activation to the safety compound ($p=.011$). By contrast, within the anxiety group, individuals with lower childhood trauma exposure did not display an age-related change in rACC activation to the safety compound ($p=.528$). These findings suggest that childhood trauma may interfere with an age-related pattern of prefrontal engagement during safety learning and provide novel insight into approaches to optimize interventions for youth with trauma exposure and anxiety.

1-L-74 Specific contributions of gray matter alteration to neurodevelopment in antenatally growth restricted very preterm infants

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Intrauterine growth restriction (IUGR) is the second leading cause of new-born death. Surviving infants display long-lasting problems, encompassing cognitive and behavioural domains. AIMS: To study the effect of IUGR on very preterm (VPT) infants' brain volumes on MRI scans at 40 weeks and cognitive and behavioural outcomes at 22 months of life. METHOD: Participants were 35 IUGR and 249 appropriate for gestational age (AGA) VPT infants (GA < 33 weeks) enrolled in the Evaluation of Preterm Imaging Study. Structural T2 images were acquired at term equivalent. Cognitive development at 22 months was assessed with the Bayley Scales for Infant Development, behavioral outcome was rated with the Modified-CHecklist for Autism in Toddlers (MCHAT). RESULTS:At 40 weeks term-equivalent, IUGR infants displayed increased grey matter (GM) in right: supramarginal gyrus, gyrus rectus, superior temporal gyrus compared to preterm AGA infants. Decreased GM volumes was observed in left precentral gyrus and frontal middle orbital gyrus and in right hippocampus and fusiform gyrus. At 22 months, IUGR performed significantly lower on cognitive (IUGR: 90.81 ± 9.3 vs AGA: 95.86 ± 11.98; $t(45.1) = -2.72$, $p < .05$), motor (IUGR: 94.61 ± 8.98 vs AGA: 98.26 ± 9.15; $t(39.1) = -2.11$, $p < .05$) and language (IUGR: 88.32 ± 15.14 vs AGA: 94.07 ± 16.12; $t(40.1) = -1.96$, $p = .05$) tests compared to preterm AGA toddlers. They were also more likely to score positive on the M-CHAT (IUGR: 50% vs AGA: 23.32%; $X^2(1)= 8.87$, $p < .01$). Whole-group associations with cognitive outcome and positive M-CHAT screening were observed for right supramarginal gyrus, left precentral gyrus and right gyrus rectus. CONCLUSION: Brain volumes alterations observed in IUGR developing

brain are associated with cognitive outcome in VPT infants. These findings have implications for identifying antenatal impacts on child growth and developing neuroprotective strategies to constrain the effects of atypical brain volumes on later outcomes.

1-L-75 Examining the Relation between Early White Matter Abnormalities and Temperament in Very Preterm Infants

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Objective: Executive functioning deficits [1] and dysregulated behavior [2] are consistently predicted by perinatal white matter abnormalities (WMA), the most common brain injuries/abnormalities in preterm infants [3]. There is evidence that executive function deficits, which have implications for attention and social communication disorders, are also predicted by infant temperament [4, 5]. There is a dearth of research examining the relationship between WMA and early infant temperament that may help to explain the developmental trajectory leading to these potential outcomes. Method: Data from a multi-site prospective, longitudinal study of very preterm infants (¡Ü32 weeks) were utilized. All infants (n=213) underwent magnetic resonance imaging (MRI) at ~41 weeks post-menstrual age, and mothers completed the Infant Behavior Questionnaire-Revised-Short (IBQ-R-S) [6] when the infant was 3 months old (corrected age). All MRI scans were read by a single pediatric neuroradiologist using a standardized approach [7]. Multivariate regression was used to evaluate whether MRI-diagnosed WMA scores predicted parental temperament ratings. Results: WMA predicted lower ratings on the IBQ-R-S Activity (¦Â=-.14, p<.05), Smiling & Laughing (¦Â=-.15, p<.05), High Intensity Pleasure (¦Â=-.20, p<.01), and Vocal Reactivity (¦Â=-.16, p<.05) subscales, adjusting for gestational age, child sex, and recruitment site. Conclusions: MRI-diagnosed WMA in very preterm infants was associated with more challenging temperaments (less activity, smiling/laughing, vocalization, and enjoyment of novel or stimulating activities) at 3 months corrected age. Lower ratings on these IBQ-R-S scales is predictive of poorer attention regulation [4, 5, 8] and impaired parent-child interactions [4], both of which are influential for cognitive and emotional development. Dysregulated behavior in childhood may have a neurobiological basis and an onset that begins early in infancy.

1-L-76 Alteration in Gray Matter Volume and Thickness in Adolescents with Severe Obesity

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Objective: Obesity is associated with alterations in gray matter volume (GMV) and cortical thickness (CT), but the association between these properties and adiposity has not been well characterized in adolescents, particularly CT. Additionally, no studies have assessed both gray matter properties in all regions of the brain in adolescents with obesity, particularly those with severe obesity. Methods: Thirty-five adolescents (14-21 yrs) with normal intellectual function who were healthy weight (HW; n=17) or with severe obesity (OB, BMI percentile≥95; n= 18) underwent T1-weighted structural magnetic resonance imaging (MPRAGE). GMV and CT were assessed using the Computational Anatomical Toolbox in Statistical Parametric Mapping (SPM) 12. Group differences in global GMV and CT were examined using parcellations from the Neuromorphometrics and Desikan-Killiany atlases, respectively. All results were controlled for total intracranial volume and reached significance of p<0.05 Bonferroni corrected for multiple comparisons. Results: Relative to HW, OB showed decreased GMV in all lobes: bilateral inferior frontal and orbitofrontal cortex, right parietal operculum, temporal pole, and occipital pole, and left inferior temporal gyrus, as well as subcortically, in left putamen. OB also showed cortical thinning in all lobes: bilateral inferior frontal and orbitofrontal cortex, precentral gyrus, and cuneus, left middle frontal gyrus, and in multiple temporal and parietal regions. Conclusions: Orbitofrontal GMV reduction in OB replicated past work in adults. Our results reveal more extensive reductions, including other lobes and specifically in the gray matter

mantle. Such widespread gray matter reductions could result from pathology related to neuroinflammation and are concerning in adolescents in light of their effects on cognitive function and academic achievement.

1-L-77 Transdiagnostic links across ADHD and mental health symptoms: a network approach

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Background: There is considerable evidence suggesting an increased risk of various psychiatric disorders among children with ADHD. Despite well-documented comorbidities, little is known about specific mechanisms and risk factors which might explain these relationships. Method: In this study, we conduct exploratory analyses with a sample of developmentally at-risk children and adolescents with both diagnosed and undiagnosed difficulties in attention, learning, and memory (N = 314, 66% boys, 51% undiagnosed, Mage = 9.6, SD =2.5). We specified a conditional independence model across individual ADHD-symptoms and parental ratings of mental health difficulties using network analysis. This approach is particularly suited to detect direct relationships remaining after adjusting for the influence of all other symptoms in the network. The network model included parental ratings of ADHD symptoms (Conners-3: Inattention, Hyperactivity, Learning Problems, Executive Functions, Aggression, and Peer Relationships) and mental health difficulties (RCADS: Depression and Anxiety). Results: Consistent with the literature, we observed high levels of mental health difficulties in this group: 45% were rated above the clinical cut-off for depression and 28% met the cut-off for clinical levels of anxiety. The network model suggested that difficulties with aggression, peer relationships, executive functions, and hyperactivity were all directly related to levels of depression. Discussion: The results highlight three distinct direct pathways, which may contribute towards the comorbidity across ADHD and depression. Such transdiagnostic links may be of particular importance as key targets for interventions. Pre-registration of confirmatory models: At the next step, these findings were pre-registered as confirmatory hypotheses to be replicated using the same methods and scripts in a separate community sample (NKI-RS; Nooner et al., 2012). Data access has been requested but not yet obtained.

1-L-78 Establishing a neural basis for the high frequency of comorbidity amongst RD, ADHD, and DCD

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A high frequency of comorbidity between Reading Disorder (RD), Attention Deficit/ Hyperactivity Disorder (ADHD), and Developmental Coordination Disorder (DCD) is an often reported, yet poorly understood phenomenon. It is possible that the comorbidity may be related to the design of behavioral testing batteries used to diagnose children in a clinical setting. For example, tests designed to probe symptoms for RD may include a motor component that creates a disadvantage for children with DCD, increasing the chance of comorbidity. Alternatively, it is possible that there is a common neural basis driving comorbidity, thus challenging how distinct the disorders are often thought to be. Here, we explore neural correlates for RD, ADHD, and DCD in resting state data to explore this question. We collected resting state data and behavioral measures often used in clinical settings to diagnose these disorders in children ages 6-12. As per previous findings, we found a high correlation between our behavioral measures for RD, ADHD, and DCD. To examine neural correlates, we used a whole-brain atlas to build a connectome-based predictive model (CPM; (Finn et al., 2015; Shen et al., 2017)), similar to previous studies predicting individual differences in sustained attention (Rosenberg et al., 2016). Rather than just establishing functional connectivity measures that correlate with the behavioral scores, we use cross-validation to find a predictive and generalizable neural network for each behavioral measure. We then looked for regions amongst the neural networks that mediate the strong correlation seen amongst the behavioral measures for RD, ADHD, and DCD. Using the neural networks and their mediating regions, we plan to develop a CPM as a predictive tool to assess the risk of comorbidity.

1-L-79 Pathways to autism in intellectual disability

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Aim: Genetic diagnosis provides opportunities to understand links between intellectual disability (ID) and autism spectrum disorder (ASD). To identify pathways from genetic diagnosis to ASD in ID, we 1) mapped ASD trait structure, 2) compared ASD traits across groups defined by causative genes' function, and 3) investigated cognitive-behavioural predictors of ASD traits within each group. A complementary cognitive testing method (FarmApp) was designed to measure cognitive processes across a wide range of abilities. Method: 49 people with ID of monogenic origin (aged 5-26) took part. The sample was split into two groups based on causative genes' function: synaptic (n=27) and chromatin (n=22) related. Parents completed standardised measures of adaptive ability, emotional-behavioural function and ASD traits. FarmApp tasks (e.g. Go/No-Go) assessed cognitive functions. Principal component analysis (PCA) mapped dimensions of ASD traits in the whole sample. Within groups, developmental, emotional-behavioural and FarmApp measures were explored as predictors of ASD dimensions. Results: PCA identified three ASD dimensions in the sample: Flexibility, Social Understanding and Social Motivation. ASD total and dimensional scores did not differ between groups. However, different cognitive and behavioural correlates predicted ASD dimensions in each group: (In)flexibility was associated with Anxiety in both groups, and Hyperactivity and better Go/No-Go accuracy in the Chromatin group. Poorer Social Understanding was related to ID severity in both groups, Hyperactivity and poorer No-Go inhibition in the Synaptic group, and inattention in the Chromatin group. Social Motivation was related to better Go-only accuracy in both groups, and Hyperactivity in the Synaptic group. Conclusion: Genetic diagnosis is unlikely to be a strong predictor of the presence of ASD in ID. Instead, it may highlight divergent cognitive and behavioural mechanisms contributing to the development of ASD traits.

1-L-80 Social processing in Autism Spectrum Disorders using machine learning approach for visual stimulus segmentation

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Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder, associated with reciprocal interaction and social communication difficulties. Among these impairments is poor eye contact modulation, which is detectable within the first few years of life and often continues into adulthood. Eye tracking technology, in conjunction with dynamic, naturalistic scenes, provides unique insight on the complexities of eye movement patterns. One persisting challenge, however, remains linking accurate gaze locations with the sizable content derived from dynamic stimuli. The present study sought to evaluate ASD and typically developing eye movement patterns by utilizing a machine learning algorithm to generate objective labeling of naturalistic scenes. In this study, a deep neural network was trained on an existing image dataset, labeled for object type, body parts and scenes (PASCAL-Part), then applied to assign labels to 24 novel and unlabeled movie clips (14s each, 9,360 frames total). Participants with ASD (n=37) and their age-matched controls viewed these Hollywood movie clips, each of which depicted a social interaction. Controls spent significantly more time looking at facial features, while participants with ASD looked significantly more outside the face, at other body parts, or at background objects. Behavioral data plays an integral role in understanding the brain, linking brain states to a measurable output. As we seek to explore intricacy of ASD gaze patterns, a machine learning approach can advance the technical capability of eye movement analysis. Supplemented by these tools, researchers can utilize eye tracking to support diagnoses, assess progress of training, and ultimately evaluate individual or population differences of social processing.

1-M-81 Neural basis of biased competition in development: Sensory suppression in visual cortex of school-aged children

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Natural visual scenes contain a large amount of information. Due to the limited processing capacity of our visual system, multiple objects in a typical visual scene cannot be represented in the visual system independently. They interact with one another in a competitive manner. The neural mechanisms underlying sensory competition have been extensively studied in nonhuman primates and adult humans, but it remains unclear how such sensory interactions evolve in the developing visual system. Here, we investigated competitive interactions among multiple objects in the visual cortex of adults and school children (age 8 to 12) by using fMRI in the conceptual framework of biased competition theory. We presented multiple objects simultaneously (thus competing), or sequentially (not competing) and measured the amplitude of visually evoked responses. Responses evoked by simultaneously presented stimuli were smaller than those evoked by sequentially presented stimuli in extrastriate cortex. Such response suppression is a measure of the degree of sensory competition among objects. Sensory competition effects were also modulated by the spatial distance between the objects as a function of receptive field (RF) architecture across the visual system. At age 8-12, these effects were similar to those in the adult brain. We discuss how this paradigm can be useful to examine how neural functions related to the processing of saliency, perceptual grouping, and top-down selective attention develop.

1-M-82 Development of rhythmic sampling during visual attention

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When we focus our attention at a specific target in a visual scene, we experience the allocation of attention as a constant and continuous process. In contrast, recent reports show that perceptual sensitivity during focused attention is not constant, but rhythmically alternates between enhanced and diminished states. Evidence from monkey electrophysiology suggests that environmental sampling is promoted during enhanced states of perceptual sensitivity, while attentional shifts may occur during diminished states to allocate attention at new, more relevant, targets. Rhythmicity is, therefore, critical to selective attention, allowing it to be flexibly applied to the most relevant behavioral target at every moment in time. In adults, the rhythmicity of attention allocation occurs within the theta range (3-8Hz). To date, nothing is known about how this rhythmicity evolves across development. Additionally, tasks that are used for testing the rhythmicity of attention are long and tedious. Our aim, therefore, is to develop a behavioral task for testing rhythmicity in school-aged children, by condensing a task that is validated in adults. Adults will perform a Posner-like cueing task in which they fixate their gaze at a central point on a screen and covertly attend to one of two peripheral squares in which a target could appear. Attention will be captured by an exogenous cue. The target is a subtle contrast decrease in one of the two squares. Critically, the cue-target interval will randomly vary between 300-1100 ms, in order to construct time traces of hit rates relative to the cue-target interval. These time traces will be fast-Fourier transformed to quantify significant rhythmicity and the predominant frequency. To examine if this task is adaptable for children, we will analyze what minimal amount of trials is needed to preserve the rhythmicity in the full data set. We hypothesize that the rhythmicity of attention becomes more adult-like during school-aged years.

1-M-83 ADHD symptom burden relates to distinct neural activity across executive function domains

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The current study addresses the question of unique vs. overlapping relations across three domains of executive function (EF) and attention (ADHD) symptom burden. Three in-scanner tasks from distinct EF domains (cognitive flexibility: a cued switching task, working memory: an n-back task, and inhibition: a stop-signal task) were collected from a pediatric group with and without an ADHD diagnosis (N = 63 (22 F), M = 12.49 years, 35 diagnosed). Whole-brain activity from each task was separately correlated with parent reports of inattention and hyperactivity symptoms from the Conners-3. We also applied 13 regions of interest (ROIs) from a set of 'core EF' regions previously shown to be engaged across all three tasks. Across the three domains, brain activity related to ADHD symptom burden, but the direction and location of these

associations differed across tasks. In the cognitive flexibility task, activity in motor regions positively related to both inattention and hyperactivity, while dorsal anterior cingulate positively related to hyperactivity symptoms. In the working memory task, default mode activity in medial pre-frontal cortex positively related to both measures of symptom burden. During stop trials from the inhibition task, we saw a negative relation between hyperactivity and posterior cingulate activity. Whole-brain results were robust when age was included in the model as a covariate. Four ROIs related to hyperactivity only; however, these also showed no consistent pattern across EF domains. Taken together, activity in motor, task control, and default mode network regions related to ADHD symptom burden, and these relations did not overlap across EF domains. We observed both distinct and overlapping patterns for inattention and hyperactivity symptoms. By studying multiple EF tasks in the same sample, we identified a heterogenous neural profile related to attention symptom burden in children, which may be used to inform ADHD intervention efforts.

1-M-84 Neural Correlates of Attention to Ambiguous and Non-Ambiguous Adult and Peer Emotional Expressions in Adolescence

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Adolescence is a time of dramatic changes in social behaviour, including a shift during which interactions with peers- rather than with family-becomes paramount. This period is accompanied by increasing interest in, and time spent with peers, and well as greater sensitivity to peer evaluation and feedback. Moreover, the relationships adolescents develop with peers can powerfully shape long-term social and emotional outcomes. Thus, peers become a salient source of social information during adolescence, which may be reflected in the ways in which adolescents perceive and decode the subtle or ambiguous emotional expressions that typify "real world" social interactions. However, existing evidence of facial-emotion processing during adolescence has typically employed adult faces and faces that depict emotional extremes as stimuli, making it unclear whether facial expressions of peers and adults are similarly processed during this developmental period. The Late Positive Potential (LPP) is useful neural marker of sustained and flexible attention to salient stimuli and is sensitive to subtle variation in facial affect. The present study, therefore, examined modulation of the LPP to ambiguous and non-ambiguous emotional faces of same-age peers and adults in 42 adolescents (mean age =13.42; 66% female). We examined modulation of the LPP while participants viewed 320 blends of happy-neutral, angry-neutral or fear-neutral faces (e.g., neutral, 33% happy, 66% happy, 100% happy) presented for 300 ms each. As same-age peer faces increased in emotional intensity from neutral and approached happy and angry extremes, adolescents' LPPs similarly increased. This linear effect was not observed when viewing adult faces. These findings indicate that adolescents not only allocate their attention differently depending on whether the social target is a peer or adult but that they are also more sensitive to the subtle emotional nuances of peer facial expressions.

1-M-85 Educational outcomes depend both on visual and multisensory control of selective attention

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Visual attention skills shape learning, but how do these abilities interact with multisensory processes that must contribute to shaping literacy and numeracy skills? We investigated how involuntary multisensory integration and top-down visual attention develop together during primary school and how these processes contribute to reading and basic maths. We recorded EEG from Swiss 1st-grade (aged 4-5) 3rd-grade (aged 6-7) and 5th-grade (aged 8-9) children, and adults, while they searched for colour-defined targets, preceded by colour and colour-sound distractors. Spatial-cueing effects and N2pc component (analysed canonically and using electrical neuroimaging [EN]) served as behavioural and EEG markers of visual attention capture. Literacy and numeracy were measured with a standardised test (EDA 4-11). 3rd-graders showed adult-like top-down attentional control over visual stimuli but only 5th-graders showed additional

multisensory enhancement of attention capture. In adults EN revealed stable patterns (template maps) of lateralised EEG activity in N2pc time-window that were modulated by multisensory and visual processes. In children, adult-like N2pc's (154-300ms over PO7/8) were absent, but EN revealed presence of adult maps in this time-window. Visual and multisensory processes modulated age-specific maps in N2pc time-window in both 3rd- and 5th-graders. Crucially, these EEG patterns (but not behavioural markers) correlated with educational outcomes, with age determining the sign and specificity of relationships. Our study is the first to track concomitant development of visual and multisensory control of selective attention, and suggests that age determines which of these control processes attention relies on in supporting learning. These findings showcase how combining rigorous yet naturalistic paradigms with robust multivariate signal analyses and real-world variables can help clarify and support processes underpinning learning in the real (multisensory) world.

1-M-86 Top-down saliency maps link physical navigation and memory-guided attention in early childhood

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Using memory to guide attention is critical for efficient exploration. Until now, we have not been able to measure memory-guided attention development in a manner that is both precise and ecologically valid. We tested children's memory-guided search abilities in the SmartPlayroom, which is outfitted with video and eyetracking technologies. We then used computer vision algorithms to identify objects and characterize top-down guidance and exploration strategies. Children (4-9 yrs) completed a naturalistic search task. They first searched for colorful geometric toys that served as Reference objects. They then searched for objects placed Near to, or Far from the Reference objects. We designed the space such that when initially searching for Reference objects, children should be more likely to incidentally fixate Near relative to Far objects. We thus examined the impact of this incidental encoding of a landmark on subsequent memory-guided attention. On Reference trials, children could scan the room, fixate the target, and then navigate to retrieve it. Alternatively, they could navigate while searching, fixate, then retrieved it. Younger children with more navigate then fixate Reference trials were faster to locate Near relative to Far objects, $F(1,33) = 5.721$, $p < .05$, when they subsequently became search targets. We next generated a top-down saliency maps for each Reference object and fit fixations on Near and Far trials to these maps. Younger children whose fixations suggested they were using top-down saliency for the paired Reference object when searching for Near and Far targets, were faster to find Near relative to Far objects, $F(2,31) = 3.424$, $p < .05$. Our data show that navigation is critical to spatial learning in early childhood, that this supports stronger landmark representations as indicated by top-down computational visual attention models, and ultimately more efficient memory-guided attention over development.

1-M-87 Caregiver and Infant Cortisol Mediate the Effects of Socioeconomic Risk on Infant Attention: Implications for the Social Transmission of Risk

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Exposure to environments of early life stress, such as socioeconomic risk and poverty, can shape the development of stress physiology and cognitive processes such as attention. However, more research is needed to better understand the mechanisms and processes by which early-life adversity impacts cognitive and physiological development. The purpose of the present study was to investigate the potential transmission of early-life socioeconomic risk from parent to infant via stress physiology, and its effects on infant attention. Specifically, using data from a large, longitudinal sample (N=1,292) of low-income families, we used structural equation modeling to examine whether the association between early life socioeconomic risk measured at 7 months of age and an observational measure of infant attention at 24 months of age was serially mediated by mother's and infant's cumulative cortisol levels (measured at 7, 15, and 24 months), respectively. Results revealed that cumulative infant cortisol partially mediated the association between socioeconomic

risk and attention, but only through maternal cortisol. Importantly, this effect was present over and above the indirect path from socioeconomic risk through infant cortisol to infant attention independent of maternal cortisol. Further, these effects were observed while controlling for multiple relevant covariates including ethnicity, gender, age, and parenting behavior. These results suggest that maternal cortisol may be a distinct indirect pathway through which environmental adversity relates to infant cortisol and early attention. These findings also highlight the importance of investigating both caregiver and child stress physiology together. Broadly, our findings provide support for the idea that the negative effects of socioeconomic risk on early cognition may be partially transmitted from mother to child via stress physiology.

1-M-89 Altered attentional processing in pediatric anxiety

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Background: Anxiety disorders are the most common form of psychiatric illness in children. Increased attention to threatening stimuli has been implicated in pediatric anxiety disorders though attention-related alterations in anxiety disorders may not be threat-specific. We hypothesized that pediatric anxiety disorders would be associated with general increases in bottom-up attentional processing, which may be explained by increased activation in the ventral attention network. Objective: To apply a multi-modal (behavioral task; fMRI task) approach to investigate the nature of attentional deviations in pediatric anxiety. Methods: A youth sample (N=129, 75 females, mean age=10.6, SD=1.4) with wide variation in anxiety symptom severity (Pediatric Anxiety Rating Scale (PARS) mean=15.1, SD=9.3, range=0-33) completed an adapted Posner task to explore attentional biases to varying cues (square box, angry face, neutral face, both angry and neutral faces). A subset of participants (N=61, 31 female, mean=10.5, SD=1.3) completed a variant of the task while undergoing task-based fMRI scanning. We measured fMRI activity to each cue type in regions-of-interest in the ventral attention, default mode, cingulo-opercular, and fronto-parietal networks. Results: Anxiety as measured by the PARS was positively associated with stimulus driven attention to the square box cue ($F(1,125=4.94$, $p=.03$) but not to other cue types. Anxiety was specifically associated with brain activity in the right ventral lateral prefrontal cortex, as greater symptom severity related to increased activation in the ventral attention network. Conclusions: Pediatric anxiety is associated with generalized increases in the involuntary capture of salient stimuli independent of emotional valence, which are associated with increased activity in the ventral attention network. The ventral attention network and involuntary attention may be targets for intervention in pediatric anxiety disorders.

1-N-90 Cerebellar language lateralization in bilingual and monolingual children and adolescents

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Research on the cerebellum has traditionally focused on its role in motor functioning. Recently, there has been a shift towards acknowledging its role in higher cognitive functioning, including language processing. Language is dominant in the left cerebral hemisphere amongst a neurotypical population and on average, lateralization increases throughout development until adulthood. The cerebellum is contralaterally connected both anatomically and functionally to the cerebrum, therefore most language processing tends to be represented in the right cerebellar hemisphere. However, little is known about the development of language lateralization in the cerebellum, which may be more bilaterally represented than in the cerebrum across all ages. Additionally, research is inconclusive on cerebral language lateralization between bilinguals versus monolinguals. Most research shows no differences in lateralization, yet some shows more bilateral activation in bilinguals. To address these questions, we will conduct a preregistered analysis in two datasets. Children 4-6 years old (n=39; 16 bilingual) and adolescents 12-14 years old (n=70; 22 bilingual) listened to a language localizer while undergoing fMRI. Bilingualism is operationalized as learning a second language within 24 months after birth. We will compute a laterality index (LI) for each participant for both cerebral and cerebellar language activation from -1 to 1. We hypothesize that cerebellar language representation will be more strongly right lateralized in

the adolescents than in children (controlled for handedness and gender). Additionally, we predict that there will be no significant difference in LI scores between bilinguals and monolinguals across both age groups, suggesting that language lateralization develops similarly in the cerebellum regardless of bilingualism. Finally, we will also investigate whether lateralization relates to assessed language skill.

1-N-91 Charting the Impact of Bilingualism on Social and Communicative Development in Children With and Without Autism

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The limited literature that currently exists regarding the impact of bilingualism upon those with autism can be summarised as follows: bilingual exposure is unlikely to lead to poorer development and could provide cognitive advantages. However, parents are concerned about the potentially harmful effects of bilingualism. This research explores how bilingualism affects cognitive and language development. Here we focus on the relationship between bilingual exposure and social cognition. We are collecting data from autistic and neurotypical bilingual children aged 5-12. We have currently enrolled 90 children and will have complete and processed data for 60 autistic and 60 neurotypical children by July 2019. These will be analysed for presentation at Flux. Children complete a battery of social cognition tasks including standardised assessments and eye-tracking paradigms. Parents complete a number of questionnaires including a Bilingual Language Calculator. We anticipate that measures of social cognition will be highly correlated, and will run a principal components analysis to identify latent variables representing distinct facets of social cognition. Abilities will be analysed as follows: 1) Mean differences between groups based on diagnostic status, bilingual exposure (high versus low) and the interaction term for these. We predict that autistic vs neurotypical group differences will be reduced when bilingual exposure is high. 2) Continuous relationship between bilingual exposure and executive function abilities, taking account of IQ, language and diagnostic group. Two-way ANCOVA's will be used to assess interaction contrasts, followed by pairwise post hoc comparisons. This study takes a critical step towards exploring whether bilingualism can provide a naturalistic opportunity to develop social cognition skills. The work has implications for future clinical practice and will contribute to an evidence base for parents to make an informed choice for their child.

1-N-92 Cortical plasticity associated with a parent-implemented language intervention

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Objective: Children's early language experiences, including high quality parent-child interactions, are related to their linguistic, cognitive, and academic development, as well as their brain structure and function (Romeo et al., 2018). On average, children from lower socioeconomic status (SES) backgrounds receive reduced language exposure, and several parent-implemented interventions have resulted in both improved home language environments as well as increases in children's language skills (e.g., Leech et al., 2018). However, the neuroplastic mechanisms underlying these changes are yet unknown. Methods: One hundred lower-SES 4-to-6 year-old children and their primary caregivers were randomly assigned to either a 9-week family-based intervention focused on enhancing children's communication, executive functioning, and school readiness skills or a no-contact control group. Children completed pre and post assessments of verbal and nonverbal cognition, and subsets of each participant group additionally completed LENA home language recording and structural neuroimaging, from which longitudinal cortical thickness changes were calculated using Freesurfer. Results: Controlling for baseline measures, families who completed the intervention exhibited significantly increased adult-child conversational turns. The magnitude of turn-taking change was positively correlated with increases in children's language scores, and was also positively correlated to cortical thickening in language-related left inferior frontal regions, as well as social-related right supramarginal regions. Conclusions: This is the first study to investigate

neural mechanisms underlying perturbations to children's language environments. Results suggest that parent-implemented language interventions may improve children's language skills via cortical plasticity in canonical language and social regions during development. This has implications for social and educational policies for early intervention.

1-N-93 Mapping neural correlates of language processing in early childhood development using High-Density Diffuse Optical Tomography (HD-DOT)

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Mapping the neural correlates of language processing across early childhood development presents unique and significant challenges. Traditional methods like functional magnetic resonance imaging (fMRI) are loud and require participants to lie supine and still. This severely limits studies on processing of aurally-presented stimuli and language generation and is excessively challenging for sensitive participants, such as preschool-aged and, in particular, infant and toddler children. As such, fMRI data in early childhood development are often collected using sleeping or sedated participants, limiting the generalizability of the results to natural language processing. Due to its silent and open imaging environment, high-density diffuse optical tomography (HD-DOT) provides a compelling surrogate for fMRI that has been extensively validated in adults and is particularly well-suited for use with young children in more naturalistic environments. The aim of the present study is to capture cortical activations underlying emerging language processing abilities in toddlers and preschoolers in the range of 18-60 months old. Data from children ages 24-69 months (N=13 total; data from 8 children are presented) were collected in response to single, concrete nouns presented aurally in a block design paradigm. Developmentally appropriate words were taken from the MacArthur-Bates Communicative Development Inventories and were divided into easy, medium, and advanced lists (# of letters = 2-4, 5-6, and 7-9, respectively). Results demonstrate that HD-DOT localizes the perception of single words in primary auditory cortex in awake, non-sedated children, consistent with adult localizations. Future directions include optimizing child-friendly data collection processes and extending stimuli from single words to narrative stories in order to investigate higher order, multi-domain language processing evoked by more naturalistic language stimuli.

1-O-94 Individual Alpha Frequency and Child Cognitive Development

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Individual Alpha Frequency (IAF), an EEG-based measure, is stable and correlated with cognitive abilities in healthy adults. This study aims to assess IAF as a marker of brain development in children and its relationship with home environment. Resting state EEG, cognitive-behavioural and home environment data are being collected at 2 timepoints, 12 months apart, from 96 healthy children (50f/46m; mean age 7.8[SD=1.2]) from a range of socioeconomic backgrounds. Here, we report the results from the first timepoint. Subjects completed Wechsler Intelligence Scale for Children, 5th Edition subtests Block Design, Vocabulary, Matrix Reasoning, Similarities and Digit Span. The Neuropsychological Battery (NEPSY) Inhibition and Word Generation subtests, the Rey Complex Figure task and the Sustained Attention to Response Task were used to assess executive function. Peak alpha frequency (PAF) and centre of gravity (COG), measures of IAF, were derived from two minutes of eyes closed resting state data, collected using a 32 channel EEG. Results were analysed using multiple linear regressions. These indicated a relationship between age and COG (beta=0.20, 95% CI=0.10, 0.29) but not PAF, suggesting COG may be a more appropriate measure in this age group. For cognitive measures, adding COG as a predictor did not improve model fit over a baseline model including age, except for the NEPSY Inhibition I task completion time, where a trend towards model improvement was apparent (COG: beta= -3.08, 95% CI=-10.40, 4.25). As expected, a relationship was found between SES decile and general intelligence (beta=1.30, 95% CI=0.10, 2.50). This large data set extends the adult research on IAF and intelligence to childhood. If data from the second timepoint are consistent with

these findings, future research should investigate when IAF emerges as a marker of cognitive ability, why the relationship is not seen in primary school children, and whether an alternative metric exists for this age group.

1-O-95 Sensory perception and processing in early childhood

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Somatosensory perception plays a pivotal role in the early stages of human development. The sense of touch is one of the primary learning and exploration mechanism used in young children, influencing the development of motor, social and communicative behavior (Cascio, 2010). However, sensory processing in early childhood (<8 years) is understudied. This is surprising given that atypical sensory processing emerges early in a range of neurodevelopmental disorders such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) (Cascio, 2010; Thye et al., 2018). We will use vibrotactile psychophysics and electroencephalography (EEG) to investigate sensory tactile processing in 40 typically developing children aged 3-6 years compared to 30 young (18-25 years), healthy adults. The vibrotactile testing will include measures of amplitude and duration discrimination, which examine different aspects of cortical inhibition (Puts et al., 2013, 2011). EEG will be used to probe how early responses in the sensory cortex (sensory-evoked potentials, SEPs) adapt to repeated vibrotactile stimulation. A measure of adaptation, reflecting changes in cortical excitation and inhibition, will be obtained by subtracting SEPs in a control condition (inter-stimulus interval (ISI) = 1050 ms) from an adapting condition (repeated stimulation; ISI = 150 ms). Measures of sensory discrimination and SEP adaptation will be compared between young children and adults. Further, changes in these measures as a function of age will be investigated in the children. We expect to find higher detection thresholds and reduced adaptation to repeated stimulation in young children relative to adults, indicating lower sensitivity and lower cortical inhibition. We also expect that measures of sensory discrimination and SEP amplitude will be associated with age in children, indicative of developmental changes in the neural correlates underlying somatosensory processing.

1-O-96 Response time variability is associated with more current and future negative life outcomes in children

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Aims: Intra-individual variability in response times (RT-variability) has been associated with symptom severity in ADHD, ASD, schizophrenia, and dementia. This study investigates its potential as a marker of risk for negative outcomes in terms of both psychopathology and more general well-being. Methods: We recruited 28 typically developing 7-8 year-old children from an on-going longitudinal study on working memory training. They performed an fMRI-adapted N-Back as well as several other cognitive tasks. We used a step-wise regression analysis including accuracy and RT-variability measures from the N-Back task as independent variables and scores from Strength and Difficulties Questionnaire (total and externalising scores) and Math performance at 6 or 12 months after training as outcome measures. We also tested for similar relationships in a sample of 3,223 children from the ABCD study. For the ABCD sample, we used the total and externalising T-scores from the Child Behaviour Check List (CBCL) and body-mass-index (BMI) as outcome measures. Results: In the longitudinal sub-sample, RT-variability during the N-Back was significantly associated with future SDQ total scores (Standardized Beta=0.44, p=0.013), externalizing scores (Standardized Beta=0.44, p=0.01), and Math performance (Standardized Beta= -0.612, p=0.002). We found a similar association in the ABCD study. There, RT-variability in the N-Back was significantly related to CBCL total (Standardized Beta=0.023, p=0.014) and externalizing (Standardized Beta=0.029, p =0.003) measures, as well as BMI (Standardized Beta=0.027, p=0.003). Conclusions: RT-variability during the N-Back task is correlated with adverse outcomes on measures of academic performance, general behavior, and health. This increased RT-variability might be thus an early signal reflecting inefficient processes underlying the dynamic control of sustained or selective attention, or interference inhibition processes, response selection and/or execution.

1-O-97 Effects of binge drinking and depression on cognitive-control processes during an emotional go/no-go task in college-aged adults

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Alcohol consumption may cause impairments in social, health and occupational domains, and stressors resulting from problematic alcohol use have been implicated in the etiology of depression. In contrast, the onset of depression may precede alcohol use disorders, suggesting that depression serves as a vulnerability for alcohol abuse. The goal of the current study was to examine differences in neurocognitive processes across groups marked by binge-drinking and depression, in order to identify patterns of cognitive and affective processing impairments. Participants (n = 100; 65% female; 68% Caucasian) were recruited from undergraduate courses based on self-reported symptoms of depression and alcohol use. They completed an Emotional Go/No-go task while undergoing EEG. Mean amplitudes for N2 and P3 components were examined with 2 (Depressed/Non-depressed) X 2 (Binge/Non-binge drinkers) X 4 (Happy/Sad/Angry/Calm) X 3 (Left/Middle/Right) X 2 (Go/No-go) repeated measures ANOVAs. There were significant Trial Type X Emotion X Depression X Binge-Drinking interactions for N2 ($F(3, 80) = 6.62$, $p < .01$) and P3 ($F(3, 80) = 4.65$, $p < .01$) components. Non-depressed binge-drinkers ($M = -3.27$, $SE = 1.5$) exhibited more negative N2 amplitudes than non-depressed non-binge drinkers ($M = 1.67$, $SE = 1.56$) on Happy Go trials. Among non-binge drinkers, there were significant differences across depressed versus non-depressed groups in P3 components on Happy Go ($M = 2.31$, $SE = 1.07 < M = 7.39$, $SE = 1.12$), Angry Go ($M = 2.41$, $SE = 1.09 < M = 5.91$, $SE = 1.14$) and Sad No-Go trials ($M = 2.61$, $SE = 1.27$ $M = 6.59$, $SE = 1.33$). Differences in early inhibitory control were observed in binge-drinkers without depression. Further, the effects of depression on later inhibitory control were specific to non-binge drinkers. These results account for the cooccurrence of depression and alcohol use in the context of emotional processing, and may ultimately point to specific neurocognitive risk processes.

1-O-98 The impact of peers on adolescent brain response following errors is associated with the quality of recent peer interactions

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Peer interactions are particularly salient during adolescence. During this period, the emphasis on peer relations during this period is often marked by increased fear of being viewed negatively by peers. Individual differences in the perception of recent peer interactions may impact neural responses to errors made in the presence of peers. The current study uses fMRI to examine how the perceived quality of recent peer interactions (whether they were positive or negative) impacts brain response when adolescents make cognitive errors while being observed by a peer. In the current analysis youth ages 8-17 years old completed a cognitive control task (Eriksen Flanker) during fMRI. Participants completed half of the task alone and half while they believed they were being observed by a same-age, same-sex peer. Prior to completing the imaging portion of the study, all participants completed 1-week (3x per day) of ecological momentary assessment (EMA) to assess peer interactions in real-time. Specifically, participants rated the quality of their recent peer interactions from "very positive" to "very negative." Data collection is ongoing. The fMRI analysis will use the average quality of recent peer interactions across the week as a continuous, between-subject variable. Social context (peer, alone) and trial type (error, correct) will be entered as repeated, within-subject variables. All analyses will control for age. We hypothesize significant clusters in regions underlying error monitoring (insula, ACC) and cognitive control (IFG, lateral PFC) to emerge from the full omnibus interaction (quality X social context X trial type). We posit that participants who report more negative real-world peer interactions will show greater engagement of these regions following an error in the peer, compared to the

alone, condition. These findings will demonstrate the importance of recent social experiences and social context on neural responses to cognitive errors in adolescents.

1-O-100 Synchronization between brain regions in parents and their adolescent children during a conflict discussion task

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Objective: Parent-adolescent brain synchronization during a conflict discussion was examined using fMRI hyperscanning. Methods: Twenty-five psychiatrically healthy parents (M age = 43, 96% female) and their adolescent children (M age = 15, 64% female) completed a conflict discussion task while undergoing fMRI hyperscanning (i.e., concurrent fMRI scanning of two interacting participants). Prior to the scan, parents and adolescents completed a disagreement survey to identify their 3 most frequent conflicts. During the scan, the dyad discussed each conflict using headsets. Dyads were instructed to describe the conflict (2 min) and then work to solve the conflict (2 min). Speech-related artifacts were removed using a validated 'de-noising' procedure. Associations between parent and adolescent brain activity were examined using cross-correlation analyses for the BOLD signal time-course during the describe and solution blocks, respectively. The amygdala was used as a seed region to determine correlated activity in brain regions of the other member of the dyad. Linear mixed-effect model analyses were used for a group analyses with a voxelwise threshold of $p<.001$ and cluster-size $p<.05$. Results: Activity in the adolescent right amygdala was synchronized with activity in the left precentral gyrus of the parent brain with negative lags (followed adolescent activity) during the solution block. Activity in the parent left amygdala was synchronized with activity in the left precentral gyrus of the adolescent brain with negative lags during the describe block as well as bilateral precentral gyrus of the adolescent brain during the solution block. Conclusion: The results provide novel evidence for synchronization between brain regions in parents and adolescents during a real-time conflict discussion task using fMRI hyperscanning. Furthermore, these findings may provide additional insight into the neural circuity underlying parent-adolescent social interactions.

1-O-101 Neural differentiation of learned threat associations is influenced by early childhood temperament

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Children with Social Reticence (SR), or temperamental shyness, display elevated threat sensitivity and may sometimes inaccurately classify safe stimuli as threatening. This implies important differences in how threat-stimuli are represented in fear circuitry in children with high vs low SR. However, little is known about whether such overgeneralization might stem from a perceptual source. We use Representational Similarity Analysis (RSA) in conjunction with functional magnetic resonance imaging (fMRI) to examine the similarity of neural representations of threat- vs safe-stimuli in fear and perceptual neurocircuitry among children classified as high vs low SR. Participants were longitudinally assessed on SR at ages 2, 3, 4, 5, and 7 years. At 11-13 years, 41 children (M=13.38 ±0.62 yrs., 44.2%F) underwent fear conditioning and extinction. One month later, participants returned for fMRI scanning during an extinction recall task in which they viewed "blends" of the CS- and CS+. We test the hypothesis that high SR youth would show greater overgeneralization to blended cues during extinction recall. We used RSA to compare multi-voxel patterns of activity in the Inferior Temporal (IT) Cortex, a higher-order visual area, in response to CS+, CS- and blends. RSA uses correlations of fMRI voxel activity to quantify the similarity of pairs of neural representations via construction of a Representational Dissimilarity Matrix. We find

differences in both perceptual and emotion brain areas as a function of SR when participants are cued to evaluate their fear t(39) = 2.112, p = .041). This indicates a perceptual source for the overgeneralization between CS+ and CS- due to SR.

1-O-102 Pre-Registration: Neural Bases of Intergenerational Transmission of Emotional Regulatory Traits

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Cognitive reappraisal (CR) is a common emotion regulation strategy that involves considering an affective stimulus from an alternative perspective so as to alter its emotional impact. Recent work suggests CR is only moderately heritable and not predicted by shared environmental factors, raising questions about the role parents play in their children's acquisition of emotion regulation strategies. However, these findings have been under-explored in childhood and adolescence, when amygdala-prefrontal circuitry matures and CR skills improve. Our planned analysis will leverage behavioral reappraisal data currently being collected from parents and adolescents, alongside fMRI reappraisal task data collected in the adolescents during a separate testing session. During the reappraisal task, participants are shown negative or neutral images and asked to imagine they are close to (Close trials; emotion reactivity) or far from (Far trials; emotion regulation) the events depicted. We propose the following primary hypotheses for relationships between parent and child emotional variables: Reactivity: We hypothesize that greater parental behavioral reactivity (Close/Negative > Close/Neutral) will predict greater child reactivity during the laboratory session, and this relationship will be mediated by left amygdala activation during reactivity. Regulation: We hypothesize that greater parental regulation capacity (Far/Negative > Close/Negative) will predict greater child regulation capacity during the laboratory session, and this relationship will be mediated by amygdala-vlPFC connectivity during reappraisal. Exploratory analyses will examine age as a moderator of these effects. General Implications: This study may shed light on parental entrainment of neural circuits underlying emotion regulation. Future work may explore the impact of relationship quality on these findings and apply similar analyses to concurrently collected data in parent-child dyads after international adoption.

1-O-103 How Much Sleep is Enough Sleep?Effects of Self-reported Sleep Hours on the Brain Functions of School-age-children.

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Inadequate sleep has immediate and long-term negative impacts on children's academics physiological, cognitive, and mental health (Matricciani et al., 2012). Despite the importance of sleep for children's overall well-being, we do not know enough about the impacts of sleep on children, particularly how sleep affects the developing brain. Daily restriction of an hour of sleep for a week, in 6-8 year old children, results in attenuated ERP amplitudes over posterior brain regions during multiple cognitive tasks. This indicates that minor sleep restriction affects children's neurocognitive functioning (Molfese et al., 2013). Additionally, children who sleep 5 hours less than their peers who get habitual sleep, show decreased slow wave activity in the posterior brain regions during the first hour of sleep, reflecting reduced recovery of brain cells (Kurth et al., 2016). Above-mentioned studies depict the effects of reduced sleep on children's brain. However, findings from a behavioral study propose that sleeping more also deteriorates cognitive functions in 12-16-year-old children, reflected by lower ACT scores (Eide & Showalter, 2012). In this light, we compared resting state EEG data of 51 8-15-year-old children with high (> 10), medium (7.5- 9.5), and low (< 7) hours of parent-reported sleep, the night before the testing session. Using time frequency analysis of the EEG, we investigated changes in the neural signal during resting state within the theta (3-7 Hz) and beta (20-30 Hz) bands. We identified significant differences ($p<.05$) related to sleep. Specifically, the middle sleep group revealed attenuated posterior theta and beta power compared to the high and the low sleep groups. These data suggest that both low and high hours of sleep might similarly influence children's brain

functioning. This warrants more research about the underlying reasons behind these differences and the cognitive implications of both over and under sleeping during childhood.

1-O-104 Differential Mechanisms Supporting Social-vs-Monetary Reward Processing in Adolescent Anxiety and Depression

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Anxiety and depression often emerge in adolescence, potentially due to a normative increase in the desire for peer acceptance and developmental changes in brain regions that comprise the reward network. Despite the salience of peer feedback during adolescence, neural responses to reward have largely been examined in the monetary, not social domain. Moreover, most paradigms confound different aspects of reward processing (e.g., receiving feedback, being correct). Anxiety and depression are associated with alterations in reward networks; however, little is known about how anxiety and depression in adolescence relate to social vs non-social rewards. Adolescents (N=28) underwent fMRI while completing novel monetary and social feedback tasks, which tease apart reward domain (social/monetary), valence (positive/negative), and outcome (correct/incorrect). Participants were asked to decide between a pair of stimuli (doors/age-matched peers), which would provide positive (win money/positive social evaluation), or negative (lose money/negative social evaluation) feedback, prior to receiving feedback about the accuracy of their responses. Region of interest analyses found that left ventral striatum response varied by domain, valence and outcome of reward. Unique associations between anxiety, depression, and brain function were observed for correct, but not for incorrect trials, in the social, but non-social task. Specifically, adolescents with high-anxiety, but low-depression symptoms, displayed greater left ventral striatum activation when correctly identifying peers who gave negative feedback. High-depression and low-anxiety symptoms were associated with greater striatal activation to correctly identifying peers who gave positive feedback. These results suggest a brain-based mechanism may reinforce negative prediction biases in anxiety and depression in adolescence.

1-O-105 Examining the Neurocircuitry of Habits in Adolescents and Young Adults

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Habitual behavior refers to actions that have become reflexive or automatic, executed without the cognitive demands of conscious awareness. Critically, habitual behaviors do not depend on the outcome value of one's action but are instead triggered by antecedent stimuli or context. Despite the ubiquity of habitual behavior in daily life, surprisingly little is known about its neurodevelopment. Here, we describe novel work aimed at characterizing the neurocircuitry supporting habits in human adolescents. Adolescent and adult (control) participants recruited from the community will undergo functional magnetic resonance imaging (fMRI) while performing a validated, free-operant task protocol previously used to elicit habitual responding in adults. Briefly, participants respond via button press to visual cues associated with food rewards, delivered on a variable interval schedule to promote responding. Participants will be grouped into short (1-day) or long (3-day) duration training groups. Following training, participants will undergo selective satiation of one food reward, thus devaluing it. Participants will then perform the task again (extinction phase). If task behavior remains goal-directed, response rates should decline to the devalued food; if habitual, then response rates to both food cues should remain stable. We will assess behavior using repeated measures ANOVA as well as patterns of brain activity, with a focus on quantifying functional activation within a priori habit-related neurocircuitry (e.g., posterior putamen), throughout training and during extinction. This project will be among the first to characterize brain systems supporting habits in a developmental population, and lay critical groundwork for future work investigating how habits may be modified to promote healthy behaviors.

1-O-106 Behavioral and neural signatures of working memory in childhood

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Working memory function changes across development and varies across individuals. Although a rich literature describes behavioral and neural signatures of working memory in adulthood, the patterns of behavior and brain function that track individual differences in working memory during development are less well understood. Here we establish associations between working memory, cognitive abilities, and functional MRI activation in data from over 4,000 9-10-year-olds from the Adolescent Brain Cognitive Development study, an ongoing longitudinal study in the United States. Behavioral analyses reveal robust relationships between working memory, short-term memory, language skills, and fluid intelligence. Analyses relating out-of scanner working memory performance to memory-related activation in an emotional n-back task demonstrate that frontoparietal activity in response to an explicit memory challenge indexes working memory ability. Furthermore, this relationship is domain-specific, such that fMRI activation related to emotion processing during the emotional n-back task, inhibitory control during a stop-signal task, and reward processing during a monetary incentive delay task does not track memory abilities. Together these results inform our understanding of the emergence of individual differences in working memory and lay the groundwork for characterizing the ways in which they change across adolescence.

1-O-107 Poverty and Maltreatment: Distinct Pathways to Emotion Regulation Deficits

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Objectives: Poverty and maltreatment predict deficits in emotion regulation (ER), a risk factor for poor health outcomes. Functional coupling of brain regions implicated in cognitive control (dlPFC, vlPFC, dmPFC, inferior parietal, dACC) and in emotional reactivity (i.e., amygdala, insula) support ER. Poverty is associated with deficits in cognitive control, and maltreatment with deficits in emotion identification (EI) and threat sensitivity. Thus, we aim to dissociate emotional and cognitive pathways to ER deficits from poverty and maltreatment. Methods: Data were from children aged 4-19 in the Preschool Depression Study. Poverty (Income to Needs), maltreatment (Life Events Checklist), cognitive (NIH Toolbox), and emotion data (Penn Emotion differentiation), were collected in annual waves. fMRI data collected during wave 4 from a sadness reappraisal task (n=149) will be analyzed. Analysis Plan: Mediation will test hypotheses that poverty contributes to ER deficits (ER Checklist & Cognitive ER Questionnaire) via impairments in cognitive function, while maltreatment contributes via disruptions in EI. We hypothesize that poverty contributes to ER deficits via aberrant reactivity in cognitive control brain regions while neglect contributes via aberrant activity in EI regions. We will use whole brain and ROI based repeated measures ANOVAs to examine activation in ER-related cortical regions and the amygdala during the fMRI ER reappraisal condition vs. view sad vs view negative. Lastly, we will examine the hypothesis that psychophysiological interaction analyses between cortical-limbic regions in reappraisal vs. non-reappraisal conditions will reveal weaker coupling in poor youth, but stronger negative connectivity in maltreated youth, due to heightened amygdala activation driving greater cortical recruitment. Implications: These analyses will reveal the relative contributions of emotional and cognitive mechanisms to ER deficits in youth facing poverty and maltreatment.

1-O-108 Adolescents exhibit dampened prefrontal activation to stress compared to children and adults

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Stress is pervasive across the lifespan and has differential effects on brain development depending on when it occurs. While many studies have documented how stress affects brain development, few studies examined developmental differences in how the brain responds to stress. Extant research reports that adolescents show amplified and prolonged stress responses compared to children and adults, yet the neural mechanisms underlying these adolescent-characteristic responses are unclear. We present preliminary data on age differences in neural response to a cognitive and emotional challenge. Thirty-nine adults (19-20 years), 30 adolescents (14-15 years), and 25 children (9-10 years) completed an fMRI task in which they performed mental math problems under a non-evaluative "practice" condition and under a challenging and evaluative "test" condition, presented in alternating blocks. On practice trials, participants mentally solved timed math problems without answer choices and pressed a button. On test trials, they were told to select the correct answers on timed challenging math problems and received feedback accordingly. After each test block, they saw their performance rating, manipulated by researchers to indicate that their performance was poorer and declining faster across time relative to that of their peers. fMRI analyses focused on the Test > Practice contrast; linear and quadratic age effects were tested in FSL. There was a quadratic age effect on stress reactivity in right frontal pole, left dorsolateral prefrontal cortex, and anterior cingulate cortex such that adolescents showed blunted activation in these regions for Test > Practice relative to children and adults, who did not differ from each other. Simple effects tests showed that while there were no age effects during Practice, adolescents showed lower activation in these regions during Test relative to children and adults, suggesting that adolescents may be under-engaging prefrontal regions under stress.

1-O-109 Normative development of vibrotactile metrics in healthy boys and girls

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Tactile abnormalities in neurodevelopmental disorders have been widely described. However, a normative developmental trajectory of how development of tactile sensitivity has not been established. This is important in determining the extent of tactile abnormalities in neurodevelopmental disorders. In this study we examined the developmental trajectory in 210 healthy children (6-12 yrs). Tactile sensitivity was established using a battery of tasks specifically designed to test various aspects of tactile detection and discrimination in pediatric cohorts linked to inhibitory neurophysiology, including detection threshold, amplitude and frequency discrimination, and reaction time. All stimuli were applied on the left index and middle finger using a Cortical Metrics vibrotactile stimulator. Staircase tracking was used to determine thresholds. Results revealed detection thresholds comparable to prior findings in smaller cohorts, with significantly increased dynamic vs. static threshold ($p<.0001$) indicative of feed-forward inhibition. We find that a significant negative correlation of age with: static detection ($r=.28$, $p<.001$), amplitude discrimination at baseline ($r=.15$, $p=.02$) and with dual-site adaptation ($r=.30$, $p<.001$), frequency discrimination ($r=.18$ $p=.01$), simple and complex reaction time (both $r>.2$, $p<.001$). The difference between static and dynamic detection threshold was significantly and positively correlated with age ($r=.21$, $p=.006$), suggestive of increased feed-forward inhibition as the GABAergic system matures. The results reveal age-related improvements in tactile sensitivity and discrimination. These likely reflect developmental changes in cortical inhibition with improved sensory gating across child development. Future study will examine individual differences in age-related changes, associations with daily-life sensory experience, and associations with other physiological measures of cortical inhibition, such as GABA-edited MRS.

1-O-110 Neural correlates of self-evaluation during puberty

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Forming a clear and multifaceted concept of the self is an important life challenge in adolescence. Previous studies have shown that self-concept changes during adolescence and that underlying neural correlates also change, for example in

the medial prefrontal cortex (PFC). Very few studies have examined the change in self-evaluations/-concept and its neural correlates in relation to puberty, and whether pubertal processes relate to self-evaluative neural processes over and above age. The current study uses data from 174 girls aged 10.0 to 13.0 years to examine this. The girls completed a functional MRI paradigm in which they decided whether or not an adjective describes them, including positive and negative adjectives grouped into three factors: 'prosociality', 'antisociality/aggressiveness', 'surgency/detachment'. Participants also completed the Pubertal Development Scale and morning saliva samples to measure DHEA, testosterone and estradiol levels. We expect that (1) activation in the ventromedial PFC (vmPFC) and pregenual anterior cingulate (pgACC) during self-evaluation (relative to the control condition) increases with age; (2) pubertal development, both hormonal changes and self-reports of physical changes, will explain activation in areas subserving self-referential, affective and reward processes over and above age. This effect of pubertal development on neural activation will depend on adjective type/factor; (3) activation in vmPFC, pgACC and ventral striatum will be higher for positive adjectives compared to negative. In addition, on a trial-by-trial-level, negatively valenced adjectives that are endorsed as self-descriptive will engage the vmPFC and pgACC more than those that are rejected. This project is preregistered here: https://osf.io/g94h8/.

1-O-111 Development of cognitive control and frontostriatal circuitry in children with Autism Spectrum Disorder or Obsessive-Compulsive Disorder: A longitudinal fMRI study

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Compulsive behaviors are among the core symptoms of both Autism Spectrum Disorder (ASD) and Obsessive-Compulsive Disorder (OCD) and are thought to be associated with impairments in cognitive control. However, findings have been inconsistent and it is still unclear how the quality or severity of compulsive behavior relates to changes in cognitive control and associated neural circuitry in children with these disorders, and how this changes over development. In a multicenter, longitudinal study (TACTICS; Translational Adolescent and Childhood Therapeutic Interventions in Compulsive Syndromes), we investigated the behavioral and neural correlates of cognitive control, using a modified stop-signal task in children (N=95, baseline: 8-12y, follow-up: 10-14y) with ASD or OCD, and typically developing (TD) children. At baseline, children with ASD and OCD did not show changes in cognitive control or changes in brain activity in task-relevant neural networks compared to TD children. Longitudinal analysis showed that stop-signal reaction time (SSRT) ($p < .001$) decreased in all children. There was an interaction between diagnostic group and time for SSRT ($p = .039$) and stop-signal delay (SSD) ($p = .026$) where task performance increased most for children with OCD. There were no whole-brain differences between diagnostic groups, yet ROI analyses showed activity in right precentral gyrus increased for children with OCD ($p = 0.006$). In addition, reduced SSD was associated with increased activation of right insula over time in children with ASD and OCD ($p = .001$). These longitudinal data suggest that children with OCD show greater improvement in cognitive control over time than children with ASD and typically developing controls, even though there were no between-group differences in brain activity. These findings suggest that there are no specific deficits in cognitive control in ASD and OCD, but rather suggest that any relation between this ability and symptoms may be dimensional.

1-O-112 Brain Responses to Socially vs. Non-socially Relevant Aversive Auditory Stimuli in Youth with and without Autism

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Objective: Individuals with autism spectrum disorder (ASD) show deficits in processing both sensory and social information but the mechanisms underlying the relationship between these symptoms are not well understood. Previous research indicates that youth with ASD over-activate sensory cortices and amygdala when exposed to aversive non-social auditory and tactile stimuli (Green et al. 2015). Moreover, TD youth show increased activity in auditory language and frontal regions but ASD youth show decreased activity in the same regions when completing a social task in the presence of sensory distraction (Green et al. 2017). To better understand how the social significance of sensory stimuli affects brain activity in youth with ASD, this study examined differences in neural responses to mildly aversive social and non-social auditory stimuli in youth with and without ASD. Methods: 16 ASD and 12 typically developing (TD) controls, age 10-17 listened to 3 blocks each of 15-sec white noise and sounds of children screaming on a playground while undergoing fMRI. Sounds were matched to be comparably aversive and their order counterbalanced among subjects. Analyses were corrected for multiple comparisons at $p<.05$. Results: The TD group showed significantly greater discrimination of the social vs. nonsocial sounds in their brain response: while both groups had greater social>nonsocial activation in auditory cortex, the TD group also showed greater activation in medial prefrontal cortex, caudate nucleus and limbic regions. Conclusions: Unlike TD youth, ASD youth did not show selective activation to social noises in regions related to social cognition, reward processing and executive control. Results suggest that TD but not ASD youth selectively attend to the social significance of aversive stimuli, whereas ASD youth may be more focused on the general aversiveness of the noise. This failure to discriminate the social significance of stimuli may relate to their social impairment.

1-P-113 Localizing differences in between network functional connectivity in attention deficit/hyperactivity disorder

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Objective: Attention deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder effecting between 9 and 15% of children worldwide. Previous research has indicated that ADHD is characterized by disrupted functional connectivity within and between brain networks. For example, children with ADHD exhibit increased within network connectivity in the default mode network (DMN), and decreased connectivity between the fronto-parietal (FP) and subcortical (SUB) networks. The goal of the current study is to examine differences in functional connectivity between pairs of functional brain networks to gain a better understanding of the disrupted functional connectivity that characterizes children with ADHD. Methods: We measured whole-brain modularity, global efficiency and average participation coefficient in a sample of 33 children with ADHD and 33 typically developing children. All children underwent a 6.5 minute resting state scan. We used a new method for localizing group differences in network connectivity measures, the network statistic jackknife. Group differences in network metrics were localized to connections between pairs of functional networks. Results: Results show that the functional connections between the DMN, the SUB and the cingulo-opercular (CO) networks were associated with significantly lower participation coefficient for children with ADHD compared to typically developing children. No other pairs of functional networks exhibited a group difference. Conclusion: Results suggest that reduced between network functional connectivity in children with ADHD is localized to connections between the DMN, SUB and CO networks. This is consistent with prior research implicating regions in each of these networks with symptoms and cognitive deficits often observed in ADHD, including attention and motor control. This clarifies prior whole-brain differences observed in ADHD and suggests that those findings may have been driven by this subset of networks.

1-P-114 Dynamic changes of functional connectivity are associated with age and cognitive ability

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It has recently become clear that patterns of intrinsic functional connectivity show dynamic changes, even within relatively short time intervals. Not much is known however, about the behavioral significance of these changes. Here we examine to what extent the time spent in particularly states of functional connectivity and the flexibility to switch among states are associated with age and ability level. We used resting-state fMRI data from 553 participants (305 females) from the Philadelphia Neurodevelopmental Cohort (PNC), a large community sample that includes children and adolescents between 8 and 21 years old. Functional connectivity (FC) was examined using an independent component analysis-based approach, focusing specifically on components previously associated with general cognitive ability. Dynamic functional connectivity was computed using a sliding window approach and k-means clustering. Clustering yielded four connectivity states. Preliminary results indicate that there were developmental, as well as individual differences in the expression of these states. Most notably, older individuals spent more time in a state that was characterized by synchronization of frontoparietal and dorsal attention networks, and less time in a state that was characterized by hypoconnectivity within the frontoparietal network and hyperconnectivity between the salience network and the striatum. Individuals with higher scores on a measure of academic achievement (i.e., WRAT-4-reading) spent more time in a state that was characterized by overall segregation of functional networks. Individuals with higher WRAT-reading also showed more transitions between states. Taken together, age and ability level were associated with individual differences in the expression of particular states of connectivity, as well as the flexibility to switch among states. We are currently following up on these effects using a replication sample.

1-P-115 Associations of Premotor Connectivity with Handwriting Impairment in Children with Autism

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Objective Children with Autism Spectrum Disorder (ASD) struggle with handwriting, especially letter form (LF). The dorsal premotor cortex (PMd) is crucial for handwriting. Here, we examined functional connectivity of PMd as it relates to LF in children with ASD and typically developing (TD) children. Methods Resting-state fMRI was acquired from 76 children (38 ASD), balanced for age (8-12 years), sex and head motion during the scan. We identified functional subregions of the left and right PMd (5 L and 5 R) using a data driven approach and estimated whole-brain functional connectivity (FC) per subregion using dual regression. Handwriting was assessed under 3 conditions: copy (C), trace, fast trace (FT). LF was assessed using an automated template matching procedure. LF scores were covariates in a GLM of whole-brain maps (FWE $p < 0.05$, cluster-correction). Results Effect of diagnosis (Dx) was observed for C ($p < 0.005$) and FT ($p < 0.001$): children with ASD showed worse LF than TD. FC analyses revealed that better C LF was related to greater L lateral PMd-R occipital pole FC in ASD, and reduced FC in TD. Similarly, better FT LF was related to greater L ventrolateral PMd-R visual cortex (V1) FC in ASD, and reduced FC in TD. Conversely, greater FC between L rostral PMd and supplementary motor area (SMA) was related to better C LF in TD. Further, for both ASD and TD children, greater R PMd and L rostral PMd connectivity was related to better C LF; and R lateral PMd-R V1 connectivity was related to better C and FT LF. Conclusions The ASD-specific association of better LF with greater L PMd-occipital FC suggests children with ASD rely on visual-motor integration when copying or tracing letters. In contrast, TD children seem to rely on premotor circuits, including PMd and SMA, when performing such skills. Further, greater R and L PMd connectivity with better LF across diagnostic groups suggests bilateral synchronization of the PMd during writing, as shown in prior research.

1-P-116 Maternal cannabis use during pregnancy affects fetal hippocampal functional connectivity.

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Introduction: Prenatal cannabis exposure is associated with altered child behavioral outcomes and in animal models has been linked to altered prenatal brain development. Information about whether maternal prenatal cannabis exposure

alters human brain development before birth is an open question. Here, we examine the hypothesis that prenatal cannabis use influences prenatal limbic system connectivity in the human fetal brain. Given that GABAergic interneurons are highly expressed in the hippocampus and given that exogenous cannabinoids suppress GABA release, we expect prenatal cannabis use to be associated with increased hippocampal resting state functional connectivity (RSFC) in the human fetal brain. Methods: RSFC MRI data were collected in 81 human fetuses (30 maternal cannabis; 51 control). Subject-specific ROI-voxel maps of bilateral hippocampal-cortical connectivity were generated and compared between groups using a two sample t-test. Results: We observed increased hippocampal RSFC to regions of the cerebellum, nucleus accumbens, parietal cortex, posterior cingulate cortex, basal ganglia, and orbitofrontal cortex in fetuses prenatally exposed to THC. In contrast, fetuses with prenatal exposure showed decreased hippocampal connectivity to the anterior cingulate cortex, insula, dorsolateral prefrontal cortex, and sensorimotor cortex. Conclusions: These data indicate that prenatal exposure to cannabis relates to altered neuroconnectivity in utero. Given the limited knowledge of fetal RSFC to future child development, it is too early to speculate about the implications of these prenatal differences. However, given prior research linking prenatal cannabis exposure to future child behavioral issues and given numerous studies in adults linking altered limbic RSFC to psychopathology, it is possible that cannabis-related alterations in fetal RSFC may in the future be shown to relate to negative behavioral outcomes.

1-P-117 Executive functions in reading: impairment and plasticity in children with and without dyslexia

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Approximately 15% of children in the western world have reading disabilities, a neurodevelopmental disorder known to impact academic achievements as well as social and emotional wellbeing. Identification of the underlying factors contributing to RD is crucial for proper classification and planning of remedial interventions. Current strategies rely exclusively on behavioral measures and are of limited precision. Here, we aimed to study the role of cognitive control in reading among children from birth to age 12 years using a multimodal approach utilizing several MRI methodologies as well as EEG data. Results provided potential biomarkers for reading difficulties in children: EEG data suggested decreased event related potentials evoked from the anterior cingulate cortex (ACC) and functional MRI data showed decreased functional connectivity of cognitive control networks. Using MRI, we then demonstrated the effect of an executive-function based intervention on these functional connections during both reading and resting-state conditions. Greater attention- and inhibition-related ERPs were observed following training. The advantages of using neuroimaging methods in evaluation of neurodevelopmental disorders in children and the challenges the field of developmental neuroimaging is facing will be discussed.

1-P-118 Cognitive control networks are functionally and structurally connected during narrative comprehension from infancy to 9 years

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Background: During the first few years of life, massive changes in both gray and white matter occur. The Cingulo-Opercular (CO) and Fronto-Parietal (FP) networks are part of the cognitive control system. The Cingulum Bundle (CB), Superior Longitudinal Fasciculus (SLF), Inferior Fronto-Occipital Fasciculus (IFOF), Inferior Longitudinal Fasciculus (ILF) and Arcuate Fasciculus (AF) are white matter tracts central for performance on language and executive functioning tasks. Depicting the developmental changes in neural circuits and white matter tracts from infancy may provide unique insights into the role of cognitive control in narrative comprehension, a critical linguistic ability, during infancy. Methods: 74 typically developing children between the ages: 17-107-month old participated in the study. Study 1: participants had a functional MRI session while listening to stories inside the scanner, study 2: participants underwent a DTI scan. Measures of graph theory, within and between the CO and FP networks functional connectivity and Fractional anisotropy (FA) in

white matter tracts were assessed. Results: Age significantly and positively correlated with functional connectivity within the CO network and between the CO and FP networks. Age contributed significantly to FA variation in all tracts. Significant positive correlations were found between cognitive abilities (FSIQ score) and FA in left and right hemisphere tracts. Conclusions: The CO and FP networks are functionally connected from early infancy. The interaction between the two networks occurs during narrative comprehension in children younger than 9 years. The relationship between FA and age/cognitive ability changes along the tract length illustrating variability in age-related white-matter development at the tract level.

1-P-119 Associations Between Prenatal Father-Infant Attachment and Fathers? Social-Cognitive Network Connectivity

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Fathers play a critical role in parenting. However, the neurobiological underpinnings of successful adjustment to fatherhood have not been well-specified. Resting state connectivity in brain networks associated with social cognition, in particular, the default mode network (DMN), may reflect fathers' interpersonal relationship functioning, including within the father-child relationship. This study examines whether expectant fathers' connectivity in the DMN is associated with their prenatal self-reported attachment to their infants. We used resting-state functional magnetic resonance imaging (fMRI) and independent components analysis (ICA) to assess resting-state functional connectivity (rsFC) in functional hubs of the DMN of 25 expectant first-time fathers whose cohabiting partners were in mid-to-late pregnancy (20-35 weeks). We used a dual-regression approach to test associations between ICA-derived measures of DMN rsFC and self-report measures of antenatal paternal attachment (Paternal Antenatal Attachment Scale, PAAS). We found that fathers who reported greater antenatal paternal attachment showed increased rsFC of the DMN, particularly to its posterior hubs (posterior cingulate and precuneus). They also showed associations between DMN regions and areas associated with emotion processing, motivation, and reward (e.g., orbitofrontal cortex, caudate, thalamus, and nucleus accumbens (NACC)). These findings suggest that individuals with more robust FC within the DMN and between the DMN and regions implicated in emotion and reward processing report stronger bonds with their children prior to birth. These findings underscore the importance of examining social cognitive neurocircuitry in fathers and provide valuable mechanistic insight into the neural correlates of father-infant attachment.

1-P-120 Functional connectivity and early number skills in first grade students

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Early math intervention leads to positive impacts for at-risk students (Clarke et al, '16), but there remains a subset of students who do not respond to intervention (Fuchs & Vaughn, '12). If the needs of all learners are to be met, additional research is needed to find mechanisms to increase the efficacy of interventions and decrease non-responsiveness (Miller et al, '14). However, questions remain about the relationship between behavioral constructs of math performance (symbolic and non-symbolic processing) and math achievement, and evidence on the neural underpinnings of early number skills is scarce. Our aim here was to examine behavioral and neural indicators of math performance and explore differences in functional connectivity based on early number skill changes in a large group of first graders. rsfMRI scans were completed on 64 first-graders at two time points with Panamath (Halberda et al, '08) and ASPENS (Clarke et al, '11) measures of magnitude comparison, outside the scanner. Data were analyzed using FSL, including FIX for denoising and an innovative approach to stitching/scrubbing submitted separately (Smith et al, this meeting). We then performed group ICA and dual regression to examine differences using TFCE to establish significance. Interrogating connectivity differences in a well published set of resting state networks (Smith et al, '09), we found no significant relationship between functional

connectivity and non-symbolic processing as assessed by Panamath at either time point. Analyses of ASPENS data are pending. Further work is needed to explore neural indicators of early number skills and math achievement. Ultimately, gaining insight into the learning needs of students and the neural signatures associated with math performance will be critical for refining and expand the tools, materials, and services educators utilize to ensure all learners have full access to the field of math and to related STEM fields as they advance in their schooling.

1-P-121 Social risk perception and functional brain connectivity between reward and mentalizing brain regions during adolescence

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Health risk behaviours, such as binge drinking and illicit drug taking, increase during adolescence--a period of heightened sensitivity to peer evaluations. Therefore, health-risking behaviors are likely to incorporate perceptions of peer evaluations. We investigate whether an adolescent's expected involvement in health risk behaviours is related to perceived social consequences of engaging in these behaviours. During this period of development, subcortical-cortical circuits become more finely tuned. In this study, we are interested in understanding how individual differences in the functional connectivity of regions that sub-serve motivational and social cognitive processes (such as mentalizing), relate to risky decision making. Participants (N=57) were recruited from the community, 11-17 years, mean 14. Expected involvement in health risk behaviours was assessed using items from the cognitive appraisal of risky events (CARE) questionnaire and the perceived social consequences of these behaviours were assessed using an adapted version of the CARE which we call the social appraisal of risky events (SARE). Functional connectivity was assessed during resting state functional MRI (rs-fcMRI). Mixed effects models including participant as a random intercept were compared using Akaike information criterion and likelihood ratio tests. Perceived social consequences of engaging in a health risk behaviour predicted expected involvement in that specific behaviour, controlling for age, sex and IQ. A model including an interaction between perceived social consequences and rs-fcMRI between reward (NAcc) and mentalizing (DMPFC, TPJ) regions explained more variance in health risk behaviours. Individuals with greater functional connectivity between bilateral NAcc and DMPFC show an attenuated relationship between perceptions of social risk and their propensity to engage in health risk behaviours.

1-P-122 Behavioral inhibition is linked to functional connectivity during reward anticipation and greater risk-taking in adolescents.

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Atypical development of frontostriatal reward systems may drive increased risk-taking and susceptibility for substance use disorders (SUDs) in adolescents. Delineating how this network variability manifests and changes dynamically with age in adolescents may reveal novel targets for SUD prevention. In the current study, participants (N=87; 11-13 yrs & drug-naive at baseline) completed three waves of testing, including the Wheel of Fortune virtual functional MRI gambling task, at three 18-month intervals. Data from all waves were pooled and analyzed with the generalized psychophysiological interaction (gPPI) method in CONN to determine task-dependent connectivity. Conditions of interest focused on decision-making between high- (HR) or low-risk (LR) options; a 3-second delay between decision and feedback; and win/loss feedback. Seed regions for gPPI analysis were key reward network areas: caudate, nucleus accumbens, putamen, and anterior cingulate cortex. Mean connectivity within clusters (cluster-wise threshold: $p<0.05$ FDR) was used to model behavioral correlates across subjects. HR decisions occurred less frequently with increasing age ($p<0.002$) and with

greater behavioral inhibition ($p<0.05$), as measured by the Behavioral Inhibition Scale (BIS). Older age was also correlated with more money won ($p<0.001$) and shorter reaction times for LR decisions ($p<0.003$). Greater BIS score ($r=0.15$, $p<0.04$) correlated with increased connectivity between bilateral caudate and right frontal pole during the delay condition. These results suggest that adolescents with lower levels of behavioral inhibition make more risky decisions and experience weaker caudate-to-orbitofrontal cortex connectivity during anticipation of reward, with a possible interaction between them. Future analyses will examine the developmental time course of these interactions across waves and their ability to predict future patterns of risk-taking and substance use related to SUDs.

1-P-123 An anterior-to-posterior functional connectivity shift in the developing fronto-parietal number network

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Previous studies have identified a fronto-parietal network important for number and mathematics-related tasks, and functional neuroimaging has suggested a frontal-to-parietal shift with development. We hypothesize that in older children, posterior cortical areas are more active than frontal areas not only because of developmental changes within each area, but also because of changes in functional connectivity across areas. Therefore, we predict that this shift will also be reflected in functional connectivity. We will compute the degree of connectivity in a graph model of the fronto-parietal network for each node in two groups of school age children: 2nd graders and 5th graders. We predict that 2nd graders' frontal nodes will have greater degrees of connectivity than 5th graders' frontal nodes and that 5th graders may have greater degrees of connectivity in parietal nodes. We will use previously identified coordinates from a meta-analysis of numerical cognition (Yeo, Wilkey, & Price, 2017) as nodes in our network. We will calculate the correlation in resting state BOLD signal between each pair of nodes. Then, using a within-subject median split to determine the number of edges, we will calculate the degree of connectivity for each node. Finally, we will perform a paired sample t-test for each node using grade as the binary predictor (grouping) variable. We will consider both the degree of connectivity of individual nodes this way, as well as the average degree of anterior vs. posterior nodes (based on the y-axis midpoint). We will also consider the relationship between the sex and age in months within each grade, and if necessary include age in months and sex as a control covariates in a linear regression and/or ANCOVA model where average degree of connectivity is the outcome variable. We will interpret our findings in the context of an interactive specialization model of cognitive and neural development.

1-P-124 Childhood violence exposure and resting-state connectivity: Person-specific networks capture heterogeneity and some consistency.

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Objective: Early adverse environments are heterogeneous and characterized by variability in stressors (violence exposure, social deprivation) that affect individuals uniquely. Although early adversity effects on the brain are being delineated, most investigations fail to consider heterogeneity in the environment and the individual. Thus, we used a person-specific approach to reveal links between violence exposure, social deprivation, and adolescent resting-state connectivity in the salience network (SN) and default mode network (DMN). Methods: We analyzed resting-state fMRI data in 171 adolescents from the Fragile Families and Child Wellbeing Study in conjunction with longitudinal data on childhood violence exposure and social deprivation. We used Group Iterative Multiple Model Estimation (GIMME), a data-driven, sparse modeling approach, to estimate person-specific networks that contained connections shared by everyone in the group, community algorithm-detected subgroups, and unique for individuals within and between the SN and DMN. We examined links between early adversity, subgroup membership, and overall connectivity patterns. Results: GIMME identified 2 subgroups. One (N=129) had few subgroup- and many individual-level connections. The other (N=42) was

more homogenous, with many subgroup and few individual connections. The former had high violence exposure (t(74.44)=2.54, p=0.01). Overall, violence exposure was associated with fewer connections within the SN (B=-1.13,p=0.008) and between the SN and DMN (B=-1.42,p=0.029), adjusting for social deprivation, demographics, current stress, internalizing symptoms, motion. Conclusions: There is neural heterogeneity and consistency associated with early-life adversity. Heterogenous resting-state connectivity maps revealed two data-driven subgroups and a consistent influence of violence exposure on reduced SN and SN-DMN connections across individuals, potentially reflecting accelerated pruning or reduced differentiation.

1-P-125 Adolescent stress and the development of neural circuits underlying social behaviors

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Psychiatric disorders peak in prevalence during adolescence and adverse experiences early in life increase the lifelong risk of developing a psychiatric disease. Impairment in social behaviors is a key feature of many psychiatric disorders and adolescence is a time when social reorientation (from caregiver to peers) takes place, and social skills mature - setting the stage for critical maturational milestones. Research from human neuroimaging and rodent optogenetic studies have started to reveal neural circuits implicated in social behaviors. The ventral hippocampus (vCA1) is an intriguing region as it undergoes dynamic changes in its neural circuitry with frontal cortex during adolescence. However, little is known about the developmental trajectory of the vCA1 with other brain regions. In particular, the vCA1 and its projections to the key reward brain region, the nucleus accumbens (NAc), may play an important role in driving social approach and withdrawal behavior. Using a mouse model, we show that stress exposure during the onset of adolescence leads to reduced sociality and altered social communication (measured by ultrasonic vocalizations) towards a novel conspecific in adulthood in female, but not male, mice. To explore the developmental trajectory of the vCA1's structural connectivity with the NAc, we infused the anterograde tracer PHA-L into the vCA1 at P21 (late childhood), P30 (early adolescence), and P60 (early adulthood) and measured the relative fluorescent intensity of terminals in the NAc. Here, we show that male mice show a dynamic developmental surge in neural connectivity to the NAc that peaks at P30 and decreases by P60. Studies are underway to determine whether or not females show the same developmental surge in neural connectivity. Finally, the observed behavioral deficits may be accompanied by disrupted neural activity in response to rewarding social input, specifically between the vCA1 and NAc.

1-P-126 Neurobiological embedding of recent or concurrent child maltreatment in connectivity patterns

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Around 1 in 4 children will experience childhood maltreatment (CM). In terms of neural functioning, a history of CM predicts reduced resting-state functional connectivity (rsFC) in networks that are implicated in psychopathology (e.g., default mode network (DMN)). An important caveat here is that CM research often focuses on adult populations, years after maltreatment has occurred, and it remains to be established whether the neurobiological embedding of CM is evident shortly after (or during) the experience of CM. Establishing a more detailed time course of immediate neurobiological impacts of CM has the potential to identify novel targets for earlier preventive interventions. We examined rsFC in children (N=108; 43 females; 8-13 years old) who experienced CM in the past year and age-matched children with no history of CM. We considered rsFC within and between regions and networks known to be adversely affected by trauma, i.e., habenula, amygdala, DMN, salience network (SN), and executive control network (ECN). Compared to controls, children with a history of CM exhibited weaker connectivity between bilateral amygdala and the habenula (p=.03). There were no group differences within or between network strength in the DMN, SN, or ECN and effects did not vary by CM type. This study is the first to report diminished habenula/amygdala rsFC in children with a history of CM. Preclinical models suggest that the habenula is susceptible to the effects of trauma and disrupted

habenula function has been implicated in mental health disorders, which are more prevalent and less retractable in those who experience CM. Functional and structural deficits in the amygdala are ubiquitous following CM and the current data provide novel insight into the potential importance of the interaction of this region and the habenula in CM, i.e., disruption to habenula/amygdala circuitry may be a biomarker of neurodevelopmental trajectories and mental health challenges following maltreatment.

1-P-127 Variation in fetal limbic system functional connectivity relates to prenatal household SES

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Socioeconomic status (SES) has been established as a major influence in child brain and behavioral development. More specifically, low SES has been linked to adverse early health outcomes and deficits in cognitive, behavioral, and emotional domains (Azad et al., 2012). While there is reason to believe that low SES alters brain development in utero, the mechanism and timing through which it impacts the developing human brain remains unknown. Here, we examine the origins of SES-related variations in brain network development using functional magnetic resonance imaging (fMRI) to measure resting state functional connectivity (RSFC) of the human limbic system in utero. Data were collected from 118 pregnant women recruited during the second and third trimesters of pregnancy. Most of the women in this study are from low resourced environments (74%). Fetal RSFC was obtained during prenatal high-quality fMRI scans (M=32.4, SD=4.2 gestational weeks). Maternal self-report of family demographic information, including marital status, occupation, and education, was used to generate the Hollingshead Four-Factor Index of SES for each household. CONN Toolbox v18 was used to generate maps of fetal limbic network RSFC from bilateral amygdala seeds. Multiple regression of RSFC maps and household SES, controlling for fetal age at scan, revealed reduced RSFC to the medial prefrontal cortex, left insula cortex, anterior cingulate cortex, and thalamus with decreasing SES. Conversely, we observed increased RSFC of the amygdala to neighboring medial temporal regions, right lateral prefrontal lobe, and cerebellum with low SES. Overall, changes in fetal limbic system RSFC demonstrated here suggest that the adverse effects of SES on child outcomes, especially neurocognitive and affective development, may have their origin in the fetal period, even before major influences of environmental factors can take hold.

1-P-128 Advantages of Multi-shell Diffusion Models for Studies of Brain Development in Youth

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Diffusion-weighted imaging (DWI) has advanced our understanding of neurodevelopment, but has been hindered by analytical obstacles. In a developmental sample, we sought to evaluate these obstacles by comparing the most common DWI metric of interest, fractional anisotropy (FA), to two metrics derived from state-of-the-art processing methods: return-to-origin probability (RTOP) from Laplacian-regularized Mean Apparent Propagator estimation and intra-cellular volume fraction (ICVF) from Neurite Orientation Dispersion and Density Imaging. We imaged 123 subjects comprising a broad developmental window (12-30 years, M = 20.9). We utilized a multi-shell diffusion MRI protocol (117 directions, 1.5 mm3 isotropic) and evaluated in-scanner head motion estimates prior to conducting preprocessing. Comparative analyses were conducted by examining the relationship of age to mean white matter values, voxel-level values, and along deterministic tractography network edges for each diffusion metric. Multiple comparisons were false discovery rate-corrected. As expected, age significantly related to mean FA in white matter while controlling for sex and head motion ($F = 3.267$, $p = 0.041$). However, mean ICVF ($F = 14.13$, $p = 3.58\times10^{-7}$) and RTOP ($F = 12.66$, $p = 8.00\times10^{-7}$) demonstrated

more definitive relations. Furthermore, only 2 FA voxels were significantly associated for age after correction for multiple comparisons., as opposed to > 10,000 voxels for both ICVF and RTOP. Network edges revealed a similar trend: 80 FA-weighted edges related to age, whereas 418 related to ICVF-weighted edges, and 321 to RTOP-weighted edges. Additionally, while mean white matter values of FA ($p = 0.004$) were significantly confounded by head motion, ICVF and RTOP demonstrated no such relation ($p > 0.258$). Taken together, we demonstrated multi-faceted advantages of using ICVF and RTOP to characterize neurodevelopment, particularly in motion-prone populations like children.

1-P-129 Functional networks and minimum spanning trees in developmental dyslexia

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Objective: Developmental dyslexia is potentially the most common developmental disorder that can affect up to 17% of children. While neuroimaging studies have been able to identify the cortical areas involved in the reading deficit, the high heterogeneity within the spectrum still remains poorly investigated. This study explores how neurophysiological functional connectivity and network topology are related to specific sub-types (fluent or dysfluent) of dyslexic readers, using resting-state magnetoencephalography (MEG). Method: We used measures of reading fluency to stratify our sample of 31 (mean age 12 years old) children with dyslexia, in fluent and dysfluent dyslexic readers. By applying an atlas-based (AAL) MEG beamformer approach, we obtained a detailed anatomical mapping of neurophysiological patterns for different cortical (alpha, beta, theta and delta) rhythms in source space. We used Phase Lag Index (PLI) to measure the resting-state functional connectivity (RSFC). To describe the network topology the Minimum Spanning Tree (MST), an acyclic subgraph which reconstructs the backbone of the functional network, was applied. MST topology was characterised using different global and centrality measures (e.g. degree, betweenness centrality). Results: While RSFC did not differ between the two groups, differences in MST were detected between fluent and dysfluent readers. In particular, when compared to fluent dyslexic readers, the dysfluent group showed a more centralised and less integrated functional network in alpha and beta frequency bands. Conclusion: The current study offers a unique contribution to current neurodevelopmental studies into describing atypical reading trajectories and their network configuration within the dyslexic spectrum. By detecting different neurophysiological types of MSTs defined by fluency traits, we hope we took a step forward into the attempt of understanding better the cortical networks underlying the heterogeneity of dyslexia.

1-P-130 Subnetworks that comprise the core functional brain networks display distinct patterns of maturation

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Over the past two decades, understanding of the brain's intrinsic organization has grown rapidly. It is now widely accepted that the brain is composed of a series of distinct functional networks that coordinate to support complex behavior. While much work has explored the maturation of underlying brain structure, we still have little understanding of how these functional networks change across development. Furthermore, recent work has shown that, in adults, each of the primary networks is composed of 2-3 subnetworks. Examining the pattern of maturation across not just the brain's primary networks, but also within each of their subnetworks, may provide a clearer window into the nature of functional brain development. In the present study, we examined age-related variation in resting-state functional connectivity, using fMRI resting-state scans of 467 participants (ages 3-21) from the Pediatric Imaging, Neurocognition and Genetics publicly available dataset. We estimated linear, logarithmic, quadratic, cubic, as well as general additive patterns of maturation using age as a continuous variable. While exploring changes in functional connectivity, within each of the primary networks, showed that each network displays distinct change, examining the maturation of the subnetworks revealed a unique pattern that was obscured when exploring change in the larger networks alone. We found that each of the primary networks, including those that support basic processing such as the somatomotor system, have one subnetwork

that already displays unchanging, adult-like levels of connectivity, by the age of 3, and one/two subnetworks that undergo significant change across development. This works suggests that within each core system, one subnetwork may support functions that develop very early on, while the other/others may support the development of more complex capacities that emerge slowly across development. Further research is needed to explore this possibility.

1-P-132 A Preliminary Evaluation of Potential Epigenetic and Neural Biomarkers of Emotion Dysregulation in Children

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Emotion dysregulation in the form of severe temper outbursts (STO) in children is highly impairing and frequently the impetus for treatment. However, little is known about the underlying biomarkers of such behaviors. Methylation of brain derived neurotrophic factor (BDNF), specifically in the promotor IV region, has been linked to psychiatric risk (Boulle et al., 2012; Kundakovic et al., 2015), and psychopathology-related alterations in brain (Zeni et al., 2017). The present study represents a preliminary effort to apply such approaches to children with STO (n=16), compared to those without (4 children with ADHD,7 non-psychiatric controls). Buccal samples were analyzed for percent methylation of 8 CpG sites in BDNF promotor IV. A subsample of 10 children completed structural and resting state functional MRI scans. Seed-based intrinsic functional connectivity (iFC) analyses were conducted using the anterior midcingulate cortex (aMCC), a region that has previously shown differential iFC in children with STO(Roy et al., 2018). The Composite score of the parent-reported Emotion Regulation Checklist (ERC-C) was used as a measure of emotion regulation. Of the 8 CpG sites analyzed, only CpG6 was significantly lower in the STO group than the non-STO group ($t(24)= -3.56, p=.002$). Methylation values for CpG6 were then entered as a predictor into aMCC iFC analyses. Differential connectivity related to BDNF methylation was observed in four clusters: middle temporal gyrus, subgenual ACC, medial PFC, and precuneus. To examine how these iFC values relate back to the original phenotype, bivariate correlations were conducted with ERC-C scores. Positive correlations were observed for all clusters ($r's>.60$, $p's<.05$). This novel, preliminary study suggests that BDNF might be an important peripheral biomarker of the underlying neural mechanisms of STO. Further research is necessary to clarify the relationship between epigenetics and altered iFC in larger samples of children with STO.

1-P-133 A Joint Network Optimization Framework to Predict Clinical Severity from Resting-State Functional Connectomics

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Objectives: Current machine learning applications to functional connectomics focus on classification (e.g., diagnosing patients from controls). However, predicting dimensional measures of clinical severity remains an open challenge due to inter-subject variability and the complex relationship between neuroimaging and behavior. We propose a novel joint network optimization framework to overcome these challenges. Our work extends conventional machine learning methods by using the structure of resting-state connectivity matrices to capture both group- and individual patient-level effects. Methods: Our framework consists of two mathematical parts. The first term decomposes the resting-state fMRI (rsfMRI) correlation matrices into a set of group-level subnetworks, which correspond to patterns of co-activity in the brain, and person-specific subnetwork contributions. The second part uses the patient-specific contributions to predict clinical severity via multivariate regression. Our algorithm jointly optimizes for the parameters that best relate neuroimaging and behavior. Results: We validate our framework on rsfMRI data from 58 children with autism spectrum disorder (ASD). We use the automated anatomical labeling atlas to compute region-wise correlation matrices and consider three measures of clinical severity: the autism diagnostic observation schedule (ADOS) total raw score, the parent-report social responsiveness scale (SRS) total raw score, and a video-coded measure of praxis. We use ten-fold cross validation to quantify the median absolute error in predicting each score. Our framework outperforms both

conventional machine learning techniques and graph theoretic measures of connectivity. Conclusions: We have developed the first unified framework to predict dimensional measures, as assessed by generalization accuracy. Our estimated subnetworks capture ASD-relevant interactions. Our approach will open new avenues for studying both typical and atypical development.

1-P-134 Longitudinal resting-state fMRI in individuals with autism

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Background: New techniques that facilitate analyzing data from a single subject (Gordon et al., 2017), rather than group average statistics that mask heterogeneity across subjects, have proven useful in understanding variance in neural network topography. However, these techniques have yet to be applied to a clinical population with the explicit intent of looking at change in functional connectivity (FC) over time. Methods: In an ongoing data collection, 6 subjects (6-30 years old, 3 males) with Autism Spectrum Disorder have completed 2-3 of 4 total longitudinal scan sessions, each session separated by 4 months, totaling one year of scanning. Subjects completed 18 minutes of resting state fMRI (multi-band, multi-echo) at each visit, along with 18 minutes of watching neutral videos, and 18 minutes of watching videos related to their restricted interest. The content and intensity of subjects' restricted interests were tracked. Results: Correlation matrices of FC for each subject's scan session demonstrate that FC is more similar within subject than between subject (within subject average Pearson's correlation = 0.773, between subject = 0.477). The youngest subject demonstrated a pattern whereby sessions closer in time had higher correlations than sessions further apart. No other subject exhibited a relationship between FC correlation and temporal proximity of sessions. Behaviorally, 4 of the 6 subjects exhibited at least one change in restricted interest between sessions. Conclusions: This study has demonstrated that longitudinal fMRI over a year's time is feasible in a clinical and developmental population. Stability of neural networks over time is reproduced in this clinical population, despite behavioral changes, and distinct heterogeneity between subjects implicates the importance of specific and individualized treatment options.

1-P-135 Two patterns of atypical development involving distinct functional networks in Tourette syndrome

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Tourette syndrome (TS) is a complex disorder with symptoms that involve sensorimotor and top-down control processes that fluctuate over the course of development. Understanding the neural substrates supporting the range and time course of symptoms in TS may require a whole-brain description of large-scale circuitry and examination of these substrates across development. Here, we used functional connectivity MRI to examine, in TS, the diverse functional networks across the brain that support cognitive functions. We considered the connections within each functional network and between each pair of functional networks separately. We then compared the development (here, cross-sectional differences between children and adults) of these connections in TS to that in healthy controls. We found evidence for two patterns of atypical development in TS that involved different within-network and cross-network connections. Developmental differences that were greater in TS than in controls were among control and processing networks. These connections did not differ between control children and adults, but were stronger in adulthood TS. By contrast, developmental differences that were smaller in TS than in controls involved functional connections between subcortical structures and control and processing networks. The strength of these connections increased/decreased between control children and adults, but to a smaller extent in TS and were indicative of immaturity in adulthood TS. These two distinct patterns of atypical development may be supported by different mechanisms. Divergently stronger functional connectivity in adulthood TS may be associated with frequent, coordinated engagement of attention, top-down control, and sensorimotor processes that accompanies a history of tics. The incomplete maturation of the

integration and segregation of the subcortex and cortical sensory and attention networks may be a factor in persistent tics in adulthood.

1-P-136 Neonatal default mode network connectivity relates to autism symptoms at ages 2 and 5 years

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Background: Infants born very preterm (VPT, <30 weeks gestational age [GA]) are at increased risk for Autism Spectrum Disorders relative to full-term (FT) peers, though mechanisms for identifying children at highest risk remain limited. Autistic children and adults demonstrate differences in default mode network (DMN) functional connectivity relative to controls, however, it remains unknown if these differences are evident in the neonatal period. Objective: To investigate relations between neonatal DMN functional connectivity and autism symptoms in toddlers and early school-age children. Methods: In this prospective longitudinal study, resting state-functional MRI (rs-fMRI) data were obtained for 42 VPT infants (16 males, mean birth GA 27 weeks) at term-equivalent and 29 FT infants (14 males, mean birth GA 39 weeks) within the first week of life. Developmental testing was completed at ages 2 and 5 years, including parent-report measures such as the Infant-Toddler Social and Emotional Assessment (ITSEA) at age 2 and the Social Responsiveness Scale-2 (SRS-2) at age 5. Relations between neonatal rs-fMRI and autism symptoms at ages 2 and 5 years were assessed using voxel-wise whole-brain analyses with DMN seed regions, looking at term and preterm children separately and together. Results: There was no significant difference between the VPT and FT groups in their ITSEA Competence or SRS-2 scores. Neonatal functional connectivity measures between hallmark regions of the DMN, including the medial prefrontal cortex, posterior cingulate cortex and lateral parietal cortex, were related to autism symptoms at ages 2 ($p<.001$) and 5 ($p<.001$) across FT and VPT children. There were also differences in the relations between neonatal connectivity measures and childhood autism symptoms between groups. Conclusions: Children at high risk for developing autism symptoms may be identifiable in the neonatal period using DMN functional connectivity measures.

1-P-137 Neural systems supporting set-shifting in children with autism spectrum disorder

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Cognitive flexibility, the ability to switch between mental processes, is predictive of symptom severity for repetitive behaviors in autism spectrum disorder (ASD). Here we examine the neural bases of cognitive flexibility in typically developing (TD) children and ASD children using a set-shifting task involving flexible switching of thought between stimulus categories. 33 TD children and 24 children with ASD ages 7-12 years completed a set-shifting task designed to engage cognitive flexibility. In the scanner, participants were shown three objects; one differed from the other two in either shape or color. Participants were directed to select a unique object and were not explicitly told of the identifying dimensions (color or shape). In mixed blocks, the identifying attribute on successive trials alternated between shape and color. In repeated blocks, the identifying feature was consistent. Participants engaged in four 4-minute runs of the block design task. Data were analyzed using FSL software (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/). A general linear model was generated and the data were modeled to allow analysis of contrasts of interests for each individual followed by a group-level mixed effects analysis using FLAME 1. Significant clusters were identified with the $Z > 2.3$ and cluster level threshold of $p < 0.05$. The group level analysis demonstrated greater activation of the basal ganglia, temporal cortex, and hippocampus in children with ASD during performance on trials involving shifting (mixed - (color + shape)). Prior research has shown that categorization learning recruits hippocampus and basal ganglia learning systems. Greater hippocampal

and basal ganglia recruitment during cognitive flexibility trials suggests that children with ASD may recruit more neural resources when learning to associate stimuli with responses indicating category membership.

1-P-138 Functional Connectivity Between the Amygdala and Ventromedial Prefrontal Cortex is Associated with Emotional Regulation Dysfunction and Suicidal Ideation in Adolescents

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Background: Reduced functional connectivity (FC) between the amygdala and ventromedial prefrontal cortex (VMPFC) is associated with adaptive emotion regulation. Emotion dysfunction is a key psychological mechanism underlying the emergence of suicidal ideation (SI). To better understand the neural mechanisms associated with emotion dysregulation and SI, we examined these processes in adolescents with and without depression. Methods: 24 depressed adolescents (6 male; 16.15±1.4 years) and 20 healthy controls (10 male; 15.5±.95 years) completed a resting-state fMRI scan, from which we computed amygdala-VMPFC FC. To assess difficulties in emotion regulation we administered the Difficulties in Emotion Regulation Scale (DERS), which includes subscales assessing awareness, clarity, impulse, goals, non-acceptance, and strategies. To assess SI we administered the Suicidal Ideation Questionnaire (SIQ). We conducted linear regression models to test the effects of DERS and SIQ on amygdala-VMPFC FC, with age as a covariate, across all adolescents. Results: Groups differed in DERS and SIQ (ps<.0001), but not in amygdala-VMPFC FC (p=.133). Higher DERS total score was associated with higher right amygdala-VMPFC FC (B=.002; t(41)=2.09; p=.043); this association was driven by the strategies subscale (p=.042). Both higher DERS total score and strategies subscale were associated with higher SIQ scores (ps<.0001). Finally, higher SIQ scores were associated with higher right amygdala-VMPFC FC (B=.004; t(41)=2.37; p=.023). Conclusion: Given that the DERS strategies subscales probes feelings of hopelessness, we interpret our findings of positive amygdala-VMPFC FC in adolescents as a neural correlate of a maladaptive emotion regulatory strategy that may contribute to SI. Longitudinal research is needed to test whether altered trajectories in amygdala-VMPFC FC mediate links between emotion dysregulation and SI in adolescents.

1-P-139 Developmental changes in delay discounting and fronto-striatal functional connectivity among children with ADHD and typically developing children

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Background The ability to delay gratification in pursuit of a larger, albeit delayed, reward is a critical component of adaptive development. Heightened delay discounting (DD), or a stronger preference for smaller, immediate rewards over larger, delayed rewards is associated with ADHD. This study examined developmental changes in monetary DD among a sample of 336 8-17 year-olds with either a diagnosis of ADHD (n=199, 52 girls) or typically developing (TD) controls (n=137, 45 girls) with longitudinal data at least 2 years apart for a subset of the sample (n=128). Methods Linear mixed effects models were conducted to test for effects of age, diagnosis (Dx), sex, and their interactions. We also conducted mediation analyses to test for indirect effects of fronto-striatal functional connectivity (FC) during resting-state fMRI on developmental changes in DD among a subsample with a good rs-fMRI scan (n=216, 120 ADHD). Results As expected, DD decreased with age across participants (p=0.002), and there was some evidence of differential change across groups (Dx*Sex*Age, p=0.067) such that boys with ADHD showed a steeper reduction in DD with age than did girls with ADHD. Of three striatal seeds--representing dorsal, medial, and ventral subregions of the striatum, targeting the frontal lobe--we found that FC between the dorsal striatum (dSTR) and right orbitofrontal cortex (rOFC) increased with age (voxelwise p<0.001, size=264 vox, r=0.265, p<0.001) and that greater FC between these regions was associated with greater ability to delay gratification (voxelwise p<0.001, size=62 vox, r=0.297, p<0.001). Mediation tests indicated a significant indirect effect of dSTR-rOFC FC on the relationship between age and DD (b=-0.007, 95% CI =-.0124, -.0029), with similar results

obtained when examined separately for ADHD and TD groups. Conclusion These findings suggest that increased FC between the dSTR and the rOFC with age is related to greater self-control from childhood into adolescence.

1-P-140 The Relationship between Psychophysiological and Neural Responses to Auditory and Tactile Aversive Stimuli in Youth with Autism Spectrum Disorder

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OBJECTIVE Individuals with Autism Spectrum Disorder (ASD) commonly show sensory processing deficits (Leekam et al., 2007). Previous work suggests that sensory over-responsivity (SOR) in particular is related to over-reactive brain responses to aversive stimuli (Green et al., 2015). Since prior MRI studies have been limited to older, higher functioning ASD participants, the mechanisms underlying SOR are not well understood among other ASD populations such as the very young or low functioning. Thus, our study aims to investigate skin conductance response (SCR) as a potential proxy to predict brain responses to aversive sensory stimuli for ASD youth who are unable to participate in functional MRI (fMRI) scans. METHODS SCR and brain responses to mildly aversive sensory stimuli were examined in 41 ASD (31M) participants aged 8-17 years. fMRI and SCR (out of the scanner) measurements were obtained while participants experienced 6 15-sec blocks of simultaneous auditory and tactile aversive stimuli. SCR slope (habituation rate) was used to predict brain responses in bottom-up, whole-brain analyses (thresholded at $Z>2.3$; corrected for multiple comparisons at $p<0.05$). RESULTS Steeper SCR slope (faster habituation) was correlated with greater brain activation to sensory stimuli in frontal regions (ventromedial prefrontal and right frontal orbital cortices), parahippocampal gyrus, and retrosplenial cortex. CONCLUSION SCR did not predict neural markers of either general arousal or sensory responses (e.g., amygdala; sensory cortices). Rather, ASD youth with faster SCR habituation showed more activity in brain regions related to regulation and memory. Results suggest that peripheral measures of habituation may best predict the extent to which ASD youth engage regulatory processes to aversive sensory stimulation. Activity in parahippocampal and retrosplenial areas may also indicate higher levels of predictive coding, which has been hypothesized to be involved in SOR (Ward, 2018).

1-P-141 Neural mechanisms of digit processing in kindergartners: An fMRI study

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Number symbol processing is a critical foundation for math achievement. Evidence in adults suggests preferential engagement of a "Number Form Area" (NFA) in the ventral occipito-temporal cortex (vOTC), during the processing of Arabic numerals compared to other symbols, and that the function of this region relates to individual differences in calculation ability. It is currently unknown, however, 1) when preferential processing of the NFA develops, 2) what mechanisms drive category specificity in the NFA, and 3) how NFA function relates to behavior in children. We address these questions using fMRI in typically-developing kindergartners who performed a symbol classification task. Participants (n=46, Mean age 6.1±0.4yo) saw digits, letters, or scrambled symbols, deciding whether they "knew the name" of the stimulus. We found no evidence for preferential processing of digits in the NFA in relative activation level, nor in representational distinction via MVPA. Similarly, we found no evidence of differences across symbol categories in NFA-to-parietal connectivity, as would be predicted from a biased-connectivity account of vOTC functional development. In a brain-behavior correlation, a significant negative association was observed between digit-related activity in the NFA and digit naming speed ($r = -0.52$, $p < 0.001$), with higher performance related to lower activation to digits relative to other symbols. The relationship remained significant ($p < 0.02$) after controlling for letter naming speed. This finding suggests NFA function is relevant for digit recognition in kindergarten, albeit in the opposite direction than expected. Overall, our results are not easily reconcilable with prior findings in adults, suggesting a complexity to NFA development which requires further investigation, including longitudinal assessment of NFA functional maturation.

1-P-142 Multimethod evidence for a prolonged development of the visual scene network

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Navigating our environment is of high ecological relevance and involves processing of the visual scenery. Scene processing, however, develops with age: Behavioral studies show that visual scene processing improves before and beyond the age of six and reaches adult levels at ten years only. However, until now the driving neurocognitive factors for this behavioral development remained unclear. Visual scene processing relies on a network of functionally scene-selective areas: the parahippocampal place area (PPA), retrosplenial complex (RSC) and occipital place area (OPA). We investigated the development of the scene network's structure and function in middle childhood (7-8y), late childhood (11-12y), and adulthood in a series of studies employing a multimethod approach, i.e. combining an fMRI scene localizer, restingstate connectivity analysis, myelin water imaging, and DTI. Our main functional results suggest that both PPA and OPA (but not RSC) increase in functional cluster size and scene selectivity beyond late childhood and that restingstate connectivity increased with age between the OPA and the PPA, V1, and V1. Our main structural results suggest that myelin increases in within-scene-network tracts (OPA-PPA, OPA-RSC, and PPA-RSC) as well as in in tracts connecting the RSC and OPA to crucial input/output regions (V1, V2, hippocampus). Our results clearly demonstrate a prolonged development of the visual scene network in both structure and function. Thus, we uncovered the possibility that structural maturation is driven by functional development, or vice versa. Further, our studies indicate that prolonged development of category-selective areas' structure and function also takes place beyond the commonly studied boundaries of the ventral temporal cortex.

1-Q-144 Investigating ERP Consistency across Child and Adolescent Worriers in Tasks Measuring Sensitivity to Punishment

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Objectives: Although worriers tend to report greater sensitivity to punishment (e.g., negative feedback, making mistakes), less is known about worriers? neural response to punishment, especially among children and adolescents. Further, no study has compared whether worriers are sensitive to different aspects of punishment (e.g., making mistakes vs. receiving negative feedback) across different tasks. The current ERP study investigated child and adolescent worriers? sensitivity to punishment during negative feedback and while making mistakes. Method: Children (N= 43, Mage= 9) and adolescents (N=55, Mage= 12) completed two tasks: (1) the Balloon Analogue Risk Task: a risk-taking task that provides participants with negative feedback about their performance, (2) a GoNoGo task: an inhibitory control task designed for participants to make mistakes throughout the task. Results: We found a significant 2-way interaction between worry status (worry vs. low-worry) and age (children vs. adolescents) for negative feedback as indicated by the P3, $p < .05$. Specifically, worriers had a larger P3 amplitude to negative feedback compared to low-worriers regardless of whether they were children or adolescents; however, the difference between worriers and low-worriers was much smaller among adolescents. For the GoNoGo task, we found adolescent worriers had a larger ERN than low-worriers. There was no difference between worriers and low-worriers in terms of the ERN among children. Conclusions: Overall, worriers had a sensitivity to negative feedback, even in childhood. Only adolescent worriers, however, had a neural sensitivity to making mistakes. Thus, children may have more trouble recognizing when they made a mistake (e.g., given that they have to monitor their own performance) compared to when they are provided with negative feedback. These results also suggest that neural sensitivity to negative feedback may be a way to identify worriers at a young age.

1-Q-145 Factors underlying the effects of the Video-feedback intervention to promote Positive Parenting and Sensitive Discipline on parenting behaviour: the role of neural face processing

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Parental sensitivity, the capacity to recognize, accurately interpret and promptly respond to their offspring's needs, is an important contributor to child development. Infants and young children often communicate emotional needs through their faces, as they do not possess the ability to voice their needs through language. To facilitate parental sensitivity, it is important that parents are sensitive to facial expressions of their offspring. The Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) is effective in enhancing parental sensitivity and sensitive discipline, but the mechanisms explaining this efficacy remain unknown. Our aim was to investigate whether neural face processing, reflected by the N170, plays a role in bringing about intervention effects on parenting behavior. By using electroencephalography (EEG), we investigated mothers' neural processing of children's emotional faces. In a randomized controlled trial, 66 mothers came to Leiden University's Child and Family lab for two identical experimental sessions separated by 4.6 months (SD = 0.93) during which a random 33% of the mothers received 5 sessions of the VIPP-SD. Mothers' EEG activity in response to 144 photographs (i.e. 48 happy, 48 angry and 48 neutral faces) was acquired during both pre- and post-intervention sessions. Earlier we found that, compared to a control group, the N170 at post-test was lower (less negative) in the intervention group (Kolijn et al., submitted manuscript). Currently, we are working on mediation analyses to test whether the change in N170 amplitudes mediates the intervention effect on parenting behavior. Also, we will explore contributions of attention-related components (P1, P2 and the late positive potential) to effects of the VIPP-SD on parenting behavior. Ultimately, we hope to gain insight into the mechanisms underlying the effects of successful parenting intervention programs and support the development of such programs.

Day 2, Saturday, August 31

2-A-1 Maturation of Domain-General Neurocognitive Processes

Brenden Tervo-Clemmens, Finnegan Calabro[1], Beatriz Luna[1]

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Cognitive control functions are available in early development but the ability to engage them in a reliable manner matures into adulthood. The initial literature has focused on individual functions and it remains unclear whether cognitive development is driven by multiple, independent processes or the maturation of more common shared processes. Building on an emerging literature demonstrating shared processing of cognitive functions in adults, the current project tests the hypothesis that adolescent cognitive development is driven by a subset of domain-general processes. Participants (N=187) completed a battery of cognitive assessments, including eye movement (visually guided saccade, antisaccade, memory guided saccade) and computer-based (CANTAB: Stockings of Cambridge, Spatial Span, Delayed Match to Sample) tasks, across a fifteen-year accelerated longitudinal study (687 visits, ages: 8 - 33-years-old). Results from an exploratory bifactor analysis showed that two primary factors, representing domain-general cognitive control (DGCC) and latency, accounted for nearly half of the variance (49.1%) in task performance. Subsequent non-linear modeling of age-related changes in these factors demonstrated robust developmental improvement in DGCC ($p < .001$, growth observed until 20-years-old) and decreases in the latency ($p < .001$, growth observed until 18-years-old). Consistent with study hypotheses, DGCC and latency factors significantly mediated (p's < .01) age-related changes in nearly all individual tasks. Importantly, within-subject changes in DGCC were associated with a broad pattern of cortico-subcortical functional connectivity. Together, these results suggest that adolescent cognitive development may be driven by a small group of domain-general processes, providing a unifying framework for models of cognitive development and insights into cognitive deficits that may emerge during adolescence.

2-A-2 Changes in the insula and caudate nucleus activity during SST induced by inhibitory control training. A fMRI study in school-age children

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[1]Paris Descartes, [2]INSERM, [3]CHU de Caen

Inhibitory control (IC) plays a critical role in cognitive and socio-emotional development in normal and pathological conditions (Borst et al Dev Med Child Neurol 2015). IC changes in childhood is associated with the development of the prefrontal cortex during this developmental period. Recent researches in children have reported IC improvements following short-term IC training (Zhao et al Dev Sci 2008), but the neuroplastic changes that support these processes are not fully understood. In this context, we used a placebo-controlled trial to examine neural activation before and after IC training - parametric Stroop task and Stop-signal Tasks (SST) - or an active-control training - AC, knowledge- and vocabulary-based tasks (placebo). Sixty-eight healthy children (9.9 ± 0.56 y.o., 29 males), recruited from primary schools in Caen, France, underwent fMRI during SST before and after being randomized to either IC or AC training. Participants performed IC or AC tasks 15 min per day, 5 days a week for a month on a tactile tablet at home. Analyses focused on SST changes after training on behavioral and neural (fMRI BOLD) changes. Current results are based on a subsample of 43 participants. Results of the full sample (ongoing analyses) will be presented at the congress. SST reaction time (RT) decreased after training but there was no difference between IC and AC ($F(1,54) = 4.04$, $p = .049$). Whole-brain analyses of fMRI data (Aron & Poldrack J Neurosci 2006) before training in IC and AC children revealed classical neural network of IC ($p < .05$, FWE): insula, ACC, IPL, MFG, SMA. Furthermore, different activations changes after training were detected in IC and AC: AC training induced posterior brain changes (IPL) while IC training induced anterior brain changes (insula, caudate nucleus). These preliminary findings, to be confirmed on the complete sample, suggest that neural measures may detect finer-grained changes after IC training in children than behavioral measures.

2-B-3 Gonadal hormone administration alters neural response to both unfamiliar peer's and own mother's voice in adolescents

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[1]Research Institute at Nationwide Children's Hospital, [2]Nationwide Children's Hospital

Objective: Pubertal maturation is marked by a social re-orientation away from caregivers and towards expanding peer networks. Accompanying changes in social engagement with friends over family, and in neural response to social stimuli, are thought to be potentiated by gonadal hormones. The current study investigated the effect of gonadal maturation on neural processing of socio-emotional cues by peers versus parents in a sample of 12- to 18-year-old participants receiving exogenous hormone administration for gender dysphoria. Methods: While undergoing functional magnetic resonance imaging (fMRI), youth heard auditory recordings of their own mother and of an unfamiliar teenager speaking short phrases in angry and happy tones of voice. Multivariate analyses of the effect of hormone dose, emotion type, and speaker type on whole-brain activation were performed, controlling for chronological age. Results: Higher doses of exogenous testosterone were associated with increased response to the peer-aged voice and decreased response to mother's voice in the right mesial temporal lobe (amygdala, hippocampus, and parahippocampal gyrus) and ventral striatum. Conclusions: These results suggest that rising levels of gonadal hormones in puberty are associated with differential neural encoding of peer and caregiver social signals in reward- and motivation-related brain circuitry. Gonadal maturation may thus promote patterns of neural response that value peers over caregivers, a process that may facilitate adolescents' re-orientation towards social networks and independence from the family environment.

2-B-4 Associations between limbic white matter microstructure and social and emotional functioning in children with ADHD+ASD

Kate Stephens[1], Timothy Silk[1], Peter Enticott[1], Emma Sciberras[1]

[1]Deakin University

Children with ADHD and clinically significant levels of ASD symptoms (ADHD+ASD) have been shown to have substantially impaired functioning, over and above having ADHD alone, in particular poorer social and emotional functioning. Abnormalities in white matter tracts have been implicated in both ADHD and ASD, however research has not explored whether there is an association between social and emotional functioning and limbic tract properties in children with ADHD+ASD. This study aimed to examine whether measures of social and emotional functioning were associated with limbic tract properties in children with ADHD and ADHD+ASD. This study used MRI diffusion weighted data from the baseline of a longitudinal study of children with (N=78) and without ADHD (N=74). ADHD status was confirmed using the Diagnostic Interview Schedule for Children, while ASD symptoms were assessed using the Social Communication Questionnaire (SCQ). Clinically elevated ASD symptoms was defined as a SCQ score above 11. Social and emotional functioning was measured using the peer problems and emotional problems subscales of the Strengths and Difficulties Questionnaire (SDQ). A significant association was found for the mean fractional anisotropy (FA) of both the left (p=.007) and right (p=.008) cingulum and emotional problems in the ADHD+ASD group. There was also a significant association between left uncinate fasciculus mean FA and emotional problems (p=.04). Results suggest that there may be a biological basis to the additional emotional difficulties seen in children with ADHD+ASD. The findings of cingulum anomalies supports previous research which has linked ASD severity to abnormalities of the cingulum. Left uncinate FA has also been linked to emotion regulation problems in ASD samples. Longitudinal analyses will be conducted to determine whether there are changes in social and emotional functioning over time, and whether this is reflected in changes of mean FA in limbic tracts across groups.

2-B-5 Age-related differences in prosocial and antisocial influence in adolescence

Saz Ahmed[1], Lucy Foulkes[2], Jovita Leung[1], Cait Griffin[1], Ashok Sakhardande, Marc Bennett[3], Darren Dunning[3], Kirsty Griffiths[4], Jenna Parker[3], MYRIAD Team[1], Willem Kuyken[5], Mark Williams[6], Tim Dalgleish[3], Sarah-Jayne Blakemore[1]

[1]University College London, [2]University of York, [3]Cambridge University, [4]Cambridge Univerity, [5]Oxford Univerity, [6]Oxford University

Background Adolescents are particularly susceptible to social influence and previous studies have shown that this susceptibility decreases with age. The current study was designed to investigate whether there are age-related differences in the impact of social influence on the reporting of prosocial behaviour (any act intended to help another person) and antisocial behaviour (any act intended to cause harm/distress to another person) across adolescence. Methods Participants aged 11-18 (N=527) completed two computerised tasks. In the social influence task, participants rated how likely they would be to engage in a prosocial (e.g. "help a classmate with their work") or antisocial act (e.g. "make fun of a classmate"). They were then shown the average rating (in fact fictitious) that other adolescents had given to the same question, and were then asked to rate the same behaviour again. In the charity donation task, participants were asked how much money (out of £5) they would donate to charity. Results Participants' age, but not pubertal stage, affected the extent to which they were influenced by other people: all participants changed their rating in the direction of others' ratings with younger adolescents changing their ratings more than older adolescents. There was no difference between prosocial and antisocial influence across all age groups. Across participants, the proportion of money they reported to donate to charity and the prosocial subscale of the Strengths & Difficulties Questionnaire all positively correlated with ratings of prosocial behaviour in the social influence task. Conclusion There was an age-related decrease in the susceptibility to social influence: younger adolescents were more susceptible than older adolescents and this effect

was not dependent on the type of social information (prosocial vs. antisocial). Furthermore, the more money participants said they would donate to charity, the more likely they were to report engaging in prosocial act

2-B-6 Neural correlates of conflicting social influences on adolescent risk-taking

Seh-Joo Kwon[1], Kathy Do[1], Ethan McCormick[1], Eva Telzer[1]

[1]University of North Carolina- Chapel Hill

Objective: One defining feature of adolescence is a heightened orientation to social stimuli and cues, rendering adolescents more sensitive to peer influences. Coinciding with this increasing orientation to peers is a consistent presence of family (e.g., parents) in adolescent lives. Yet, given these two powerful sources of influence, relatively little research has investigated how parent and peers simultaneously affect adolescent behavior. Adolescence is also a period of a sharp rise in risk taking behavior. In such contexts, it is likely that there is conflicting social information delivered from parents and peers (i.e., peers endorsing a behavior while parents discouraging it). The current study examines how conflicting social information from peers and parents shape adolescent behavior, at the behavior and neural levels. Method: 28 adolescent participants (M=12.71 years, SD=.62 years) completed a social influence risk taking task. During a baseline session, participants had the opportunity to make either risky or safe choices. During an MRI session, participants completed the same task, but were shown the ostensible decisions of their peer and parent beforehand. These decisions were manipulated to either promote conflicting endorsement (i.e., peer chooses risky option and parent chooses safe option, and vice versa) or non-conflicting endorsement (i.e., both chooses risky option or both chooses safe option). Results: Behavioral results indicate that adolescents tend to take more risks when their parent endorses risk taking while a peer discourages it, than vice versa. Neural analyses will be conducted to probe the neural patterns underlying this behavioral finding. Conclusion: Results suggest that parents may have a greater influence on adolescent risk taking than do peers. Findings from this study will help us better understand how adolescents make decisions in conflicting social situations, and the neural correlates that help explain their behavior.

2-B-7 Peers exert a stronger prosocial than antisocial influence on adolescent attitudes: Evidence from brain and behavior

Kathy Do[1], Ethan McCormick[1], Eva Telzer[1]

[1]University of North Carolina, Chapel Hill

Parents and peers differentially influence decision making during adolescence, yet little is known about social conformity in contexts where parents and peers exert competing influences. The present fMRI study examined adolescent conformity to different types of behaviors in the face of conflicting influences from parents versus peers. Adolescents (n=39; 12-14 years) and their parents rated their attitudes toward everyday positively and negatively valenced behaviors that adolescents might engage. During a brain scan one week later, adolescents were shown their parent's and an unknown peer's ratings of these same behaviors, which were manipulated to conflict with adolescents' initial ratings, and indicated who they agreed with. Generalized linear mixed effects models indicated adolescents were equally likely to conform to their parent and peer when their parent's ratings conflicted with their peer's ratings, with no differences in the brain. When their parent's or peer's ratings conflicted with their initial ratings, adolescents tended to stick with their initial ratings 70% of the time. When they did conform, adolescents were more likely to conform to their peer on positive than negative behaviors, which was paralleled by decreased vmPFC activation to positive behaviors but increased vmPFC activation to negative behaviors. Furthermore, an interaction between the valence of the behavior and magnitude of peer influence suggests that adolescents were more likely to conform on negative behaviors when their peer endorsed prosocial ratings (i.e., peer rated negative behavior as "less good") than antisocial ratings (i.e., peer rated negative behavior as "more good"). These results suggest that adolescents are relatively autonomous in the face of conflicting social influence but selectively conform to positive peer influences, thereby challenging prevailing conceptions of adolescence as a period of increased and unmitigated susceptibility to negative social influences.

2-B-8 Childhood maltreatment relates to a weaker effect of negative emotional distraction on inhibitory control and less recruitment of fronto-regulatory regions

Lauren Demers[1], Ruskin Hunt[1], Dante Cicchetti[1], Julia Cohen-Gilbert[2], Fred Rogosch[3], Kathleen Thomas[1]

[1]University of Minnesota, [2]McLean Hospital, [3]University of Rochester

Adverse rearing environments, including childhood maltreatment (CM), have been shown to promote neurocognitive adaptations that may lead to dysregulated behavior, including impaired inhibitory control and heightened emotional reactivity. The current study examines the interface between inhibitory control and emotion and associated neural underpinnings in the context of CM history. We predicted that CM history would relate to altered prefrontal cortex activity during inhibitory control, especially in negatively valenced contexts. Participants were adults who were part of a longitudinal high-risk, low-income sample (n = 72, M age = 30), half with CM histories. Behavioral and brain indices of inhibitory control during emotional distraction were measured while participants underwent 3T fMRI scanning and completed an inhibitory control task (Go/No-go) with task-irrelevant emotional background images. The comparison group showed lower no-go accuracy on negative (M = .72) compared to neutral (M = .78) background trials, whereas the maltreated group did not show an accuracy difference (M = .80, M = .77). The CM group had greater no-go negative accuracy than the comparison group, when controlling for age, sex, and accuracy on no-go trials with neutral background images ($F(1,69) = 5.91$, $p = .02$). At the level of the brain, unlike the CM group, the comparison group recruited prefrontal regions (left frontal pole, right interior frontal gyrus, right frontal pole,) more when performing the inhibitory control task in the context of negative vs. neutral background images (voxelwise $p < .005$, cluster $p < .05$). Results suggest that in a high-risk, low-income sample, childhood maltreatment relates to a weaker effect of negative emotional distraction on inhibitory control and less recruitment of fronto-regulatory regions. Perhaps the CM group learned to maintain inhibitory and regulatory control capacities even in the face of negative content.

2-C-9 Utilizing conditioned safety to augment fear extinction in adolescent mice

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[1]Weill Cornell Medicine

Anxiety disorders are highly prevalent, with diagnoses peaking during adolescence. Unfortunately, existing behavioral treatments to attenuate inappropriate fear responding have limited or no success for nearly half of the adolescent population. A barrier to developing treatments better suited for this group is a lack of knowledge about how key neural circuits related to fear acquisition and inhibition mature. Using a novel 'conditioned safety' paradigm appropriate for use in adolescent mice, we have investigated key basic science questions about safety learning with broad reaching translational and clinical value. We have shown that adolescent mice are able to learn to utilize stimuli explicitly predicting the absence of an aversive outcome (i.e., 'safety signals') to attenuate fear responding. Moreover, safety signals can be used to facilitate extinction learning, thus indicating the utility of safety signals as a therapeutic tool for the adolescent population. In addition, using fiber photometry to link neural activity to real-time dynamics of fear regulation, we have found safety-signal induced elevations in activity in select populations of prefrontal interneurons. This work indicates that the heightened plasticity observed within the developing prefrontal interneuron network may offer a unique 'sensitive window' during which inhibitory signaling can be leveraged to mitigate fear expression.

2-C-10 Is Cognitive Segmentation the core limit to problem solving abilities in children?

Sinead O'Brien[1], Daniel Mitchell[1], John Duncan[1], Daphne Chylinski[2], Joni Holmes[1]

[1]University of Cambridge, [2]University of Liège

Objective: Cognitive segmentation describes the ability to manage complex activities by selectively attending to separate, simpler parts of the problem. Cognitive segmentation skills limit problem solving abilities and are strongly linked to fluid

intelligence (IQ) in adults (Duncan et al, 2017). The aim of this study is to replicate Duncan et al's findings with 50 children between 7 and 10 years of age. Method: Traditional matrix reasoning problems were modified to minimize demands on working memory and processing speed. Participants were presented with 20 three-feature problems, split into two conditions: Combined and Segmented. Combined items appeared in the traditional matrix reasoning format. Segmented items were presented in separate parts to facilitate cognitive segmentation. Analysis: General linear models will be used to predict proportion of correct responses from condition (Combined and Segmented), age and IQ. Implications: There is little consensus about what drives fluid intelligence. Performance on complex problem-solving tasks that traditionally measure fluid intelligence is broadly associated with many cognitive processes. Identifying the factors underlying fluid intelligence will aid our understanding of what constrains effective cognition in children with low IQ.

2-C-11 The relationship between pubertal onset and benefits from a task-switching training

Corinna Laube[1], Neda Khosravani[1], Linda Wilbrecht[2], Silvia Bunge[2], Ulman Lindenberger[1], Yana Fandakova[1]

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Recently, it has been proposed that gonadal hormones released during puberty play a critical role in the development of the frontal cortex and associated cognitive functions, including the ability to flexibly shift between different tasks. Specifically, gonadal hormone changes with puberty onset may influence cognitive development by decreasing plasticity, or the potential to change with experience (Piekarski et al., 2017). We plan to test this hypothesis in the context of a training study, in which children (9-11 years) practice switching between different tasks (task-switching group; completed N=46, projected N=70) or perform the tasks separately after each other (single-task group; completed N=46, projected N=70) across 9 weeks at home via tablets. Saliva and hair samples are collected to measure pubertal status via gonadal hormones. On average, puberty starts around eight years, with considerable variation in onset age (Aksglaede et al., 2009). We will examine whether individual differences in pubertal onset are associated with cognitive and neural markers of plasticity. In addition to practicing at home, children complete a task-switching paradigm inside the MRI scanner or the MRI simulator (half per group) on four occasions spaced three weeks apart. Here, participants shift between three tasks that require them to attend to a specific feature of one of three objects. The paradigm allows us to examine how errors and response times are reduced with practice when switching between tasks trial-by-trial (switching costs) as well as when switching between tasks versus performing tasks separately (mixing costs). We predict that gains from task-switching and single-task practice will be more pronounced in prepubertal than in pubertal children as measured by greater reductions in switching and mixing costs. We plan to examine how practice-related changes in frontal activity during task switching are moderated by pubertal onset, especially in the task-switching group.

2-D-12 An electrophysiological investigation of reinforcement effects in attention deficit/hyperactivity disorder: Dissociating cue sensitivity from down-stream effects on target engagement and performance

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[1]University of Central Lancashire, [2]University of Southampton, [3]Macquarie University, [4]Kings College London

Neural hypo-sensitivity to cues predicting positive reinforcement has been observed in ADHD using the Monetary Incentive Delay (MID) task. Here we report the first study using an electrophysiological analogue of this task to distinguish between (i) cue related anticipation of reinforcement and downstream effects on (ii) target engagement and (iii) performance in a clinical sample of adolescents with ADHD and controls. Thirty-one controls and 32 adolescents with ADHD aged 10-16 years performed the electrophysiological (e)-MID task−in which preparatory cues signal whether a response to an upcoming target will be reinforced or not − under three conditions; positive reinforcement, negative reinforcement (response cost) and no consequence (neutral). We extracted values for both cue-related potentials known to be, both, associated with response preparation and modulated by reinforcement (Cue P3 and Cue CNV) and target-related potentials (target P3) and compared these between ADHD and controls. ADHD and controls did not differ on cue-related components on neutral trials. Against expectation, adolescents with ADHD displayed Cue P3 and Cue CNV

reinforcement-related enhancement (versus neutral trials) compared to controls. ADHD individuals displayed smaller target P3 amplitudes and slower and more variable performance but effects were not modulated by reinforcement contingencies.When age, IQ and conduct problems were controlled effects were marginally significant but the pattern of results did not change. ADHD was associated with hypersensitivity to positive (and marginally negative) reinforcement reflected on components often thought to be associated with response preparation−however these did not translate into improved attention to targets. In the case of ADHD, upregulated CNV may be a specific marker of hyper-arousal rather than an enhancement of anticipatory attention to upcoming targets. Future studies should further examine the effects of age, IQ and conduct problems.

2-D-13 Behavioral and Neural Correlates of Feedback Responsivity in Adolescent Risk Taking

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Adolescence is key developmental period marked by an increase in exploration, risk taking, and suboptimal decisions. While risk taking is a necessary and normative part of adolescence that promotes independence and learning, risky decisions can lead to negative consequences that pose a great threat to adolescent health and well-being. To better understand which adolescents are vulnerable to negative effects of risk taking, it is crucial to consider individual sensitivity to positive and negative feedback. Here, participants (n=32, 14-18 y/o) played the Driving Game, a risky decision-making task involving driving and trying to reach the end as quickly as possible, during an fMRI scan. Responsivity to negative (crash) and positive (reward) feedback was quantified by how likely participants were to use information from previous trials to guide their decision-making on subsequent trials (deciding to stop or go at the next yellow light). Decision and outcome data were nested within participants and fed into a generalized linear mixed-effects model. For a given trial, there were 4 dichotomous measures of outcome history: previous positive outcome, previous negative outcome, 2-back positive outcome, and 2-back negative outcome. A 2-back positive outcome was a significant predictor of decision (R = 0.4125, p = .0233), while a negative 2-back outcome neared significance as a predictor (R = 0.3043, p = .0695). Individual slopes were extracted for each subject, after which feedback responsivity was calculated by the interaction (multiplication) of each participant's 2-back positive and 2-back negative scores. fMRI analyses demonstrated that this feedback responsivity score predicted brain activity in the paracingulate and superior frontal gyri during decision-making following feedback (reward or punishment) versus following neutral trials. Further analyses will attempt to use this information to predict subjects' decisions based on feedback responsivity and neural signatures.

2-D-14 Neural correlates of risk and reward in safe and risky young men who have sex with men

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Introduction Adolescents, young adults and men who have sex with men (MSM) acquire sexually transmitted infections (STI) at a much greater rate than other groups. Thus, young MSM are an important population in which to study sexual risk-taking. Engaging in condomless anal sex (CAS) and the use of methamphetamine (MA) increase the risk of STI in young MSM. We examine neurobehavioral correlates of risk in young MSM who are sexually safe (SnU, don't engage in CAS), moderately risky (RnU, engage in CAS) or highly risky (RMU, engage in CAS & use MA). Methods 155 young MSM (ages 18-30) during fMRI performed gambling (CUPS) task where reward magnitude and probability were orthogonally manipulated. To identify brain areas differentially modulated by risk and reward, we performed pairwise group comparisons in two whole brain parametric analyses. Results CAS significantly correlated with risk in CUPS, r=.215, p=.008. During gamble evaluation RMU had less risk sensitivity in PFC compared to RnU, in insula (IC) and PFC compared to SnU, and less reward sensitivity in IC compared to RnU. During decisions SnU had greater risk sensitivity in IC compared to RnU and RMU, and greater reward sensitivity in PFC compared to RnU and in MFG, PFC, IFG, IC, ACC, precuneus compared to RMU. RnU had greater reward sensitivity in MFG, IFG, dlPFC compared to RMU. During result

anticipation SnU had less risk sensitivity in PFC, IFG, ACC, putamen, IC compared with RnU and in ACC and precuneus compared with RMU. SnU had less reward sensitivity in IFG, PFC, IC than RnU and less in ACC than RMU. During feedback processing RMU had greater reward sensitivity in PFC, ACC, thalamus, precuneus compared with RnU. Conclusions Safer individuals show greater sensitivity to risk in the PFC and IC for early parts of the decision process (evaluation & choice). Riskier individuals show greater sensitivity to risk in the PFC and IC after the choice. Neural differences may lead to safe or risky sex in young MSM

2-D-15 Does Early Social Deprivation Alter Social Decision Making Processes?

Joao Guassi Moreira[1], Adriana Mendez Leal[1], Yael Waizman[1], Emilia Ninova[1], Jennifer Silvers[1]

[1]University of California, Los Angeles

Little is known about how early social experiences influence long-term social decision making behavior. This topic is important to address given that early experience is an oft potent sculptor of development. We address this issue in an ongoing study in which a sample of internationally-adopted, previously institutionalized (PI) and comparison youths (NPI = 25, Ncomp = 30) completed a risk taking task (Cups task) for themselves and on the behalf of a parent. We then modeled task behavior in three different ways to understand how early social deprivation (in the form of prior institutional orphanage care) affected social decision making processes. First, we examined whether PI youth were more or less likely to take risks as a function of who was affected (parent v self). Then, we determined whether sensitivity to self and parent feedback was modulated by early social deprivation. Last, we used computational modeling to fit prospect theory models to determine whether differences in loss and risk aversion for parent v self differed as a function of social deprivation. Results revealed several trends in behavior, namely that PI youth were 10% less likely than comparison youth to take risks when their parent was affected relative to themselves. Importantly, the groups also differed in terms of the underlying cognitive processes that drive behavior. PI youth were more sensitive to outcomes for parents relative to themselves (d = .72), and PI youth were more loss (d = .18), but not risk (d = -.03), averse when taking risks for parents relative to themselves. These results show that early social experiences shape social decision making behavior by rendering individuals more sensitive to potential pitfalls to close social others.

2-D-16 Like mother, like daughter? Associations between mothers' and daughters' neural responses to rewards are moderated by daughters' developmental status

Paige Ethridge[1], Anna Weinberg[1]

[1]McGill University

Extensive evidence suggests that risk for emotional disorders (e.g., depression) is familial. It is unclear, however, how risk for these disorders is transmitted across generations. A promising line of research suggests that vulnerability for psychopathology may be transmitted, at least in part, by inherited abnormalities in neural responses to reward. However, we know that neural regions responsible for processing rewards undergo substantial maturation during adolescence; moreover, the contribution of genetic influences is not stable across development. In the present work, therefore, we aimed to examine the familial nature of neural responses to positive feedback, and whether correspondence in neural responses between parents and children varies based on the developmental stage of the child. A sample of 74 mothers (ages 33-56) and their adolescent daughters (ages 10-19) completed a simple guessing task in which they won or lost money while an electroencephalogram was recorded. We then isolated the reward positivity (RewP), an event-related potential elicited by positive feedback. Results indicated that the negative association between mothers' and daughters' RewP was significantly moderated by daughters' pubertal status, such that the RewPs of less pubertally-advanced girls were significantly negatively associated with their mothers' RewPs. These findings have important implications for identifying biological risk markers in early life for emotional dysfunction.

2-D-17 Preregistration: Neural and behavioral mechanisms of persistence to setbacks during childhood

Michelle VanTieghem[1], Paul Bloom[1], Andrea Fields[1], Chelsea Harmon[1], Tricia Choy[1], Nicholas Camacho[1], Lisa Gibson[1], Rebecca Umbach[1], Charlotte Heleniak[1], Daphna Shohamy[1], Nim Tottenham[1]

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Persistence to setbacks allows individuals to adaptively cope with challenges they encounter. In adults, persistence to setbacks requires effective recruitment of the neural circuitry involved in effort-based motivation and emotion regulation (Bhanji et al., 2014). Although we know that these circuits undergo dramatic maturation during development, the majority of research on motivated behaviors has been conducted during adolescence, and little is known about how persistence behaviors emerge during childhood. In the current study, we used a developmentally appropriate fMRI task to characterize persistence to setbacks across two RDOC domains: effort-based motivation (positive valence system) and response to setbacks (negative valence system). On each trial, children chose between hard-effort tasks (i.e. pressing as quickly as possible with ring finger) with a higher pay-out (stack of gold coins) and the easy-effort tasks (i.e. pressing a few times with thumb) which had a lower pay-out (a few gold coins). Feedback was probabilistically reinforced in both conditions (50%) to assess persistence in the context of uncertain rewards/setbacks. Children were instructed to try their best to win as many coins as possible, even though they wouldn't win coins every trial, and earned a special prize after completing the task. After quality control assessment, 54 children ages 6-12 (mean = 10.0, SD = 1.95) provided 1 or 2 runs of usable fMRI data. Planned analyses will examine how fronto-striatal recruitment during the choice phase of the task is associated with effort-based motivation (i.e. proportion of hard vs. easy-effort choices). Second, we will test how regulatory prefrontal recruitment to setbacks (non-rewarded feedback) is associated with trial-wise persistence behavior (i.e. hard choice following a hard-effort setback). The findings will advance our understanding of the neural circuitry that supports motivated behavior during middle childhood.

2-D-18 The Upside of Social Media: The Influence of Peer 'Likes' on Adaptive Social Behavior

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Positive social sharing (PSS), the act of sharing positive information with others, is a social emotion regulation strategy that increases positivity, social closeness, and wellbeing. PSS may be especially important during adolescence and young adulthood--a developmental period marked by increased valuation of peer relationships. A common way for individuals to engage in PSS (especially in this age-group) is through social media, where they can share with and receive immediate feedback (e.g., 'likes') from their broader network of peers. This is especially true for those who struggle with face-to-face interactions but may otherwise benefit from the psychosocial outcomes of PSS (e.g., social anxiety). Here, we examine whether peer feedback promotes PSS and its adaptive outcomes. Young adults (N=49, mean age=20.31) completed a sharing task where they chose whether to share positive news articles with 3 anonymous peers. These peers then provided feedback via 'thumbs-up' (positive) or 'thumbs-down' (negative). In reality, however, rates of positive feedback from each peer were experimentally manipulated (High-80%, Neutral-50%, Low-20%). We found that social closeness increased as a function of positive feedback (high>neutral>low). Interestingly, despite no differences in sharing rates per se, a significant time x condition interaction for reaction time revealed that participants became faster at responding in the high vs. neutral condition, suggesting that feedback may influence sharing more implicitly. To explore this further, we will also present data from an ongoing follow-up study on how feedback affects sharing of more personally relevant stimuli (e.g., social media pictures). Nevertheless, these results provide initial evidence that positive social feedback, whether in-person or on social media, may promote PSS and other adaptive social outcomes, particularly in teens and young adults, and has clinical implications for those with dysfunctional social processing.

2-D-19 An ERP investigation of children and adolescents' sensitivity to wins and losses during a perceived peer observation manipulation

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Objectives: The presence of peers is thought to play an important role in adolescent risk taking by increasing adolescents' sensitivity to rewards (Chein, 2015). The purpose of this ERP study was to examine the effect of peer presence on neural sensitivity to winning versus losing in children and adolescents. Method: Participants (105 children, Mage=9.55; 147 adolescents, Mage=12.48) were randomly assigned to complete the Balloon Analogue Risk Task (BART) either alone or when they thought they were being observed by a peer. The BART is a risk-taking task that elicits neural responses to wins and losses. b>Results: An ANOVA revealed a significant 2 feedback type (wins, losses) x 2 condition (alone, peer) x 2 age group (child, adolescent) interaction for the P3 amplitude, $p < .05$. Amplitudes were larger for losses than wins (consistent with other ERP studies), but this effect was significantly stronger in the peer condition versus alone condition for adolescents only. When participants in the peer condition were asked "how did you feel about having another student watch you play?", 78% of the children who responded said "fun" or "good". In contrast, while 47% of adolescents who responded had positive comments (e.g., "Good, especially when I got all those 10s"), 53% had negative comments (e.g., "I felt stressed out. I didn't want to let them down"). Compared to adolescents with positive comments, adolescents with negative comments showed a larger P3 for losses, longer reaction time to losses compared to wins, were higher in social anxiety, and lower in sensation-seeking. b>Conclusions: This study revealed that perceived presence of peers is more salient to adolescents than to children, providing support for adolescence as a sensitive period for peer influence. At the same time, there are clear individual differences among adolescents in whether they view that peer presence as "rewarding" or "threatening".

2-D-20 Developmental change in the influence of causal judgments on reinforcement learning

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The ability to learn from positive and negative outcomes is essential throughout the lifespan. Previous research in adults has shown that valence-dependent learning can be modulated by beliefs about the causal structure of the environment such that participants update their value estimates of choice options to a lesser extent when the outcomes of their choices can be attributed to a hidden cause. The present study examined whether causal judgments similarly influence learning across development. Participants completed a reinforcement learning task in which they chose between two options with fixed reward probabilities. Participants made choices in three distinct environments in which a different hidden agent occasionally intervened to generate positive, negative, or random outcomes. Preliminary data analyses including 90 individuals ages 7 to 25 show that participants' beliefs about hidden agent intervention align with the manipulation of positive, negative, or random outcomes in each of the three environments. Across environments, younger participants were significantly more likely to attribute outcomes to the hidden agents. We also observed significant age-related differences in learning across the three environments. While older participants learned similarly across all three causal environments, younger participants showed more pronounced change in learning when the hidden agent intervened to cause positive outcomes. Together, these preliminary results suggest that while all participants demonstrate explicit awareness of the causal structure of the task environment, there may be developmental changes in the ability use beliefs about the causal structure of the environment to guide reinforcement learning. Future analyses will characterize developmental changes in the use of causal inference to guide reinforcement learning through computational modeling.

2-D-21 Reward magnitude increases learning rate and the activity in value-related brain areas in adolescent

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Introduction Adolescence is a developmental stage associated with risky decision-making. Behaviorally, greater sensitivity to incentives and relatively weak cognitive control have been observed, and may contribute to risky behaviors. Neurobiologically, this is based on the fact that the brain systems underlying learning involving reward and cognitive control systems are in a particular (dis)balance. How do cognitive control and reward brain circuits interact during risky decision-making in adolescence? We hypothesized that the change in the magnitude of the reward would generate a change in the learning rate and/or a bias (positive or negative) in the estimation of the value versus the contingency change, influencing the risky decision-making. Goal: To study brain areas associated with risky decision making in adolescents. Methods: Seventeen healthy subjects (10 women, 18-19 years), completed the experimental protocol. Subjects participated in two sessions, including a behavioral session and an fMRI scan session. In both sessions subjects solved a Task associated to risk and learning. Results: Behavioral study: In order to evaluate the learning rate associated to reward sensitivity we adjust the learning rate for each reward amount. We found the higher the reward, the higher the learning rate (rho= 0.3012; p= 0.0485). MRI: In order to evaluate the brain activity associated to reward sensitivity we subtracted the activity of without reward from the different reward amounts. We found a peak activation located in the ventral striatum. Then we explored for the activity related to the difference of reward. We found an activity located in medial posterior parietal cortex and ventromedial prefrontal cortex. Conclusions: Our results indicate an increase in the learning rate as the reward increases. Interestingly, this learning rate increase are related to subcortical and cortical areas related to value encoding during decision-making.

2-E-22 Is it possible to train self-concept? Behavioral and neural evaluation of a naturalistic training program for adolescents

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Adolescence is a period in life during which the ability for self-reflection is still developing. How adolescents view and evaluate themselves may play an important role in various life outcomes, such as in the ability to choose a major in higher education that fits your identity. However, we currently have little understanding about whether self-concept can be fostered through training and which underlying neural mechanisms would drive these changes. Therefore, we examined whether training self-concept could be beneficial for the development of self-knowledge and positive self-evaluation and whether self-concept training results in neural changes in the self-evaluation and social brain networks. We tested 38 late adolescents (16-24y, M=18.7y, 24f) on multiple self-concept measures at the start and the end of an existing naturalistic training program named "the Gap year program". This one-year program is developed for adolescents who have dropped out of higher education and focuses on fostering self-concept development. Participants evaluated themselves on trait sentences during an fMRI session before and after training, and completed questionnaires on self-esteem and self-concept clarity. Behavioral results showed significant increases in self-esteem and self-concept clarity as well as more positive academic and social self-evaluations at the end of the training. Neurally, evaluating positive compared to negative self-traits was reflected in activity in cortical midline structures such as the medial PFC, posterior cingulate cortex (PCC), and precuneus on both time points. The STS, often referred to as part of the social brain network, showed training-dependent changes, with increased activation related to the evaluation of positive traits after training. These results suggest that self-concept training can be beneficial for developing a clear and a more positive self-concept, and is reflected in neural changes related to self-evaluation in the social brain network

2-E-23 Cognitive dimensions of learning problems in children who have been identified as struggling at school

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Close links exist between children's cognitive skills and their academic attainment. Most of this evidence comes from investigations of individual differences within typically-developing children or from comparisons of children with and without reading and/ or mathematical problems. In the present study we adopt a different approach and investigate the relationships between these key cognitive functions and learning in a large heterogeneous sample of poor learners (n=800). This study asks whether the cognitive skills that differentiate learning abilities within a population of poor learners and in the general population are the same or different. It identifies cognitive dimensions that underlie these skills and maps pathways to learning. Data from 800 children aged 5 to 16 years will be analysed. The sample includes those with and without diagnosed problems, but all have been identified by a professional as struggling at school. A battery of 17 cognitive tasks plus four learning measures are included. Exploratory factor analysis will be conducted on the cognitive variables, and then on the learning variables. Resulting factor scores will be saved. Partial correlations will be used to identify associations between dimensions of learning and cognition. These associations will be modelled in AMOS / Lavaan to produce a structural equation model showing the pathways between cognition and learning. In light of the outcomes, exploratory subgroup analyses might be performed (e.g. to explore age-related changes given the wide developmental age range of 8 - 16 years). These data are critical for understanding how best to support teachers who are struggling with academic learners by asking which cognitive skills distinguish the children from each other, and how this impacts on the particular difficulties with learning that they experience. It will also enhance our understanding of the cognitive dimensions underpinning a broad range of learning problems.

2-F-24 Hippocampal multivoxel encoding signatures predict long-term memory across middle childhood and adolescence in humans.

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The episodic memory system changes dramatically across the first few years of life. However, subtle alterations in episodic memory continue throughout middle childhood/adolescence. The neural mechanisms underlying such nuanced memory development are elusive, and studies using traditional Region of Interest (ROI) based approaches provide conflicting evidence for the role of hippocampal functional maturation during those ages. In this study we employ an advanced statistical technique, multivoxel correlation structure (MVCS), to functional magnetic resonance imaging (fMRI) data, while children and adolescents were engaged in an item-context associative learning task, which was sandwiched between two resting state scans. This statistical approach enables us to examine coordinated activity within the hippocampus at rest, during learning, and immediately after learning in a purported consolidation period. We report that such multivoxel activity changes across middle childhood-adolescence, with representations at learning and rest becoming more granular (i.e., less coordinated) with age. We also report that age changes in hippocampal multivoxel activity are regionally specific, with the posterior areas of the hippocampus changing the most across development. Importantly, we find that the level of representational granularity in the hippocampus during learning, and in the post-learning consolidation period, is associated with better immediate recognition memory, and delay associative memory (1 week after the scan), respectively. These data support the use of multivariate analysis approaches for uncovering subtle changes in hippocampal maturation across middle childhood and adolescence.

2-F-25 Mapping the persistence of memory in three- to five-year-olds.

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Research across species demonstrates that adults struggle to recollect episodic memories from early childhood. Though this phenomenon of "infantile amnesia" has been widely observed, its underlying mechanisms are not well understood. Recently, Alberini and Travaglia (2017) proposed that the period of life associated with infantile amnesia (approximately,

before age five) reflects a critical period of memory development characterized by rapid forgetting of episodic events. Although rodents at this developmental stage demonstrate forgetting within hours of learning (Anderson et al., 2004), the timescale of memory persistence in humans during this period of life remains unclear. Moreover, previous work investigating memory persistence in young children has routinely relied on verbal recall, a measurement that might reflect verbal abilities rather than memory. In this study, we mapped forgetting curves in 3-to 5-year-olds (N = 118; proposed N = 135) by using a novel, developmentally appropriate storybook task that did not require verbal responses. We assessed associative memory between subjects after 5-minute, 24-hour, and one-week delay periods. While all ages demonstrate above chance memory performance after 5-minute and 24-hour delays, preliminary data indicate forgetting in 3-to 4-year-olds following a one-week delay. Across all delay conditions, we observed a significant linear increase in memory performance by continuous age. The observed age differences support the idea that hippocampal-dependent memory systems undergo rapid development during this formative stage. Notably, it appears that memories during this stage of development may still persist longer than previous accounts have suggested. These data will inform future work translating memory persistence research from rodent models to humans by establishing timescales at which we expect young children to forget.

2-G-26 The enduring effect of parents and peers on the neural correlates of risk taking and antisocial behavior during adolescence

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OBJECTIVE: Negative parent and peer influences (Dishion, Patterson, Stoolmiller, & Skinner, 1991) are among the strongest predictors of adolescent antisocial behavior (Sitnick et al., 2017). However, we know relatively little about the psychobiological processes through which these relationships influence heightened antisocial behavior in adolescence. The current study longitudinally examines the contribution of parent and peer relationships, and the neural correlates of risk taking, on antisocial behavior across adolescence. METHODS: The sample included 45 adolescent girls (Mean age = 11.81 in 6th grade) who completed annual questionnaires on parent-child relationship quality and deviant peer relationships from 6th-8th grades. In addition, participants played Stoplight, a risk-taking task, during fMRI in 9th grade and reported on their antisocial behavior during 6th grade and every 3 months following the fMRI scan. RESULTS: High parent-child closeness was associated with lower activation in the mPFC and VS during risk taking, whereas high deviant peer group affiliation was associated with greater activation in the mPFC. Furthermore, high parent-child closeness in early adolescence predicted lower antisocial behavior in later adolescence via lower affiliation with deviant peer groups and activation of the mPFC during risk taking, above and beyond previous levels of antisocial behavior. CONCLUSION: This study is one of the first to examine parental, peer, and neural differences as joint predictors of adolescent antisocial behavior in a longitudinal design. These findings highlight the enduring role of parent and peer relationships in early adolescence as they contribute to neural processing during risk taking and antisocial behavior into mid adolescence. This study underscores the importance of investigating social relationships alongside the brain to obtain a more holistic understanding of the development of antisocial behavior.

2-G-27 Chronic environmental stress is related to a maturational lag in infant brain activity by 9 months of age

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Chronic environmental stress has been increasingly linked with aberrations in young children's behavioral, cognitive, and social development, yet the effects of chronic environmental stress on neural function during the first year of life are largely unknown. Furthermore, many studies of chronic environmental stress rely on stressful circumstances (e.g., poverty or neglect), and not on physiologic markers of stress (e.g., cortisol output). The present study aims to link a physiologic index of chronic stress (maternal hair cortisol concentration) to maturational differences in infant brain

activity during the first year of life. Participants were 94 parent-infant dyads (mean infant age 9.16 months). Mothers provided hair samples that were then assayed to index the previous three months' cortisol output as a measure of chronic environmental physiologic stress. Infants completed a 5-minute baseline electroencephalography (EEG) recording in order to examine the development of brain activity during the first year of life. Compared to infants being raised in low maternal physiologic stress environments, infants in high stress environments showed increased low-frequency (theta) power and reduced high-frequency power (alpha) - a pattern consistent with a maturational lag in brain activity development. These findings hold after controlling for socioeconomic status and other confounding factors. This pattern of findings is consistent with other studies suggesting that early life stress may lead to a maturational lag in brain activity development; however, this study is the first to identify this pattern as early as 9 months of age and to tie this pattern to a physiological marker of chronic maternal stress.

2-G-28 The Culture of Socioeconomic Status and Social Reward and Threat Processing in Adolescence

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In recent years, scholars have described socioeconomic status (SES) as a form of culture that shapes whether people view and experience the social world as constrained or full of opportunity. Evidence shows that low SES relates to greater neural reactivity to negative social information. However, no research has examined the relation of SES and neural processing of social rewards and punishments. Adolescence is an important time to address this topic because it is a sensitive period for social and neural development and because SES during adolescence shapes brain development into adulthood. In the current study, we utilized a diverse (55 White, 47 Black, 58 Latino/Hispanic) sample of 170 adolescents (80 male) to examine how SES relates to brain function (fMRI) during a social incentive delay (SID) task. We ran multiple regression analyses on brain activity using two parent-reported measures of SES - neighborhood safety and economic strain. Results from whole brain analyses showed that a less-safe neighborhood environment was associated with increased brain activation in anticipation of social punishments (i.e., angry peer faces) relative to rewards (i.e., happy peer faces) in brain regions associated with salience detection (i.e., insula, bilateral fusiform gyrus), cognitive control (i.e., right inferior frontal gyrus), motor activity (i.e., supplementary motor area), and social mentalizing (i.e., temporoparietal junction, dorsomedial prefrontal cortex). Thus, teens from less-safe environments may exhibit greater awareness of threat than reward, in that they detect greater salience, exert greater cognitive control, mentally prepare for their motor response, and think more about the minds of others. Interestingly, SES was not related to behavioral task performance (i.e., hit rates, reaction times). Taken together, these findings offer unique insights into how the culture of shared socioeconomic environment may be embedded in neural processing of the social world.

2-G-29 Cognitive control and generalizability across different subtypes of caregiving adversity

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Cognitive control, or the modulation of goal-directed behavior, is typically disrupted following exposure to early adversity, with wide heterogeneity in outcomes (Richards & Wadsworth, 2004). Prior research has identified caregiving instability as one of the strongest predictors of poor cognitive control in children exposed to adverse caregiving experiences (Lewis et. al, 2007; Roos et. al, 2016). However, most of this research has been conducted within relatively homogeneous samples, raising the question of how instability generalizes across populations exposed to different forms of caregiving adversity. In the present study, we investigate cognitive control processes in a sample of school-aged children who have experienced heterogeneous early caregiving experiences (i.e. institutionalization, foster care, kinship care, temporary separations from parent) (N ≈ 330, Age = 6-12 years). We will characterize cognitive control by measuring three core constructs (inhibitory control, response inhibition, and task switching) and the underlying neural

correlates using the flanker, the dimensional change card sort, and a go/no-go task during functional magnetic resonance imaging (fMRI). We will examine whether the variance in cognitive control and its neural correlates is better explained by caregiving experience subtype versus more generic variables that transcend these population boundaries (e.g., number of caregiver switches, number of unique placements, etc.). Planned analyses will also test the impact of instability on unique aspects of cognitive control behavior (i.e., inhibitory control versus response inhibition versus task switching). These findings will inform models of equifinality and multifinality for cognitive control outcomes following exposure to early caregiving adversity in a heterogeneous sample of school-aged children.

2-G-30 Concurrent and longitudinal behavioral implications of infant negative reactivity

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Introduction: Many studies have examined relations between negative reactivity (NR) and behavioral inhibition (BI) in children. Infant NR has been shown to predict BI in childhood, and childhood BI has been linked to ADHD, aggression, and internalizing disorders. Existing literature fails to address early manifestations of relations between NR and BI that may better predict these outcomes. We sought to test if positive parenting may moderate associations between NR and BI at 15 months and predict behavioral outcomes in Pre-K. We hypothesized that NR would be related to greater BI, but that positive parenting behaviors may dampen this effect. We also hypothesized that this interaction between parenting and NR would predict hyperactivity and conduct problems in Pre-K. Methods: N=1,292 participants in the Family Life Project who completed a home visit at child age 15 and 48 months old. At 15 months, NR was measured using the Mask Task, BI was measured using the Toy Reach task, parenting was coded from a free-play task. During the Toy Reach task, the child is seated in a walker and presented with alternating sets of low- (LS) and high-stimulating (HS) toys over 4 trials. Time spent exploring toys is coded as BI. Hyperactivity and conduct problems were assessed using the Strengths and Difficulties questionnaire at 48 months. Results: At 15 months, there was a negative relation between NR and exploration on HS trials (β=-0.058, p=0.02). There was a significant interaction between NR and positive parenting (β=0.293, p=0.03) in predicting exploration on HS trials. The interaction between 15 month NR and positive parenting predicted 48 month hyperactivity (β=0.258, p=0.055), and conduct problems (β=0.246, p=0.072) at the trend level. Discussion: These results point to both concurrent and longitudinal implications of interactions between NR and parenting in infancy. Implications and hypothesized mechanisms will be discussed.

2-G-31 Age-related improvements in predictions of environmental controllability

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The ability to recognize whether one has control over an environment may foster adaptive behavior by allowing actions to be taken that maximize rewards. In controllable contexts, outcomes are contingent upon specific actions, which can be exploited to yield a desired result. In contrast, because actions are inconsequential in uncontrollable contexts, cognitive resources devoted to planning a course of action are wasted. Although the ability to detect control over the environment has been well studied in adults, the developmental trajectory of this process has not been well characterized. Cognitive processes underpinning the ability to monitor environmental controllability develop into adulthood, suggesting that the detection of control may also change with age. In this study, we examined children's, adolescents', and adults' (n=88, ages 8-25), ability to monitor the controllability of their environment. Controllable and uncontrollable conditions alternated covertly throughout the task, requiring participants to identify when their choices yielded contingent outcomes or when an action was of no consequence. We found that accuracy in both conditions increased with age. Additionally, accuracy across all ages was greater in the controllable versus uncontrollable condition, which suggests a heightened ability to detect action-outcome contingencies. Children and adults showed relatively small differences in performance accuracy between conditions, in contrast to adolescents who exhibited larger improvements in accuracy in

the controllable as compared to uncontrollable condition. In ongoing analyses, we are using computational models to further characterize age differences in learning and choice behavior. The present findings suggest that sensitivity to controllable environments may be heightened during adolescence, which may promote the exploration of actions that foster the discovery of rewards.

2-G-32 Impacts of Childhood Maltreatment and SES on Reward Processing Networks in Adulthood

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Multiple forms of early adversity have been associated with decreased adult adaptive functioning, including substance abuse, addiction, and psychopathology (e.g., Cicchetti & Toth, 2005; Pechtel & Pizzagalli, 2011). One proposed mechanism linking adverse experiences to maladaptive outcomes is through altered development of reward processing networks (e.g., Birn et al. 2017; Teicher et al., 2016). A challenge to understanding these links has been the fact that many forms of adversity tend to co-occur. Therefore, it has been difficult to determine whether specific forms of adversity carry greater or lesser risk for maladaptive reward-related outcomes. The current study examined brain activity during reward processing in 35 adults with a history of childhood maltreatment, and 33 adults with no maltreatment history. All had experienced low income or poverty in childhood. An index of cumulative SES adversity was calculated using income-to-needs ratio at multiple time points, maternal education, and participant education. Participants completed the monetary incentive delay task (MID) while undergoing functional magnetic resonance imaging. Results showed an association between cumulative SES risk and reward-related activation in several regions (occipital cortex, hippocampus, and insula; $p<.005$), We found no main effects of maltreatment status; however, maltreatment history moderated effects of SES risk on orbital frontal cortex (OFC) activity ($p<.005$). Higher cumulative SES risk was associated with less reward-related OFC activity in adults with a maltreatment history, but more reward-related OFC activity in those without maltreatment. These results suggest that multiple adverse experiences may have unique as well as additive impacts on reward systems in the brain. Further analyses of our data will examine the difference between reward anticipation and reward feedback, as well as effects of the developmental timing of stress.

2-H-33 Longitudinal trajectories of cortical thickness from birth to 6 years predict cognitive outcomes at 9 years

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Sensitive periods of brain development occur during a child's first few years of life. Animal models and human neuroimaging studies have demonstrated hierarchical brain maturation, with sensory cortices maturing first, then protracted maturation of association cortices like prefrontal cortex. Use of longitudinal studies with MRI data allow for the prediction of how individual variation in early structural brain development relates to cognitive functioning later in childhood. Therefore, we conducted analyses with a longitudinal cohort (N=50) scanned from 2 weeks to 6 years. We measured intelligence at ages 8-9 using the Wechsler Abbreviated Scale of Intelligence - Second Edition (WASI-II), measuring full scale IQ (FSIQ), along with subscores of verbal and performance IQ (VIQ and PIQ, respectively). A casewise estimation approach was used to calculate growth curve parameters (initial cortical thickness, asymptote of cortical thickness, and age at asymptote) for maturation of the prefrontal cortex (PFC) and visual cortex (VC) from birth to 6 years. We found that the asymptote of both PFC and VC cortical thickness was positively correlated with FSIQ and PIQ, but not VIQ. Interestingly, we found that the age of cortical thickness asymptote was positively correlated with FSIQ in PFC, but negatively correlated with FSIQ in VC. Initial results suggest that final levels of cortical thickness in both primary sensory (VC) and in higher-level association cortices (PFC) are related to IQ. However, the timing of maturation has different effects, with earlier maturation of sensory cortices (VC) and protracted maturation of association cortices (PFC)

being related to higher IQ. Together, these findings indicate that early sensory development in combination with protracted PFC development creates the widest window for experiential input to facilitate cognitive development.

2-H-34 The role of sleep in early infant myelin development

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The association between sleep and cognitive capacity is well-documented. In infants and children sleep is thought to facilitate neural plasticity through synaptic downscaling, facilitating memory and learning. Past research has found that later sleep is associated with poorer cognition in early years, and that the loss of just one hour of sleep can affect cognition throughout the day. In older children and adults, loss of sleep has been shown to affect executive functioning, while later sleep has been associated with poorer cognition and working memory. We focus on the role that sleep plays in the development of visual working memory, by examining measures of sleep efficiency and in 6-month-old infants, and comparing that with their myelination and cortical development. Infant sleep data were collected over at least 5 days using an actigraphy device, returning measures of sleep duration, variability and efficiency. Infant mcDESPOT sequences were collected from participants while sleeping. The results indicated evidence a relationship between sleep efficiency and myelination in key areas relating to visual working memory and executive functioning, supporting earlier behavioural results with older children which demonstrated that poor sleepers suffered in executive functioning. The findings of this study suggest a key role for sleep in the development of the VWM network, and offers further insight into the wider relationship between sleep and executive functioning.

2-H-35 The role of toddler myelination in preschool executive function development

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Infancy and early childhood are times of rapid change in the organization of cognition and behaviour, as well as brain development. An important process during this period is the maturation of myelinated white matter (WM), which facilitates rapid communication across the neural systems thought to underlie the emergence of complex cognitive abilities. Previous studies have linked WM development with cognitive development, but few studies have examined these relationships in early development. Here, we aim to explore the relationship between myelination and executive function (EF) in early development. Executive function refers to an interrelated set of neurocognitive systems that underlie behavioral control and cognitive flexibility. EF has pervasive influences on cognition and later development. A key challenge is to understand how EF develops early in development where early interventions might have the most impact. Diffusion tensor imaging studies have identified several WM tracts that are important for performance on EF tasks: cingulum bundle (CB), the superior longitudinal fasciculus (SLF), the anterior thalamic radiations (ATR), and inferior longitudinal fasciculus (ILF). We measured WM myelination using a multicomponent relaxation approach (mcDESPOT) to calculate the myelin water fraction in 30-mo toddlers. Participants also completed the Minnesota Executive Function Scale (MEFS) at 30- and 42-mo. We will examine the relationship between myelination in the previously identified WM structures, as well as, whole brain WM when participants are 30mo and executive function performance at 42-mo. We hypothesize that EF at 42-mo will be related to myelination in these WM structures, in particular in the ATR and SLF such that participants with more myelin will have better EF scores, even after controlling for age, SES and EF at 30-mo. These results will provide new insights into the neuroanatomical correlates of executive function in early development.

2-H-36 Mapping latent neuroanatomical substrates underlying severe temper outbursts in children

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Children with severe temper outbursts (STO) represent a highly heterogeneous, functionally impaired group. They often receive multiple psychiatric diagnoses such as ADHD, anxiety, and depression. This transdiagnostic nature of STO presents a challenge to investigators aiming to advance our neurobiological understanding of STO. Using the Bayesian topic model - a text mining tool to identify hidden topics from high-dimensional document data, the current work mapped a set of parsimonious neuroanatomical substrates that can explain the largest variability of structural brain anomalies across 63 children with STO (all but one with ADHD) and 41 with ADHD without STO. Applying the topic model on the z-score of Freesurfer-derived whole-brain cortical thickness values (with respect to 39 typically developing children), we identified three latent factors underlying cortical thickness patterns of the STO and ADHD groups. Specifically, thickness anomalies were observed mainly in bilateral temporal and parietal lobes (Factor 1), bilateral frontal convexity, somatosensory and parietal areas (Factor 2), and the cingulate, insular and occipital lobes (Factor 3). The topic model furthermore provided individual factor scores (i.e. probability of a given child showing thickness anomalies at each factor). The group comparison of these scores revealed that the STO group (but also having ADHD as comorbidity) showed more biased patterns towards Factors 2 and 3, whereas the pure ADHD group was more affected in brain areas recapitulated by Factor 1. Our finding suggests that the underlying anatomical substrates in children with STO are not a single entity but consist of multiple independent pathological components, a possible explanation for their heterogeneous clinical presentation. Moreover, the patterns of thickness alteration in STO were distinct from those of children only having ADHD, providing a potential disease-specific marker of this highly heterogeneous condition.

2-H-37 Reading ability, but not math ability, is associated with cortical thickness in an age-dependent manner

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Reading and math are acquired skills learned by instruction. Functional MRI studies have shown that these different skills use some shared brain regions, e.g. left temporo-parietal and bilateral frontal cortices. Studies on brain anatomy have investigated relationships between cortical thickness (CT) and surface area (SA) with reading ability, and others with math, but no study has tested if their CT/SA relationships overlap. Further, none have included both children and adults to examine the influence of age/experience. Here, we used Freesurfer to test relationships between CT/SA with single real word reading and calculation ability in 342 typically developing participants (ages 6-22) from the NIH Pediatric Database (Evans et al., 2006). First, multiple regressions tested for the unique contributions of reading ability, math ability and their interactions with age to CT/SA in regions of interest based on known networks for reading and math. We found that reading ability and its interaction with age contributed unique variance to CT of L supramarginal gyrus (SMG) and L intraparietal sulcus (IPS), and the interaction between reading and age contributed unique variance to CT in the L fusiform gyrus (FG). Calculation ability, the interaction between calculation and age, and IQ did not contribute unique variance to CT. There were no findings for SA. Next, we tested correlations between CT/SA with reading and math in three age groups to gauge the role of age/experience on these relationships ($p<.05$, Holm-Bonferroni-corrected). CT of the L SMG and L FG were positively correlated with single word reading only in the oldest age group (ages 15-22). Our findings show (i) relationships between CT and reading ability and none with math (none shared by reading and math); and (ii) a critical role of age/experience in establishing the relationships between CT and reading in L SMG, IPS, and FG.

2-H-38 Longitudinal development of hippocampal subregions during early-childhood

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Developmental research seeks to understand change overtime. Unfortunately, most studies use cross-sectional samples, which reflect age-related differences rather than changes. The goal of the present study was to utilize a longitudinal design to examine changes in the hippocampus (HPC) during early childhood. Previous work examining HPC subregion (i.e., head, body, tail) development using cross-sectional samples during early childhood has yielded mixed results

(Riggins et al., 2015; 2018). For example, work comparing subregion volumes between 4- and 6-year-olds found no differences in head (Riggins et al., 2015); however, in a sample of children aged 4-8 years, head volume increased with age (Riggins et al., 2018). Use of longitudinal data may clarify the effects and reveal developmental changes that occur during early childhood. We examined longitudinal changes in subregion volumes between 4-8 years utilizing a cohort-sequential design. The final sample consisted of 180 participants (89 females) with 326 structural MRI scans. HPC subregion volumes were obtained from T1-weighted scans (.9mm3) using a rigorous combination of gold-standard automated and manual methods. Linear mixed-effect models were used to assess age-related changes in subregion volumes. Sex effects were added to the best-fitting models and model fit was tested for improvement. Non-linear developmental trajectories were observed for head (linear, b=88.90, p<.001, and quadratic, b=-20.69, p=.003), such that volume increased with age and then subsequently decreased. Sex significantly improved model fit. Linear developmental trajectories were observed for body (b=24.86, p=.058) and tail (b=23.78, p=.005), such that volume increased with age during early childhood. Sex did not improve model fit for body or tail. In sum, subregions of the HPC show differential volumetric changes across early childhood. Future analyses will examine how volumetric changes relate to improvements in children's memory.

2-H-39 Reduced Hippocampal Volume After Childhood Violence Increases Risk for Depression After Later Life Stress

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BACKGROUND/OBJECTIVE: Stressful life events are more likely to trigger depression among individuals exposed to childhood adversity. However, few mechanisms of this stress sensitization have been identified empirically. To be a mechanism of stress sensitization, a psychological or biological process must be altered by early life adversity and must interact with recent stress, increasing its relation with depression. This study investigates whether reduced hippocampal volume is a mechanism of stress sensitization. METHODS: 149 youth (aged 8-17), with (N=76) and without (N=73) history of violence exposure, completed a structural MRI scan and were assessed for symptoms of depression. Approximately two years later, participants returned for a follow-up visit and reported on recent stressful life events and depression symptoms. This longitudinal design enabled examination of whether violence-related reductions in hippocampal volume interacted with stress at follow up to increase risk for worsening depression. RESULTS: Childhood violence was associated with smaller hippocampal volume. Additionally, recent stress predicted worsening depression among participants with smaller hippocampal volumes. Evidence of moderated mediation indicated that violence was associated with smaller hippocampal volumes, which in turn contributed to worsening depression among youth who experienced high levels of recent stress. CONCLUSIONS: These results provide compelling evidence that smaller hippocampal volumes are a mechanism of stress sensitization to depression. This work advances theoretical insights into how childhood adversity increases risk for depression throughout the life-course and informs possible future intervention, such as enhancing hippocampus-dependent processes.

2-H-40 Associations between Chronic Physiologic Stress and White Matter in Children

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Chronic stress in childhood has been associated with numerous deleterious effects on brain development, cognitive functioning, mental health, and well-being throughout the lifespan. High levels of stress have been associated with differences in gray matter in regions including the amygdala, hippocampus, and prefrontal cortex in children. However, few studies have examined how chronic physiological stress may impact cerebral white matter in children. White matter may be especially vulnerable to prolonged stress exposure. In this study, we investigated whether higher chronic stress as operationalized by hair cortisol concentration would be associated with differences in white matter integrity in the

cingulum bundle and the uncinate fasciculus, two white matter tracts previously linked to stress in the literature, and which have been implicated in executive functioning, emotion, and memory. White matter tracts were measured via diffusion tensor imaging (DTI) in 58 children ages 5-9 years. Results indicated that higher numbers of negative life events, as reported by parents, were associated with higher concentrations of child hair cortisol. Further, higher concentrations of child hair cortisol were significantly associated with higher fractional anisotropy in the cingulum. These associations were independent of child age, sex, race/ethnicity, and family income-to-needs ratio. These results have implications for better understanding how chronic stress may alter neural development during childhood. Importantly, the present findings also highlight that chronic physiologic stress may potentially accelerate the development of white matter integrity, consistent with animal models of chronic stress. Further research should look at how associations between stress and white matter organization relate to cognitive processes such as executive function to better understand the associations among stress, the brain, and behavior.

2-H-41 Childhood Socioeconomic Disadvantage, Cumulative Risk Exposure, and Surface Morphometry in Adulthood

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Childhood socioeconomic disadvantage (SED) has adverse impacts on physical and psychological development and is associated with greater risk for psychiatric disorders in adulthood. SED has been associated with cortical surface area in children, however the extent to which childhood SED is prospectively associated with brain morphometry in adulthood is unclear. Further, potential mediators underlying the association between childhood SED and brain morphometry remain elusive. Cumulative risk exposure, which sums the number of physical and psychosocial risks a child is exposed to, has emerged as a potential mediator of the relationship between SED and a multitude of developmental outcomes. In this study, we use a subsample (n = 54) of a longitudinal study of rural poverty who were neuroimaged as adults with assessments of childhood SED and cumulative risk exposure at 9, 13, 17, and 25 years of age. Using surface morphometry measures obtained from structural MRI acquired at age 25, we test if childhood SED (at age 9) is prospectively associated with surface morphometry in adulthood. Further, we test if childhood cumulative risk exposure (at age 13 and 17) mediates the relationship between childhood SED and surface morphometry in adulthood. Childhood SED has a prospective and positive association with cortical thickness and surface area in adulthood in several regions ($p < 0.05$, FWE corrected). Further, cumulative risk exposure at age 13 mediated the relationship between childhood SED and adult surface area in several cortical and subcortical regions. These findings have potential implications for interventions by highlighting the importance of childhood SED and brain morphometry and by elucidating cumulative risk exposure as a potential mediator to target in the effort to mitigate the relationship between SED and brain structure.

2-H-42 The moderating role of socioeconomic status on relations between level of responsibility and cortical thinning during adolescence

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The development of autonomy and goal-directed behaviors are key milestones of adolescence. Expectations from parents to engage in responsible behaviors (e.g., household chores, outside work) may support this emergent process by recruiting brain regions that subserve executive functions (EFs) which, when in deficit, underlie poor outcomes such as substance use (SU). Adolescent responsibility, however, may exert either beneficial or detrimental effects, depending upon the context; e.g., parental pressure to be responsible may induce stress. Outcomes related to responsibility may be moderated by family resources (SES), indicative of whether parental demands for responsibility are due either to need or personal choice. The relationship between level of responsibility and neurocognitive development has yet to be examined. Further, such a study requires delineation of contexts likely to play a role in helpful vs. harmful effects of

responsibility. We explored relationships between responsibility, SES (low vs. high), SU, and brain structure in drug-naïve adolescents (N=114; 11-14 years;60 females), some of whom initiated SU at 18-or 36-month follow-up (N=37). Contrary to expectation, greater levels of responsibility predicted earlier SU onset (Cohen's d=0.7). The low SES group reported higher levels of responsibility than the high group (d=.5). In low SES (and not high SES), higher levels of responsibility corresponded with cortical thinning in regions implicated in EF (i.e. left precuneus and right middle frontal) (d=.8), which may indicate a developmental deficit. In high SES, responsibility positively correlated with performance in a problem-solving task (Stockings of Cambridge) (d=.7). These results suggest a moderating role of SES in the positive vs. negative effects of responsibility on adolescent neurobiology and behavior, with greater responsibility predicting impaired development of regions subserving EF in low SES and improved EF behavior for those in higher SES.

2-H-43 Differential association of early experiences of threat and deprivation with brain structure.

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Exposure to adverse experiences in childhood is associated with brain structure differences later on. Threat (experiences involving harm or threat of harm) and deprivation (experiences involving an absence of species expected inputs from the environment) may represent two dimensions of adverse environmental experiences that have separable associations with later brain structure (Sheridan & McLaughlin, 2014). However, prior work has not examined unique associations of threat and deprivation with brain development in the same sample. We examined the associations of threat and deprivation with brain structure in a sample of 149 youth aged 8-17 with high exposure to adverse experiences. Building on existing theory and prior evidence from studies examining specific exposures (Gold et al. 2016, Hanson et al. 2010, Rosen et al. 2018), we predicted that exposure to threat would be uniquely associated with thinner cortex and smaller subcortical volumes in areas of the brain associated with salience processing. We predicted that deprivation would be uniquely associated with thinner cortex in frontoparietal areas associated with cognitive control. As predicted, youth exposed to threatening experience showed reduced thickness in the expected salience network, including bilateral insula, right lateral OFC, and left ACC, as well as reduced volume in hippocampus and amygdala. Excepting ACC, these differences persisted following control for deprivation. In contrast, children exposed to deprivation exhibited reduced thickness in the predicted frontoparietal network. This association did not persist after controlling for threat exposure, possibly due to the limited number of participants who experienced deprivation but not threat in our sample. These findings provide support for a model in which different dimensions of adverse experiences in childhood are associated with distinct neurodevelopmental consequences.

2-H-44 Relations Between Typical Variations in Stress and Hippocampal Volume in Young Children

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Severe early life stress exerts vast impacts on brain development in children, especially on the hippocampus (HPC; Belsky & de Haan, 2011). Research also shows that females may be more sensitive to stress than males, which is evident in higher rates of stress-related disorders in females (Marcus et al., 2005). To date, most research has focused on extreme stress (e.g., maltreatment), whereas only limited research has focused on how the accumulation of more typical stressful events (i.e., parental divorce) relates to HPC development in early childhood. The present study examined relations between typical variations in stress and HPC volume across a two-year period in a longitudinal sample of 58 children. Children were 4-6 years old at Time 1 and 6-8 years old at Time 2. At both visits, parents completed the Stressful Life Events checklist to provide an index of the number of stressful events that occurred in the child's life over the previous 12 months and children took part in a structural MRI. Total HPC volume and intracranial volume (ICV) were extracted using a combination of automated and manual methods. Preliminary analyses explored associations between Time 1 stress and Time 2 HPC volume. Results from a regression analysis controlling for effects of age, ICV, and Time 2 stress showed a

significant interaction between the number of stressful events the child experienced and sex (b = -260.64, SE = 100.08, p =.012). Specifically, more stressful events were associated with smaller HPC volume for females, but not males. These findings suggest that typical variations in stressful events may impact the HPC in a similar way to extreme events and that impacts can be observed over a relatively short time period in children. Results also suggest that females may be differentially impacted by the accumulation of these stressful events. Future analyses will investigate specificity of findings by utilizing HPC subfields and also taking into account brain structure at Time 1.

2-H-45 Relating stunting, underweight, and wasting to brain structure in 2-month-old Bangladeshi infants growing up in poverty: a feasibility and pilot study

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Anthropometric indicators, including stunting, underweight, and wasting, have been associated with poor neurocognitive outcomes. This link may exist because malnutrition and infection, known to affect height and weight, also impact brain development according to animal models. The relationship between these anthropometric indicators and brain development has not been examined in humans partly because stunting, underweight, and wasting are not common in middle- and high-resource settings with neuroimaging tools. To address this, we conducted an MRI feasibility and pilot study in a low-resource setting of Dhaka, Bangladesh. The sample size was small because feasibility needed to be tested and the challenges of conducting MRI in a low-resource setting needed to be assessed and resolved before introducing a larger cohort. Measures were acquired during infancy as this is the period of most rapid neural development. Forty infants were scanned, 29 of whom were used in the final analysis (78 +/- 9.2 days; 12 females). Stunting, underweight, and wasting were assessed using height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) scores. Infants underwent T1 sequences in a 3T MRI. Resulting structural images were segmented into gray and white matter tissue masks, which were carefully evaluated for accurate tissue labeling by a pediatric neuroradiologist. Twenty-nine infants had segmentations rated >7 (scale: 0-10) and these were submitted to partial correlation analyses with HAZ, WAZ, and WHZ, while controlling for sex and multiple comparisons (6 tests; Bonferroni). As HAZ and WAZ increased, white matter volume also increased (HAZ: rho = .52, p-corr < .05; WAZ: r = .52, p-corr <.05); WHZ was not correlated with any measures of brain volume. Overall, these results provide the first link between stunting, underweight, and wasting and early brain development. Challenges and solutions for neuroimaging studies conducted in low-resource countries will be discussed.

2-I-46 Insular resting state functional connectivity: Associations with age, internalizing, and externalizing behaviors in adolescence

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Adolescence is marked by distinct changes in emotional behavior. Elevated internalizing and externalizing during this period can confer risk for mental illness as well as risk-taking. For instance, substance use is related to externalizing traits like sensation seeking and impulsivity as well as internalizing traits (e.g, anxiety and depression). Insula thickness, activity, and connectivity strength have been linked to externalizing and internalizing behaviors. As part of the salience network, the insula serves an integrative function by detecting salient stimuli and then directing attention by activating appropriate brain areas. The dorsal anterior insula is functionally connected with cognitive control regions, and the ventral anterior insula is connected with affective control regions. As the ventral anterior insula is associated with affective control, we hypothesize that ventral insula connectivity will be related to internalizing and externalizing. In this

study, dorsal and ventral insula connectivity were examined in relation to internalizing and externalizing behaviors and age in an adolescent sample using a seed-based approach. Resting state MRI data, collected on a 3T Siemens Tim Trio scanner, was available for 111 healthy participants (ages 11-25). Whole-brain resting state functional connectivity analyses were conducted through FSL. Regression analyses quantified age-and behavior-related variations in insula connectivity when controlling for gender, and motion. Ventral anterior insula connectivity with regions throughout the superior parietal, temporal pole, and occipital cortex decreased linearly with age. Analyses are in progress to quantify internalizing and externalizing-based connectivity patterns controlling for age, gender, and motion. Findings will establish specific circuits of interest for subsequent longitudinal studies and inform our understanding of adolescent changes in emotional behavior.

2-I-47 Modes of functional development in adolescence

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Maturation of brain integration subserving cognition continues through adolescence. Initial studies suggest established network organization with increases in internetwork connectivity but in which pairs of connections are changing and the shape of developmental change are not well-understood. Using a Big Data approach, we test the hypothesis that patterns of increases and decreases in pairwise connectivity are evident through adolescence with association to cognitive development. We used resting state fMRI data from 1523 scans of 951 unique participants aged 8-32, from across three longitudinal studies collected within our lab as well as typically developing subjects from the Philadelphia Neurocognitive Cohort. Time courses were extracted from regions in the 1000-parcel cortical atlas (Shaeffer & Yeo, 2018), and 38 sub-cortical regions from the CIC anatomical atlas (Tziortzi 2011). A generalized additive mixed model (GAMM) with semi-parametric effects of age and head motion, and categorical effects of study and gender as well as FDR-correction, was fit to connectivity estimates for each pair of regions. Overall, 4.6% of edges showed age effects of which K-means clustering of the predicted age trajectories showed that 90% were linear or inverse age fits, and 10% were U or inverse-U trajectories peaking in late adolescence. These predominantly involved connectivity within and between cognitive and somatomotor networks and sub-cortical regions. In the sub-sample longitudinal study (5-12 visits), growth models fit to connectivity and generalized cognitive control scores indicated that both early and delayed maturation of functional connectivity was associated with delayed cognitive outcomes. Our results leverage big data and extended longitudinal approaches to identify connections with continued maturation through adolescence suggesting that timing of maturation impacts cognitive development.

2-I-48 : A systematic exploration of the long-term reliability of monetary gain and loss activation

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Background: Neuroimaging tasks with monetary rewards and losses are widely used in human neuroscience research. While reward activation has largely been found to have good short-term reliability (i.e., days), less is known about its long-term reliability (i.e., years). Moreover, the relative reliability of different contrasts (e.g., anticipation vs feedback) and regions-of-interest definitions (ROIs; e.g., anatomical vs. resting-state) remain relatively underexplored. Methods: 139 male participants completed an fMRI card-guessing task with monetary gains (Win) and losses (Loss) at ages 20 and 22. Activation from contrasts Win-vs-Loss, and Win- and Loss-vs-fixation, were extracted from anticipation and feedback phases. The test-retest reliability (ICC 3,1) was computed across all ROIs for all contrasts. ROIs were selected by meta-analysis (Neurosynth) and were defined by both anatomical (Harvard-Oxford) and resting-state (Schaefer 2018) atlases. Results: Reliability across ROIs and contrasts was poor (mean ICC=0.16, SD=0.11); age-related or habituation effects were not observed across sessions. Reliability was best for Win-vs-fixation and worst for Win-vs-Loss ($t=-9.1$, $p<2x10-16$), with no difference between anticipation and feedback. Reliability was higher for subcortical ROIs ($t=3.1$, $p=0.002$) and cortical

reliability did not differ depending on atlas. Within the striatum, reliability was highest in the putamen (t=4.4, p=2.3x10-5), particularly in reward anticipation (ICC=0.35, p=8.85x10-6). Discussion: Results are consistent with observations that the long-term reliability of fMRI activation is generally low. Interestingly, we observed that the widely-used Win-vs-Loss contrast had the lowest reliability across ROIs. As research using reward tasks largely focuses on the striatum, our results suggest that putamen activation during Win-vs-fixation is a more robust endpoint.

2-I-49 Prenatal Maternal Immune Activation is associated with brain microstructural tissue organization in neonates

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Prenatal maternal immune activation (MIA) is associated with alterations in offspring brain development in animal models and risk of psychiatric disorders in large-scale epidemiological studies. Yet, translational human studies of MIA in association with early brain development are sparse. Expanding our understanding of MIA's association with early tissue organization is an important step as the previous animal and human studies point to diffuse brain changes. We test the hypothesis that higher levels of MIA are associated with variation in gray and white matter organizational properties in neonates. Forty-nine adolescent pregnant women were recruited who were receiving routine prenatal care and had no major health problems. At 24-27 weeks gestation, they underwent assessments and blood draws. Interleukin-6 (IL-6) and C-reactive protein (CRP) were measured using the enzyme-linked immunosorbent assay. For the neonates, diffusion weighted imaging data were acquired on a GE Signa 3T scanner to measure the directional diffusion of water indexed by fractional anisotropy (FA). All analyses covaried for sex and postmenstrual age at scan. Higher levels of maternal IL-6 were associated with increased FA values primarily in the basal ganglia and thalamus, and diffusely across gray and white matter of the occipital lobe and right anterior temporal lobe. Higher levels of CRP were associated with decreased FA values diffuse across differing subregions of the frontal and occipital lobes, as well as the anterior limb of the internal capsules, and increased FA values of the posterior limb of the internal capsules of both hemispheres. In line with preclinical findings, we show that maternal IL-6 and CRP levels are associated with measures of tissue organization in the neonatal brain. Both immune markers share associations across the occipital lobes and the anterior temporal lobe and demonstrate distinct associations with regional tissue.

2-J-50 Effect of Age and Gonadal Hormones on Risk-Taking and Impulsivity in Gender Dysphoric Youth

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OBJECTIVE: Previous studies have indicated that adolescent development is associated with both an increase in risk taking propensity as well as an enhanced ability to engage in long-term planning behavior and control impulsivity. These two processes are thought to be driven by maturation of different neurobiological systems - one hormone dependent, and the other more dependent on chronological age. In the present study we examined the effect of exogenous administration of testosterone and estradiol on brain and behavior in a risk taking task performed during neuroimaging and on performance of an impulse control task and impulsivity questionnaire acquired outside the scanner. METHODS: In an ongoing study, adolescents between the ages of 11 and 19 receiving gender affirming testosterone or estradiol treatments for clinical management of gender dysphoria performed the jackpot gambling task while undergoing neuroimaging. Participants also completed a delay discounting task and the Barratt Impulsiveness Scale outside the scanner. The effects of specific hormone treatment, dosage, and age on these measures will be examined. RESULTS: Preliminary results of this study suggest that testosterone is associated with a dose-related decrease in activity of ventral prefrontal cortex during risky decision making but impulse control measures from the delay discount task are more closely related to age than hormone administration. CONCLUSIONS: Consistent with existing literature, the preliminary results suggest that both age and gonadal hormones contribute to different aspects of the maturation of impulsivity and

risk-taking behavior in this population of adolescents. More comprehensive comparison between specific hormone effects and interactions between age and hormone dosage will be performed as our sample size increases.

2-J-51 Changes in GABA and Glutamate underlying improvements in planning ability through adolescence

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Previous postmortem and animal studies have shown significant developmental changes in inhibitory gamma-aminobutyric acid (GABA) and excitatory Glutamatergic (Glu) neurotransmission in prefrontal (PFC) and association cortices during puberty. Changes in the ratio of Glu/GABA reflects a shift in the balance of excitatory and inhibitory signaling, leading to enhanced signal-to-noise ratio and improved reliability of signaling reflecting critical period plasticity proceeding to adult-level executive functioning. However, in vivo developmental studies in humans of changes in Glu and GABA are limited. Here we tested the hypothesis that developmental improvements in the executive planning task, the Stockings of Cambridge (SOC), would be associated with increases in GABA and decreases in Glu in PFC and related regions. 125 participants from 10-30 years of age (M = 19.85, SD = 5.47) performed the SOC task. In a subset of participants (n=98), GABA and Glu concentrations were assessed with Magnetic Resonance Spectroscopy Imaging (MRSI) using a 7T to obtain an oblique slice of 24x24 voxels (1.0x0.9x0.9mm) using a J-refocused spectroscopic imaging sequence (TE/TR=35/1500ms) with RF-based outer volume suppression. Initial findings from 125 subjects showed an inverse age-related improvement in SOC performance ($p < 0.001$), with steeper initial improvement followed by a plateau. Initial MRSI results from 36 subjects show that Glu decreased with age in right dorsolateral PFC ($p < 0.05$). In addition, the ratio of Glu/GABA was found to decrease with age in the thalamus ($p < 0.05$). Age-related changes in the association between Glu, GABA, and Glu/GABA with the SOC task will be presented. Taken together, these results suggest that executive planning ability continues to improve through the adolescent period concurrent with age-related changes in neurotransmitters, suggesting important changes in neurochemistry that reflect active critical period plasticity of the executive system.

2-J-52 Contributions of changes in frontal GABA/glutamate levels to emotion processing through adolescence.

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Processes underlying emotion regulation undergo significant maturation in adolescence. Cortical gamma-aminobutyric acid (GABA) and glutamate (Glu) levels undergo significant changes in frontal cortex through adolescence. The anterior cingulate cortex (ACC) has connections to cognitive prefrontal and limbic emotional systems supporting a unique role in emotion regulation. ACC has been found to be associated with GABA and Glu in emotion regulation. However, the contributions of these neurotransmitter systems to known development of emotion regulation through adolescence are still unknown. In this study we test the hypothesis that change in indices of emotion regulation is associated with increases in GABA and decreases in Glu in the ACC. 112 10-30 year olds (63 females) completed the Behavioral Indicator of Resilience to Distress (BIRD) task, a frustration task, and the Positive and Negative Affective Schedule (PANAS) at two times during this task. 7T magnetic resonance spectroscopic imaging (MRSI) was used to obtain an oblique slice of 24x24 voxels (1.0x0.9x0.9mm) containing GABA and Glu measurements using a J-refocused spectroscopic imaging sequence (TE/TR=35/1500ms) with RF-based outer volume suppression. Here we present results from voxels in the ACC. The PANAS negative affect score increased significantly throughout the task, confirming induced distress. Initial regression analyses testing for age effects showed a significant quadratic association (age p = 7.86x10^-6, quadratic age p = 2.05x10^-7, sex p= 1.01x10^-3), peaking in early adulthood. Initial MRSI data on 35 subjects showed that task performance is negatively associated with ACC Glu at younger ages, and positively associated with ACC Glu at older ages ($p<0.05$ uncorrected).

Findings are not yet revealing associations with GABA. These data suggest that developmental changes in emotion regulation may be driven by ongoing changes in glutamate signaling in the ACC, a region critical for emotion regulation.

2-J-53 Developing to disperse: age-dependent movement, risk taking, and object investigation of wild mice in novel spaces

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In order to achieve independence adolescent mammals must disperse from the natal site and be motivated to engage in high-risk exploration for distal resources. Changes in striatal dopamine (DA) systems are believed to play a role in regulating these motivational changes. The scope of this transition may be muted in strains of mice engineered in the lab, as these animals are far removed from ecological selective pressures. The steppe mouse (Mus spicilegus) is a wild-living species closely related to typical lab mice (derived from Mus musculus domesticus). We posit that steppe mice exhibit phenotypes shaped by ecological selection which, proximal to adolescence, reflect changes that are critical for dispersal. These changes include increased locomotion, risk taking, and novel object investigation, and may correlate with patterns of dopamine signaling in the striatum. We examined the behavior of steppe mice at various post-weaning ages (postnatal day (P) 22-120) within an open field apparatus; notably, this marked the first instance of exposure to a novel environment, an experience relevant to dispersal. At the conclusion of the open field test, we scored the behavior of mice towards a novel object placed within the apparatus. We find that, between ~P60-80, male mice exhibit peaks in total distance travelled, risk taking (i.e., time spent in the center), and time spent interacting with a novel object in the open field. We are determining how changes in striatal DA signaling relate to these observations. A synthetic nanosensor-based optical catecholamine sensor allows us to compare spatiotemporal properties of evoked dopamine release across regions of the striatum (i.e., dorsolateral, dorsomedial (DMS), and ventral (VS)) in mice prior to (P30), during (P60), and after (P120) our observed behavioral peaks. At P60 we predict to find larger DA release amplitudes and decay times within regions that are associated with reward and goal-oriented behavior (DMS and VS).

2-J-54 Longitudinal development of basal ganglia tissue-iron concentration in adolescence

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The development of the basal ganglia dopamine system during adolescence is thought to play a central role in shaping adolescent behavior, including affective and executive processing. Dopaminergic functioning also may be central to the emergence of psychopathology (such as psychosis) that often begins during this developmental window. However, indicators of dopaminergic development have historically been difficult to assess in humans in vivo. Tissue iron, which can be non-invasively quantified in vivo, is highly concentrated in the basal ganglia and has been linked to multiple aspects of dopamine neurobiology in healthy and sick populations. As such, tissue iron may be a promising indirect indicator of dopaminergic maturation. Here, we leverage a longitudinal sample of 1,574 individuals aged 8-27 years (M = 16.22, SD = 3.99; 741 males, 833 females) with up to four multi-echo T2* scans each. Using this sample of 2,359 imaging sessions, we assessed the longitudinal developmental trajectories of tissue iron in the basal ganglia. We quantified tissue-iron concentration using R2* relaxometry within four basal ganglia regions, including the caudate, putamen, nucleus accumbens, and globus pallidus. The longitudinal development of R2* was modeled using generalized additive mixed models (GAMMs) with penalized splines to capture linear and non-linear developmental processes. We observed significant increases in R2* across all regions, with the greatest increases occurring in the putamen. Our results suggest a prolonged period of basal ganglia iron enrichment that extends into the mid-twenties, potentially reflecting continued

dopaminergic maturation across adolescence and early adulthood. Developmental associations of R2* with dimensions of cognition and psychopathology are in progress and also will be reported.

2-K-55 Using multivoxel pattern analysis to determine test-retest reliability of neural representations in response to food cues in children

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Food images are commonly used cues to investigate the neural circuitry implicated in appetitive behaviors. However, the neural representations (i.e., patterns) elicited by food cues and their reliability across multiple fMRI scans is not known. Assessing patterns of neural responses across voxels provides insight into how common food features, like energy density (ED; kcal/g) and portion size (PS), are represented in the brain. 25 children (7-10 year old; 14 males) completed 2 fMRI scans, approximately 1 week apart. Children viewed 120 food images that varied in ED (high/low) and PS (large/small). Individual beta coefficients for each image category (e.g., high-ED/large, low-ED/small) were correlated across the sessions in regions of interest (ROIs) of the appetitive network (dorsal PFC, inferior frontal gyrus, fusiform gyrus, insula, striatum, caudate, amygdala). ROI reliability was defined as greater within than between category correlations across sessions. Patterns of neural responses in reliable ROIs were characterized using regression based representational similarity analysis (RSA). To do this, we created idealized (i.e. theoretical) correlation matrices where individual food cue features (ED or PS) were perfectly correlated (e.g., in the ED matrix high ED/large PS and high ED/small PS would be perfectly correlated). Linear models showed that neural patterns in left insula were predicted by the ED matrix. In contrast, patterns in left inferior frontal gyrus were predicted by the PS matrix, while patterns in left caudate were predicted by both ED and PS. Thus, patterns of neural responses were reliable across sessions in ROIs located in the left hemisphere of the appetitive network. Food attributes, like ED and PS, were represented by distinct neural patterns, thus highlighting the potential utility of this approach to examine individual differences in appetitive responses among children.

2-K-56 Test-retest reliability of neural responses to visual food cues in children

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Understanding neural responses to food cues is important for characterizing mechanisms that may contribute to maladaptive eating behaviors and obesity. Although tasks that include viewing food images are frequently used to investigate food cue reactivity, the reliability of these paradigms has not been assessed in children. Therefore, we tested the reliability of neural responses to visual food cues in 25 7-10 year old children (14 males, 3 excluded for motion). Children viewed 120 food images while undergoing functional magnetic resonance imaging at two visits conducted at least one week apart. Images were varied by energy density (ED, kcal/gram; high, low) and portion size (large, small) and were pseudorandomized in a block design across 6 runs. Whole brain reliability of neural responses was assessed through intraclass correlation coefficient and thresholded using Fisher's Z ($p<0.001$, $k>20$). Reliability was assessed for each of the four conditions and for common contrasts relevant to the study of eating behavior (high>low ED). For each of the four food conditions, test-retest reliability was above threshold in bilateral occipital cortex, fusiform gyrus, precuneus, and middle temporal gyrus. In addition, large portion, high-ED food images showed above threshold reliability in right frontopolar cortex extending into dorsolateral prefrontal cortex. Responses to high>low ED food cues showed reliability in left inferior occipital gyrus, left middle temporal gyrus, right lingual gyrus, bilateral precuneus, and left thalamus. These results suggest that while food cues elicit reliable responses within the visual processing stream, high-ED, large portion cues are unique in their ability to reliably engage regions implicated in cognitive control. Future research is needed to identify and potentially eliminate sources of within-subject variance in neuroimaging paradigms assessing food cue reactivity in children, as this will improve the validity of research in this field.

2-K-57 Mathematical modeling of the go/no-go task informs prospective prediction of substance use in emerging adulthood by clarifying the task's mechanistic neural correlates

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Objective: Behavioral and neural measures from go/no-go paradigms are thought to index inhibitory control mechanisms, deficits in which contribute to risk for substance use disorders (Wetherill et al., 2013). However, this idea has not been evaluated with formal modeling, which can disentangle and quantify distinct processes that contribute to task performance. Here we use the diffusion decision model (DDM; Ratcliff et al., 2018) to 1) elucidate neural mechanisms of go/no-go task performance and 2) leverage computational and neural metrics to predict substance use in emerging adulthood. Methods: DDM was applied to data from 143 participants in the Michigan Longitudinal Study (MLS) who completed the go/no-go during fMRI at ages 18-21. Correlations between task-related neural responses and individual differences in DDM parameters were assessed. Next, behavioral- and neural-level measures of DDM parameters were used to predict substance use at ages 22-26 for participants with outcome data (n=106). Results: Neural responses to inhibitory errors in regions linked to performance monitoring, including the anterior cingulate and bilateral insula, were strongly related to more efficient accumulation of evidence for decisions, as measured by the DDM's drift rate (v) parameter. Indices of efficiency at the behavioral and neural levels robustly predicted a substance use composite (βs=-.24 to -.31, all ps$\leq$.004) after adjusting for gender, family risk factors and previous use. Conclusions: The DDM revealed that activation of performance-monitoring circuitry during the go/no-go task is related to efficiency of evidence accumulation, and that individual differences in behavioral- and neural-level indices of efficiency are useful for prospective prediction of substance use in a critical age range. Results have implications for translational work aimed at clinical prediction and demonstrate how mathematically specified cognitive models can inform developmental neuroimaging research.

2-K-58 Using fNIRS and Galvanic Skin Response as a novel approach to infer Limbic-Prefrontal processes in early childhood

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Objective. Functional Near-Infrared Spectroscopy (fNIRS) is a popular approach to measure neural activation in early childhood populations that cannot tolerate fMRI, and provides good spatial resolution of prefrontal cortex (PFC) areas important for emotion regulation. However, fNIRS cannot reach sub-cortical limbic structures or measure limbic-prefrontal connectivity crucial to emotion regulation. Galvanic skin response (GSR) is a sensitive index of autonomic arousal heavily influenced by myriad limbic structures, suggesting GSR could be combined with fNIRS to infer limbic-prefrontal processes. We recorded simultaneous PFC activation via fNIRS and GSR in 3 to 5 year old children during a rewarding and frustrating task. We tested associations between PFC activation and GSR reactivity and recovery and whether associations were moderated by children's level of irritability. Methods. Thus far 40 3-5 year old children (M = 54 months; SD = 7.6; 55% male) completed a developmentally sensitive task (Incredible Cake Kids) comprising win and frustration blocks while fNIRS and GSR were recorded. Results. Regression models showed children with greater LPFC activation during reward had greater GSR reactivity (b= 11.5, $p < .05$) and weaker GSR recovery post-reward (b= 9.1, $p < .05$) than peers. Children with greater LPFC activation during frustration had lower GSR reactivity (b= -160.7, $p < .05$) and greater GSR recovery post-frustration (b= -108.3, $p < .05$). There was a significant irritability*GSR reactivity interaction (b= 17.3, $p < .05$) such that the inverse association was strongest for children with moderate irritability and absent those with high irritability. Conclusions. Combining fNIRS and GSR may be a promising novel approach for inferring limbic-PFC processes underpinning early emotion regulation and psychopathology. Results suggest an inverse association between PFC activation and GSR reactivity that is disrupted in children with high irritability.

2-K-59 Examining neural similarity between live peer interaction and mentalizing

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Reciprocal social interactions are essential in the development of social cognition, yet little neuroimaging work has examined this process using truly interactive approaches. Recent developmental work utilizing scanner-compatible, social-interactive tasks has elucidated brain activations during live peer interaction that overlap with regions that are engaged when making mental state inferences about an abstract character, suggesting that social interactions automatically engage mentalizing processes (Alkire et al., 2018). However, while this conjunction in activated regions is suggestive of similarity between the underlying processes, it is not a direct test of whether or not these processes are engaging these brain regions in a similar manner. Thus, this pre-registered study aims to leverage representational similarity analysis (RSA) on already collected data to determine whether live peer interaction and mentalizing are, in fact, engaging the brain similarly, thereby allowing us to infer process similarity between the two. The current study employed a within subject, 2x2 design that compared reasoning about mental or non-mental states for a live interactive partner or a story character in a sample of 28 neurotypical 8-12 year olds. Conjunction analysis between reasoning about mental versus non-mental states for characters, and about peer versus character for non-mental states revealed overlapping activity in brain regions involved in social cognition. These regions, along with conjunctions between our main effects, will serve as the regions of interest (ROI) in our RSA. Using individual stimulus betas from each of the ROIs, we will calculate 4x4 dissimilarity matrices between conditions for each ROI, which we will test against our hypothesized similarity structure. Particularly, we predict relative similarity between peer-mental, peer-nonmental, and character-mental conditions, and dissimilarity between these conditions and the character-nonmental condition.

2-K-60 Reliability in clustering solutions derived from resting state fMRI: Insights from the Human Connectome Project.

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A shift towards conceptualizing brain regions as component parts of larger networks (e.g., default-mode) has shed light on the large-scale organization of the brain and offered new markers for predicting cognition, behavior, and psychopathology. However, the utility of these markers depends on whether regions can be reliability categorized into networks across individuals. Community assignments of regions to networks is typically performed in "gold-standard" resting-state datasets of healthy young adults. However, these standard solutions are often applied to data that differ significantly from gold-standard datasets in sample size, scan duration, and/or participant characteristics (e.g., age). As such, questions remain as to the reliability of standard community assignments in test data. To probe these issues, we assessed the reliability of community detection in resting-state data across individuals and scan duration in a large, highly-sampled cohort (HCP: N=1003; 4800 TRs). Random samples of the full timeseries at different durations (e.g. 300, 1200 TRs) were drawn for each individual and community detection was performed. Community assignments were compared to assignments provided by standardized network parcellations (e.g. Power atlas). Results indicate wide inter-individual variation in the reliability of community solutions for random samples, and that many participants showing poor recovery of standard assignments. Furthermore, we demonstrate that recovery levels are largely insensitive to additional data inclusion (i.e. longer scan durations), instead depending on which TRs are included (i.e. it matters which 10 or 40 minutes of data are acquired). This suggests that standard community assignments have low reliability at the individual level, potentially impacting the predictive validity of network metrics calculated on standard atlases, especially in populations that differ from those used to derive these standard assignments (e.g. developmental samples).

2-L-61 Posterior fossa arachnoid cyst in pediatric population is associated with social perception and cortical functioning abnormalities

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Posterior fossa arachnoid cysts (PFAC) are cerebrospinal fluid-filled sacs located between the brain and the posterior arachnoid membrane. PFAC may produce not only neurological symptoms but also other symptoms still poorly understood such as behavioral and learning deficits, awkwardness, and difficulties in social interaction. These subtle social impairments have not been formally described and their underlying brain mechanisms remain unknown. In the present case-control study, we aimed to empirically characterize social impairments in a pediatric population with posterior fossa arachnoid cyst using eye-tracking. In addition, we investigated putative functional cortical abnormalities in these children using arterial spin labelling magnetic resonance imaging. Overall, 15 patients with posterior fossa arachnoid cyst (3f, age = 9.4 ± 4y) and 43 typically developing volunteer children (16f, age = 9.3 ± 3.6y) were enrolled in this study. Eye-tracking was used to record gaze pattern during visualization of social interaction scenes. Viewing times to faces of characters and to non-social background were analyzed. A voxel-wise whole brain analysis was performed to investigate rest cerebral blood flow abnormalities. Significantly reduced viewing time to faces was observed in patients compared to controls ($p < 0.01$). A ROC-curve analysis revealed that 30% of patients presented viewing time to the face lower than the cut-off, while none of the controls did. Whole brain analysis revealed a significant decrease in rest CBF in patients compared to controls bilaterally in the superior temporal gyrus ($p<0.05$ FWE cor). Conclusion: These results suggest that early life PFAC may have an impact on the functional activity of the temporal lobe, which could be associated with social perception deficits.

2-L-62 Information sharing between autistic and neurotypical people

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Objective: To explore transmission of information between individuals, contrasting autistic, neurotypical, and mixed neurotypical/autistic pairs. Methods: A 'diffusion chain' technique was used to probe information transfer between pairs of people. A researcher told the first participant in each chain a story, which they then passed on to participant two, who passed it on to participant three, and so on. The story was divided a priori into 30 details, meaning accuracy was scored on a scale from 0-30. Each diffusion chain included eight participants who were either all autistic, all neurotypical, or alternating autistic and neurotypical (n=72). Rate of decline in the number of details recalled at each stage in the chain is a measure of effective information transfer. Results: Chains of all autistic and all neurotypical people had similar rates of decline, but when alternating between autistic and neurotypical people information degraded more quickly. Multiple regression found that type of chain and position in chain accounted for 84% of the variance in detail-recall ($R2=0.84, F(5,66)=77.05, p<0.0001$). Being in a mixed chain significantly predicted detail-recall ($B=-6.04, p<0.0001$) while being in either the autistic or neurotypical chains did not ($B=0.13, p=0.93$). Chain position significantly predicted score ($B=-2.13, p<0.001$). Crucially, an interaction between chain type and chain position indicates that the mixed chain followed a significantly steeper decline in number of details remembered ($B=0.57$, $p<0.05$). Conclusion: Research to date has dwelt on autistic deficits on lab-based social tasks, that in theory underpin difficulties in real-world interactions. If social cognition is impaired in autism, interactions between two autistic people should be especially challenging. However, our findings suggest that both autistic and neurotypical people benefit from having an interaction partner with the same diagnostic status when performing an information transfer task.

2-L-63 Motor planning deficits in toddlers and preschoolers with autism spectrum disorder

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Behavioral studies have shown that individuals with autism spectrum disorder (ASD) have problems coordinating their own motor actions (Fournier et al., 2010). There is also evidence that delays and atypical patterns of development emerge early in the onset of ASD (Iverson et al., 2019). One hypothesis is that motor impairments in ASD are due to difficulties in motor planning. The present study explored two EEG markers during the execution of motor actions to shed light on the neural processes involved in planning and executing actions in toddlers and preschoolers with and without ASD. Children were between the ages 21 and 59 months (M = 41.1 months). Quality data was obtained from 23 typically-developed (TD) children and 23 children with ASD, whose diagnoses were confirmed on the ADOS-2. The children performed a task with a minimum of 15 trials in which they grasped a small toy (fish) placed on the table and placed it in a container (fishbowl). EEG data were recorded during action execution to measure frontal theta activity, as an index for motor planning, and central alpha activity, as an index for motor activity. Frontal theta activity immediately after action onset revealed group differences in recorded power, $F(1, 40) = 5.47$, $p = .02$, $\eta p^2 = .12$, with the ASD group (M = -.23; SD = .88) showing less frontal theta power compared to the TD group (M = .67; SD = 1.50). During the execution of the actions, the two groups did not differ in central alpha power, $F(1, 40) = 0.37$, $p = .55$, $\eta p^2 = .01$. These results provide new support for the hypothesis that children with ASD struggle with planning their action, but have similar activation in motor cortex during action execution when compared to TD children. This finding helps us to better understand the neural processes that underlie motor deficits in young children with ASD. If the difficulties are specific to motor planning, this would suggest the need for new or modified therapies to improve motor skills in ASD.

2-L-64 Borderline personality and perceived trustworthiness of others modulates learning mechanisms in social trust exchange

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Borderline personality disorder (BPD) is associated with impulsive, maladaptive social behaviors that result from interpersonal stressors. Moreover, during social economic exchange paradigms, individuals with BPD tend to make disadvantageous decisions in response to perceived unfairness. Here, we extended prior research by testing the effect of reputation on participants' willingness to invest in the trustee (see Vanyukov et al., 2019 for a review). 28 BPD participants and 28 Matched Controls completed a multi-round Trust Game during an fMRI scan. Furthermore, we used model-based fMRI analyses to examine neurocomputational mechanisms that underpin social decision-making. Consistent with prior research, we found that the ventral striatum was strongly modulated by prediction errors (PE). We further found group differences in prefrontal cortex (PFC) recruitment for PEs: BPD participants exhibited greater recruitment of anterior dorsal PFC (adPFC) than controls in representation of PEs for the "bad" trustee, but the converse was true for the "good" trustee. Consistent with this region's role in cognitive control, greater recruitment of this region scaled with behaving counter to the participant's prepotent biases (being cooperative (HCs) vs. uncooperative (BPD participants) towards trustee on average) in order to share ~50% of the time. Particularly, BPD participants with attenuated recruitment of this region were especially sensitive to recent rewards (e.g., very sharp increases and decreases in willingness to share as a function of the acute reward history), suggesting that BPD participants' default approach is to be highly sensitive to acute changes in reinforcement, subsequently leading to an unstable representation of others. This finding aligns with clinical theory emphasizing interpersonal ambivalence in BPD and further suggests that blunted recruitment of adPFC when learning from other's behavior may serve to escalate dysfunctional interpersonal dynamics.

2-L-65 Developmental trajectories of impaired response control are distinct in boys and girls with ADHD

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Impaired response control is common in children with ADHD with recent studies reporting differential impairments among girls and boys with ADHD in childhood. Whether impairments persist through adolescence remains unclear. This study combined cross-sectional and longitudinal data from a large sample (n=577) ages 8-17 with either a diagnosis of ADHD (n=306, 91 girls) or typically developing (TD) controls (n=271, 99 girls). Linear mixed effects models were conducted to test for effects of age, diagnosis (Dx), sex, and their interactions for measures of response control (commission error rate and response variability (tau)) during three different go/no-go tasks that differ in working memory demands and reward. As expected, basic response control improved with age across participants. However, a Dx□Sex□Age interaction emerged for both commission error rate (p=.018) and tau (p=.053). For boys with ADHD impaired response control relative to TD boys decreased with age whereas girls with ADHD showed greater impairment in response control with age relative to TD girls. A subsample was used to examine the developmental trajectories of change in response control under conditions of greater working memory demand (n=369) or reward (n=324). Analyses revealed a marginal Dx□Sex□Age interaction for commission error rate (p=.054) and tau (p=.066), such that the negative impact of working memory demand on commission error rate decreases with age among girls with ADHD (p=.001), whereas the negative impact of working memory demands on tau decreases with age among boys with ADHD (p<.001). The impact of reward on response control similarly decreased with age across participants. Our findings reveal dramatically different developmental trajectories for basic response control in boys and girls with ADHD, with decreased impairment with age among boys with ADHD and increased impairment with age among girls with ADHD. Future analyses will explore relationships with functional outcomes.

2-L-66 Mapping neural correlates to biological motion in school-aged children with Autism using high density diffuse optical tomography

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Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by marked impairments in social communication and heightened restrictive and repetitive patterns of behavior. Understanding the neural systems underlying ASD will be crucial in early diagnosis and developing targeted treatments and interventions. However, neuroimaging modalities like functional magnetic resonance imaging (fMRI) require participants to remain still in a loud, enclosed environment that is often challenging for children with ASD and limits imaging studies to primarily high-functioning children. To overcome these challenges while acquiring fMRI comparable images, we have developed high-density diffuse optical tomography (HD-DOT), a silent neuroimaging modality that can map brain function in a minimally constraining and naturalistic environment more suitable for children with ASD. In order to validate the use of HD-DOT in children with ASD, we utilized a socially relevant stimulus paradigm consisting of scrambled and coherent point-like animations of biological motion. Biological motion is a well-validated paradigm that has been used in fMRI and eye-tracking studies to evaluate altered patterns of perception and processing in those with ASD. It has indicated that compared to typically developing children, those with ASD show reduced contrasts to coherent vs scrambled motion in multiple cortical regions including the posterior temporal sulcus (pTS), parietal cortex, and dorsolateral prefrontal cortex (dlPFC). We collected HD-DOT data in children aged 9-12 years during presentation of scrambled and biological motion in a block design. Consistent with prior literature, children demonstrate localized activity in dlPFC, pTS, and visual. Future directions include using HD-DOT to measure brain activity in low-functioning children including infants and toddlers at risk of ASD and school-aged children with more severe ASD.

2-L-67 Investigating the stability of differences in social cognition related to preterm birth through early childhood

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Background: Preterm birth is associated with cognitive impairment and social difficulties in childhood. Infant eye-tracking detects atypical social cognition at 7 months in preterm infants compared with controls born at term. Objective: To investigate stability of differences in social cognition between preterm and term infants through childhood using eye-tracking. Method: 32 preterm and 27 term infants, with mean (range) gestational age (GA) at birth 29.28 (23.28-33.0) and 40.14 (37.0-42.0) respectively, completed eye-tracking at a median age of 7 months corrected GA and 5 years chronological age. At each time point, 3 free-viewing tasks presented social stimuli of increasing complexity: face-scanning (FS); face pop-out (FP) and social preferential looking (SPL). Social preference scores were calculated from the proportion of time fixating on the social aspects of the stimulus relative to the scene as a whole. Group-wise comparisons were made using the Mann-Whitney U test and individual stability assessed using Spearman's Rho. Results: At 7 months preterm infants had lower social preference scores in all 3 tasks; FS 0.19 vs. 0.40, p=0.025; FP 0.17 vs. 0.36, p=0.045; SPL 0.45 vs. 0.62, p=0.037. Group differences were not maintained at 5 years: FS 0.40 vs. 0.38, p=0.573; FP 0.26 vs. 0.29, p=0.292; and SPL 0.62 vs. 0.62, p=0.867. Significant positive correlations between social preference scores were found between all 3 tasks at 7 months ($r>0.40$, $p<0.01$) and between the FP and both other tasks at 5 years ($r>0.31$, $p<0.05$,) but not between FS and SPL ($r = 0.10$, $p=0.45$). No significant correlations were found between social preference scores per task, or overall, across time points. Conclusions: Early social attentional differences in preterm infants are not maintained at 5 years of age; further study is required to determine whether atypical social cognition in infancy contributes to the ontogeny of the broader preterm cognitive phenotype.

2-L-68 Shape of Gesture Learning Curve Predicts Praxis and Social Function in Autism

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Autism spectrum disorder (ASD) is considered a neurodevelopmental disorder, yet it is not entirely clear how developmental processes affect the trajectory of the disorder. We have hypothesized that both core social and highly prevalent motor deficits in the disorder reflect impaired skill learning. We tested this hypothesis in the context of manual gesture imitation, as gesture and imitation atypicalities are well described. 18 participants with high-functioning ASD and 19 typically developing (TD) controls, aged 8-12, watched a video of a unimanual, meaningless gesture and then copied it. The video and imitation were repeated a total of 4-6 times per gesture. 8 gestures were scored. Dependent variables were % gestures performed correctly at repetitions 1-4. Analyses adjusted for age, sex and motor coordination (Physical And Neurological Examination of Subtle Signs). Children with ASD had a downward translation of imitation performance curve, but similar trajectories. Markov models assessed learning from one repetition to the next. TDs showed greater learning from repetition 2 to 3, but children with ASD began to "catch up" by repetition 4. We used the first principal component to characterize the overall shape of the learning curve. Examining only ASD children, learning curve shape was a strong predictor of tool use and communicative gesture praxis (via a version of the Florida Apraxia Battery modified for children; Cohen's d=.90;p=.010); and was a moderate predictor of ASD severity (Autism Diagnostic Observation Schedule; d=-.67;p=.038). Examining both TD and ASD groups, the effect of learning curve shape on praxis was large (d=1.24;p<.001); the effect on diagnosis (binary) was moderate (d=-.68;p=.001). Although children with ASD make similar practice-related gains in imitation over the course of 4 repetitions of novel gesture imitation, the internal shape of the learning curves differ in a way that relates to performance of both to social and motor skill.

2-L-69 Interoceptive associations in early onset addiction to smoked cocaine

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Objectives: Neurocognitive plasticity is critical for maturation throughout adolescence. However, these adaptive processes also increase vulnerability for developing addictions. The connection between plasticity and vulnerability for addictions is not fully known. Smoked cocaine (SC) is the earliest intermediate product of cocaine hydrochloride (CC) production and represents a public health problem for teenagers in developing countries. SC is highly addictive mainly due to its fast administration route, which has been linked an increased ability to sense and process body signals (interoception). However, there is scant evidence about changes during adolescence and no report has assessed interoception in SC consumers. In this study, we implement a multimodal approach (behavioral, EEG, and neuroimaging) to study differences in interoceptive performance between adolescent consumers of SC, CC and controls (CTR). Methods: We included 25 participants that smoked cocaine (SC), 22 that insufflated cocaine (CC), and 25 matched CTR. Cocaine consumption begun between ages 14-16. We applied a heartbeat-detection (HBD) task and measured modulations of the heart-evoked potential (HEP) during interoceptive conditions. We complemented these measures with structural (MRI) and functional connectivity (fMRI) analysis of the main interoceptive hubs (insular, ACC and somatosensory cortex). Results: HBD and HEP results showed that only SC consumers presented ongoing psychophysiological measures of enhanced interoceptive accuracy. This pattern was associated with a structural and functional tuning of interoceptive networks. Conclusions: Our findings provide the first evidence of an association between cardiac interoception and SC consumption in adolescents. They also support models that propose hyper-interoception as a key aspect of addiction while suggesting that this enhancement may depend on specific administration routes.

2-L-70 Behavioural and mental health problems in children struggling at school: An application of the Strengths and Difficulties Questionnaire

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Children with cognitive, behavioural and developmental problems are at increased risk of experiencing mental health problems. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) is an effective screening measure for mental health problems in typically developing children. It is unclear whether the SDQ is useful for identifying the same problems in struggling learners. The aim of this study was to investigate the relationship between SDQ scores and mental health in a heterogeneous sample of children with problems in attention, learning and memory. Participants aged 5-18 years were referred for a research assessment by a health or education professional, as part of a larger study investigating the causes of learning problems (n=295, 100 girls). Parents completed both the SDQ and the Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000). The Emotion subscale of the SDQ predicted parents' ratings of their child's anxiety and depression. Higher scores on the Emotion subscale were associated with an increased likelihood of having a score in the clinical range on the Total Anxiety, Depression and Total Anxiety and Depression subscales of the RCADS-P. Further, ROC analyses, plotting SDQ Emotion against Total Anxiety and Total Anxiety and Depression, showed excellent levels of discrimination (Hosmer, Lemeshow, & Sturdivant, 2013). Visual inspection of the curve suggests an optimal cut-off score of 7 on the SDQ Emotion subscale predicts clinical levels of Anxiety and combined Anxiety and Depression. These findings suggest the SDQ could be a valuable screening tool for identifying mental health problems in children with cognitive, behavioural and developmental problems. The cut-off scores identified here for the Emotion subscale may provide a quick and easy method for practitioners to index at-risk children who may need further assessment and support.

2-L-71 Global memory impairments and hyperactivation of affective and motivational systems for successfully-encoded social stimuli in children with ASD

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The ability to remember faces is critical for social interaction, and emerging evidence has linked face memory deficits to social dysfunction in ASD. However, previous studies have not addressed the domain specificity of memory deficits, and the neurobiological basis of memory deficits for social and nonsocial stimuli. Here we address critical gaps by (i) assessing memory for social (faces) and nonsocial (scenes) stimuli in children with ASD compared to typically-developing (TD) children; and (ii) identify neural correlates of memory deficits. We recruited 25 children with ASD (4 female; Mage=10.95 years old, MFSIQ=113.76) and 24 TD children (5 female; Mage=10.87 years old, MFSIQ=122.13), who underwent neuropsychological assessments and fMRI scanning during encoding of 50 faces and 50 scenes. In the encoding phase, participants were asked to make a category judgment distinguishing faces and scenes during two 6-minute fMRI scanning sessions. After 30 minutes, 100 studied pictures were randomly presented and intermixed with 100 new foils in a memory retrieval task, and participants were asked to judge whether these pictures were studied in the encoding phase or not. Behaviorally, compared to TD peers, children with ASD showed impaired performance on the memory retrieval task ($p = 0.038$) independent of category (accuracy, MASD = 0.57, MTD = 0.61). Remembered faces, compared to scenes, was associated with greater right ventral striatum, amygdala, and fusiform gyrus activation in children with ASD. Remembered scenes had higher parahippocampal and lingual gyrus activation in the ASD group. In contrast, TD children showed posterior cingulate cortex activation related to remembered faces, whereas occipital and PHG regions were activated for remembered scenes in TD. Our findings reveal impaired global memory deficits in children with ASD across social and non-social domains, and that successful memory for faces requires hyperactivation of affective and motivational systems.

2-L-72 Cortisol stress response, right amygdala volume, and depressive symptoms in preschool age children.

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In adults, a diagnosis of Major Depressive Disorder (MDD) often correlates with elevated levels of the stress hormone cortisol and alterations in hippocampal and amygdala volume. Given that high levels of stress often precede MDD onset, researchers have hypothesized that cortisol could act on the highly dense glucocorticoid receptors of the hippocampus and amygdala to bring about a depressive phenotype. Despite the growing consensus that the roots of MDD are often neurodevelopmental and that depressive symptoms may be present as early as age three, no research to date has explored the relationship among cortisol response to stress, depressive symptoms, and hippocampal and amygdala volume in preschool age children. To address this gap in the literature, we assessed stress response by acquiring salivary cortisol samples following an in-lab stressor in 52 children between 4-6 years of age, 47 of whom also provided high-quality structural MRI data and measures of parent-reported depressive symptoms. In the full sample, we observed a statistically significant relationship between cortisol response to stress and elevated depressive symptoms. In the sample with high-quality structural MRI data, we did not observe a relationship between hippocampal or amygdala volume and depressive symptoms. However, among the children with both high quality MRI and salivary cortisol data, we observed a significant negative relationship between right amygdala volume and a greater cortisol response to stress. No correlation between hippocampal volume and cortisol response to stress was observed. The current results provide novel evidence suggesting that individual differences in cortisol response to stress are already related to right amygdala volume during the preschool period. They also suggest that longitudinal studies will be required to better understand the origin and long-term implications of this relationship.

2-L-73 Gray Matter Density Patterns in the Prefrontal Cortex Predict Irritability Scores

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Background: Irritability is a temperamental domain that spans the normative-to-severe spectrum, with the latter end often reported as a symptom of nearly every psychiatric disorder. Recent work has found alterations in prefrontal, parietal, striatal and limbic function in children with higher irritability. Little is understood, however, about how structural brain development during childhood is related to the full spectrum of irritability. Objective: Map the structural neural correlates of dimensional irritability across childhood. Methods: T1-weighted structural MRI data was collected from 185 children ages 4-12 (age=7.98±1.94 years, 53% male) across 4 studies (3 sequences). Irritability was assessed using the Multidimensional Assessment of Preschool Disruptive Behavior. Regional gray matter density (GMD) was derived from the structural MRI using a custom segmentation pipeline developed for preschool data. We used support vector regression to assess the relationship between irritability and whole brain, voxel-wise gray matter density. Model accuracy was derived from regressing the predicted and actual irritability scores and cross-validating across scanner sequences. The voxel-wise multivariate maps that informed the significant model were then examined. Results: Preliminary analyses (N=117, age=8.11±1.88 years, 58% male) suggest that higher irritability scores (Temper Loss scale; sample score range 0-81) were associated with distinct patterns of decreased GMD in the bilateral dorsolateral prefrontal cortex (PFC), the orbitofrontal cortex, and the striatum. GMD in the prefrontal and parietal cortex was also predictive of age. Conclusions: These results suggest that childhood irritability may be associated with distinct development of the PFC-mediodorsal thalamus-striatum loops, which could be a potential target for cognitive or behavioral intervention.

2-L-74 Reduced longitudinal growth of the cerebellum is associated with greater symptom severity in pre-school children with ADHD

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BACKGROUND Prior research suggests the cerebellum may contribute to the pathophysiology of attention deficit-hyperactivity disorder (ADHD), with cross-sectional imaging analyses revealing reduced volumes within lobule 9 correlate with ADHD symptom severity. However, examination of ADHD-associated differences in longitudinal change in cerebellar structure has been limited. METHOD 63 children with ADHD (36 male) and 45 typically-developing (TD) children (29 male) aged between 4 and 12 years were scanned one to five times (total 268 scans). High resolution images were examined and aligned to the SUIT-template using nonlinear normalization. Lobular volumes were generated using an internally developed cerebellar atlas. The cerebellar atlas was then back-projected into native-space for regional calculation. Tissue segmentation was used to interrogate gray and white matter within each cerebellar label. RESULTS Analyses revealed an overall effect of age on left lobule 9 (LL9) gray matter volume. Diagnosis significantly moderated this effect ($p<.01$), such that children with ADHD exhibited less LL9 growth as they aged, as compared with TD children. Mixed effects linear model revealed a significant three-way interaction of age, diagnosis and ADHD symptom severity ($p <.01$): Among children with ADHD, greater symptom severity was associated with less LL9 growth ($p<.01$). Results in right lobule 9 were not significant. CONCLUSION Our results extend prior findings from cross-sectional research, revealing reduced longitudinal growth of left lobule 9 in young children with ADHD, with lesser growth predicted by greater symptom severity. Abnormalities in left lobule 9 may contribute to ADHD pathology through established connections with the dorsal attentional network, important to top-down attentional reallocation to task-relevant stimuli.

2-L-75 Functional Connectivity Between the Default Mode and Task Positive Networks is Associated with Failures of Response Control in Children with Attention Deficit/Hyperactivity Disorder

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Objective: ADHD is characterized by inattention and hyperactivity/impulsivity, symptoms associated with impairments in cognitive control. It is thought that these features of ADHD arise from disrupted patterns of functional connectivity. Specifically, it has been proposed that lapses of inattention may arise from "intrusions," or hyper-connectivity, of the

default mode network (DMN) to task-positive networks. Thus, the goal of this study was to elucidate the role of DMN inter-network interactions in relation to response inhibition during a go/no-go (GNG) task. Methods: Resting state fMRI scans were acquired from 46 children with ADHD and 46 typically developing (TD) children aged 8-12. Brain regions corresponding to the DMN, frontoparietal (FP), somatomotor (SM), salience/cingulo-opercular (SAL), and subcortical (SUB) networks were selected. Graph theory network analyses were conducted, and modularity (overall degree of network segregation) and participation coefficient (degree of inter-network integration) were calculated. All participants completed a GNG task outside of the scanner, and commission errors (failure to inhibit a button press on no-go trials) were quantified. Results: For children with ADHD, higher average participation coefficient and lower modularity across the selected networks was associated with an increased commission error rate ($p<.05$). Analyses of network pairs revealed that a higher commission error rate was associated with higher participation coefficient specifically between the DMN and all task-positive networks (FP, SM, SAL, SUB; all $ps<.05$). These relationships did not hold in the TD children. Conclusion: Among children with ADHD, increased integration between the DMN and task-positive networks is associated with failures of response control. These findings appear to support the default mode interference hypothesis of attention and provide a potential biomarker for guiding interventions aimed at improving behavioral control in ADHD.

2-L-76 Salience Network Co-activation Patterns in Children with Autism Spectrum Disorder

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Recent analyses using resting-state fMRI data have shown that individuals with ASD can differ from typically developing individuals (TD) with regards to various metrics of brain dynamics. These metrics include dwell time (how long a brain network configuration persists), frequency (how many times a network configuration emerges), and transitions (how many times network switching occurs). These recent studies have focused on whole brain analyses, agnostic to specific neural systems known to be impacted in ASD. Thus, it is unknown if differences in brain dynamics exist at the level of individual brain networks such as the salience network (SN), which is identified as a potential locus of dysfunction in ASD. This proposed registered analysis will examine data collected from 203 children (9-12 years; n = 95 ASD) from the ABIDE I and ABIDE II databases (Erasmus and Stanford) combined with data collected at the University of Miami, that are matched on age, IQ, and head motion ($p's > 0.05$). Following standard preprocessing steps, a high model order independent component analysis (ICA) will identify relevant network regions-of-interest (ROIs). Post-processing of non-noise independent component (IC) time-series will include despiking, nuisance regression (white matter, CSF, head motion), and filtering. SN ICs will be used in a targeted ROI co-activation pattern (CAP) analysis where the top 30% of the highest activation points for each SN node will be concatenated across all non-noise ICs. Frequency, dwell time, and transitions will be calculated via k-means clustering and compared between ASD and TD groups using t-tests with multiple comparison correction. Based on previous research, we hypothesize that individuals with ASD will show altered SN dynamics, exhibiting increased frequency, longer dwell times, and decreased transitions. These results will help to identify specific brain network dynamics underlying one of the most prevalent neurodevelopmental disorders.

2-L-77 Anomalous relationship between sensorimotor GABA levels and task-dependent cortical excitability in children with Attention-deficit/hyperactivity disorder

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Background: Disinhibited, impulsive behavior, a core feature of Attention-deficit/hyperactivity disorder (ADHD), is highly prevalent and impairing. The neural basis of ADHD remains elusive despite high prevalence and impact. Previous work showed reduced brain GABA levels in children ADHD using Magnetic Resonance Spectroscopy (MRS) as well as reduced Short Interval Cortical Inhibition (SICI) as measured using Transcranial Magnetic Stimulation (TMS). However, the link to the behavioral manifestation of ADHD is unclear. Long-standing clinical observations prompted the question, "Do children with ADHD manifest cortical physiologic signs of dis-inhibition and -modulation?" Methods: In 45 typically developing (TD) children and 37 children with ADHD, aged 8-12 years, we applied paired-and single pulse TMS over left primary motor cortex at REST and during a response inhibition TASK (child version of the Slater-Hamel) with motor evoked potentials (MEPs) measured in right hand. Additionally, we measured brain GABA levels using GABA-edited MRS (3T Philips) in a 27 ml voxel over left primary sensorimotor cortex (SM1). Data were analyzed using a mixed model repeated measures approach. Results: Results show that in both cohorts, SICI is positively associated with SM1 GABA levels (more GABA is SICI nearer 1, $p < 0.0001$)). For TD, the relationship between SM1 GABA and was modulated by state, with positive association for REST ($p = 0.009$) and negative for TASK ($p < 0.0001$) with single- and paired pulse convergence with increasing GABA ($p < 0.05$ for interactions) . In contrast, for children with ADHD the association was negative for both REST and TASK. Discussion. The results reveal ADHD-associated anomaly in the relationship of SM1 GABA, cortical inhibition, and modulation from rest to active state. The findings further suggest that children with ADHD tend to be in a 'task-ready' state at baseline. The findings provide novel biomarkers for guiding ADHD diagnosis and therapy.

2-L-78 Higher Levels of Inflammatory Cytokines are Associated with Reduced White Matter Organization in Depressed Adolescents

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Background: Elevated inflammation as measured by cytokines, such as interleukin 1-beta (IL-b) and tumor necrosis factor (TNF-a), has been linked with adult Major Depressive Disorder (MDD); few studies, however, have examined the relation between inflammatory cytokines and depressive neurophenotypes in adolescents. One robust neurophenotype of MDD is reduced white matter organization of the cingulum cingulate (CC), a frontolimbic tract that underlies emotion regulation. Here, we examined associations between IL-1b and TNF-a with white matter organization of the CC in adolescents with and without MDD. Methods: 32 adolescents diagnosed with MDD and 57 controls recruited from the community (N=89; 32 males; 16.01±1.14 years) completed a diffusion-weighted MRI scan, from which we computed mean fractional anisotropy (FA) across left and right CC using deterministic tractography. Of these participants, 24 MDD and 26 CTL provided capillary blood, from which concentrations of IL-1b and TNF-a were assayed using a Luminex multiplex bead array. Linear models covarying for age, sex, and BMI were used to test whether these cytokines were associated with CC FA across all participants. Results: Depressed youth exhibited significantly higher levels of inflammatory cytokines than did healthy controls (all ps<.03) but did not differ in CC FA (all ps>.20). Further, higher levels of IL-1b were significantly associated with lower left CC FA across all participants (β=-.32, $t(44)$=-2.27, p=.028) and trending between TNF-a and CC FA (β=-.25, $t(44)$=-1.74, p=.089). Conclusions: Consistent with data from depressed adults, we found robust evidence of elevated inflammation in depressed adolescents and, further, that higher inflammation is associated with reduced white matter organization of the CC. We anticipate that with longitudinal data in a larger sample size, we will be able to test if elevated inflammation affects normative development of white matter of the CC in depressed adolescents.

2-L-79 Preliminary Validation of Automated Computer-Vision Methods for Assessing Motor Imitation During Dance Videogame Task in Children with Autism

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Motor imitation impairments are common in autism spectrum disorder (ASD) and may contribute to impaired development of reciprocal-social skills. Current human-coded methods of measuring imitation are time-consuming, introduce bias, and limit assessment to predetermined elements. This study develops and validates the use of a computer vision algorithm, dynamic time warping (DTW), to address these issues and investigate imitation in children with ASD. Thirty-seven children (21 ASD, 16 TD, age= 8 - 12 years) participated. Children imitated an avatar performing a dance sequence comprised of novel whole-body movements. Children's movements were recorded using two Kinect depth cameras. The x-y-z coordinates of 20 joints were extracted from the depth recordings for DTW analysis. A human-coded (HC) measure was developed and used to assess performance and validate the accuracy of DTW. For each move, elements describing changes in limb locations were defined. Higher HC scores indicate better imitation. DTW algorithm temporally aligns the child's time-course to the avatar's time-course by minimizing the Euclidean distance between them. We optimized DTW to weight the relative contribution of each joint per move. Higher DTW distances indicate greater difference between the child and the avatar and poorer imitation. HC scores were reliability-coded by two raters ($\kappa = .915$, $p < .001$). HC and DTW scores were significantly correlated ($r = -.84$, $p < .001$) and this correlation held equally strong within ASD ($r = -.75$, $p < .001$) and TD ($r = -.90$, $p < .001$). DTW distances revealed significantly better imitation in TD than ASD ($F(1,35) = 6.79$, $p = .01$) and HC scores confirmed this trend ($F(1,35) = 8.22$, $p = .0007$). The findings support the use of a computer vision-based algorithm, DTW, to investigate autism-associated differences in motor imitation. This approach for assessing motor imitation could prove useful in establishing biomarkers for assessing diagnosis and response to intervention.

2-L-80 Testosterone-Cortisol Ratio, Cortico-Amygdalar Structural Covariance and Cognition

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Cortisol and testosterone are the end products of two hormonal axes, the hypothalamic-pituitary-adrenal (HPA) axis and the hypothalamic-pituitary-gonadal (HPG) axis. Testosterone, a sex-steroid hormone, has been shown to have both neuroprotective and neurotoxic effects, whereas cortisol, a glucocorticoid, displays primarily catabolic and neurotoxic properties. Both testosterone and cortisol have been shown to play a role in age-related cortical development throughout childhood and adolescence. Here, we examined the effect of the testosterone-cortisol (TC) ratio on amygdalar volume, cortical thickness, and cortico-amygdalar structural covariance in a longitudinal sample of typically-developing children and adolescents from ages 4-22. We also investigated associations between TC related cortico-amygdalar covariance, and cognitive and behavioral measures. Results indicated TC ratio was associated with cortical thickness of the superior parietal lobule (Broadmann Area 7) and as well as visuo-amygdalar and somatosensory-amygdalar structural covariance. TC-related cortical thickness was associated with lower scores on tests of working memory. In addition, TC-related structural covariance was associated with lower scores on tests of executive function, but with higher scores on tests of working memory. Neither TC-related cortical thickness nor TC-related structural covariance was associated with behavioral measures. Thus, higher testosterone levels, relative to cortisol levels appear to result in a net increase in structural connections between the amygdala and visuo-somatosensory areas as well as a reduction in the age-dependent cortical thinning of the superior parietal lobule. This may in turn promote bottom-up, amygdala-dependent influences on the cortex which ultimately affect working memory and executive function.

2-M-81 Mapping visual attention to levels of inhibitory control: A mobile eye tracking investigation

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Inhibitory control (IC) works to control prepotent responses in support of higher-order goals (Diamond, 2006). Although high levels of IC are generally viewed favorably, heightened levels of IC in behaviorally inhibited (BI) children, a group

marked by increased risk for anxiety (Chronis-Tuscano et al., 2009), may actually potentiate risk for internalizing problems (White et al., 2011). Traditionally, IC is measured with standardized laboratory paradigms, operationalizing the construct through patterns of behavioral responses. Variations in IC may also be evident in visual orienting (Amso & Scerif, 2015). We will investigate patterns of visual attention as a more fine-grained assessment of IC, and also examine if visual measures of IC moderate the relation between BI and internalizing symptoms. 5-7-year-old children from the community, oversampled for high levels of BI, completed the Tower of Patience task (Goldsmith et al., 1994) while wearing a mobile eye-tracker. This task asks children to play a game of Jenga with an experimenter. The children must take turns with the experimenter while the experimenter takes an increasingly longer time to choose a block across turns. Data will be behaviorally coded for violations of turn-taking, reflecting lower IC. Mobile eye tracking data will assess the child's fixations to the experimenter, the Jenga blocks, or elsewhere, capturing attentional strategies that correspond with behavior. Parents will also report on child BI and count of internalizing symptoms. State Space grids (Hollenstein, 2007) will track the relation between gaze and in-the-moment behavior and variation within and between participants, examining different states of visual attention patterns and corresponding behavior. These states will relate to level of inhibitory control. Furthermore, we will use a Poisson regression to examine the moderating effect of IC on the relation between BI and internalizing symptoms.

2-M-82 Error-related activity and attention difficulties in children

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Research in adults suggests there is a consistent set of brain regions in task control networks that are active during errors, or incorrect relative to correct trials (Neta et al., 2015). In a previous study, we investigated error-related activity that was consistent across multiple tasks collected from a sample of typically developing children ages 8-17 years. Child error activity had high representation in cingulo-opercular control regions. Here, we extend this research to examine error-related regions in children with parent-reported attention deficit hyperactivity disorder (ADHD) diagnoses (N=44, mean age=12.01y, ages 8-18), recruited for the same set of projects as the typical child sample. Cognitive models suggest that children with ADHD show poor behavioral regulation of control, which may, in part, be due to deficits error-processing. Regions of error-related activation were investigated during incorrect vs. correct trials for a response inhibition task (N=38) and a switching task (N=23) through whole brain analyses and regions-of-interest applied from the adult error literature. Children with ADHD had greater positive activation during incorrect vs. correct trials in cingulo-opercular regions for both the inhibition and switching tasks, similar to findings in the typical child sample. We also examined whole brain correlations with parent-reported attention symptom burden subscales of hyperactivity and inattention during incorrect vs. correct trials across a subset of the typical and ADHD samples (N=24 typical, N=22 ADHD). Results suggest a positive correlation between hyperactivity symptom burden and error-related visual and parietal activation during the switching task. Preliminary results suggest that error-related patterns of activation across children with and without ADHD may be qualitatively similar in cingulo-opercular control regions, but differ in regions outside control networks.

2-M-83 Naturalistic social attention across a dynamic social interaction

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Social attention is essential for successful social engagement, the ability to interact with novel and familiar others. However, most research assessing social attention has relied on static, computer-based paradigms that fail to account for the dynamic nature of social interactions. The proposed study will use mobile eye-tracking data to examine (1) how

young children attend to their social environment and (2) if attention to the social environment fluctuates based on the affective context of a given interaction. 42 children (21 sex-matched dyads; M=6.10 years, SD=0.59) participated in a larger study designed to assess relations between temperament and attention to the social environment. Prior to participation, children were oversampled for behavioral inhibition (BI). Dyads completed a 5-minute free play while collecting mobile eye-tracking (MET) data. To-date, MET data have been coded for 27 children (18 dyads; some dyads only one child gave usable data) at 30-frames-per-second for gaze to areas of interest (AOIs; peer, toys, other). Second-by-second gaze duration is indexed by the number of frames per second to each AOI category. Additionally, second-by-second coding of each child's affective state (negative, neutral, positive), coded as a categorical measure for each second, has been completed for 14 children (7 dyads). We will model the data using multilevel models nested by dyad, retaining the second-by-second nature of the coded data. Our outcome measure will be continuous gaze duration. We will assess for an interaction between our categorical predictors of affective state and AOI after controlling for BI level and proportion of codable MET epochs. We anticipate that children will spend more time looking at the peer during positive compared to negative affective states. This analysis will provide important information about how children attend to a naturalistic social environment and if changes in affective context may relate to changes in social attention.

2-M-84 The self-reference effect in adolescence

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Adolescence is a period of development in which the self-concept changes profoundly. Little is known about how this emerging sense of self in adolescence is reflected in memory and perception. In this study we will investigate the self-reference effect in adolescence. We will do this with two tasks (the words task and shapes task). In the words task, participants will be asked to judge words in relation to the self (e.g. does the word MUSICAL describe you?) or in relation to a familiar other of their choosing (e.g. does the word SARCASTIC describe Hermione Granger?). Participants will later be given a recognition test on words shown in this phase. In the shapes task participants will learn to associate shape-label pairs. For example, participants will be told that a circle represents them and a square represents Hermione Granger. They will then be asked to judge whether briefly presented shape-label pairs (e.g. circle-YOU) match or mismatch. We will recruit ~200 female participants age 11-30. In both tasks we are expecting to find a self-reference effect, in which items encoded relative to the self will be better remembered (in the words task) and more quickly and accurately recognised (in the shapes task). We predict that adolescents will show a larger self-reference effect across both tasks because of the importance of self-relevant stimuli during this period. Since participants will be judging positive and negative words about the self and other, we will also be able to investigate how valence affects memory. We predict that adolescents will show a heightened memory for negative words judged in relation to the self. This is because adolescents experience more frequent negative affect than adults (Larson et al., 2002) and negative affect is associated with self-referential biases towards negative stimuli (Harmer et al., 2009). Our results may lead to a better understanding of the cognitive mechanisms involved in the development of a self-concept in adolescence.

2-M-85 The relation between environmental stress and attention to emotion in parents living across three demographically different locations

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Exposure to disorder in the environment impacts the way that individuals process emotion(Logan&Graham-Bermann,1999). Importantly, minorities in urban environments, are at higher risk for exposure to environmental stressors than White individuals (Butcher&Morrison-Piehl,1999). Thus, it is possible that the stressful environment common of minority families might impact how they process emotional information. Data for an ongoing longitudinal study are being collected across 3 sites where populations vary in violence exposure: Newark, NJ, which houses low-income minority

families(N=17); Harrisburg, PA, a working class sample(N=22); and, State College, PA, consisting of mostly middle-class families(N=67). To assess patterns of attention, 2 versions of a visual task were administered. Participants were presented with 9 images; all the photos were either from a single category, or included one image from a discrepant category. Participants were asked to indicate whether all 9 images were from the same category. The social condition included images of angry and happy faces and the non-social condition included snakes and frogs. Latency to fixate the discrepant image was measured using an eye-tracker. To measure environment stress, participants completed the Parental Daily Hassles Scale(Cronic & Greenberg,1990). Results show that adults from Newark report significantly higher rates of environment disorder($F(2,106)=36.417$, $p<0.001$) when compared to the other sites. When examining the relation between disorder and threat detection, there was a significant positive relation between daily hassles and latency to detect angry faces ($r=.569$, $p=02$), only for the sample from Newark. There were no significant relations between stress and non-social threats. These findings indicate that adults from Newark who reported higher levels of daily hassles were slower to respond to angry faces. Suggesting that heightened levels of environmental disorder play a role in emotional processing.

2-M-86 Real-world models of developing selective attention: The benefits of naturalistic paradigms & electrical EEG imaging

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The aim of educational neuroscience research is to better understand the neurocognitive processes shaping how developing brains learn. We now understand that children's ability to learn and deploy new skills depends critically on their capacity to promote the processing of task-relevant information and suppress the goal-irrelevant information (i.e., "selective attention"). However, the narrow focus on some stimulus categories might have created a gap between cognitive models of developing attention and their direct relevance to attention in the classroom. One way to address this gap is to combine the rigour of these laboratory studies with naturalistic stimulation and robust, information-rich techniques to analyse brain activity (e.g. Matusz et al. 2019 JOCN). It is well-established that brain naturally represents information in a multisensory fashion and integrates multisensory information to improve behaviour and cognition. Indeed, we find that developing selective attention follows different principles in multisensory and in traditionally studied, visual settings. In one EEG study, 6-7-year-olds (n=40) performing search for colour-defined targets attended to colour and colour-sound distractors differently than adults. The children showed adult-like feature-based selective attention but not reliable bottom-up multisensory enhancement of visual attention. Importantly, they did now show the N2pc (negative-going EEG component across posterior sites ~150-300ms post-stimulus), a traditional EEG marker of adult selective attention. However, analysis of global characteristics of lateralised brain activity (electrical neuroimaging; Murray et al. 2008) across the N2pc time-window revealed adult-like stable topographic patterns ("template maps") in children's EEG, as well as modulations by distractor colour and multisensoriness. I discuss how such "naturalistic" approaches can bridge traditional and real-world investigations into processes orchestrating education.

2-M-87 Stability of attention from infancy to early childhood in the preterm infant

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Objective: To investigate group differences in visual attention skills between preterm and term born children, and to determine whether attention profile at 9 months is maintained at 5 years. Method: 88 preterm and 67 term infants (gestational age mean (SD) = 28.8 (2.4), 39.9 (1.4) weeks respectively) were recruited with ethical approval from the UK National Research Ethics Service. During eye-tracking, participants viewed a central stimulus, before the appearance of a novel peripheral stimulus. Time to First Fixate (TTFF) the peripheral stimulus was used as a measure of attention switching (gap condition) and disengagement (overlap condition). The task was administered at 9 months and then again

at 5 years in the same cohort. Cross-sectional group differences in TTFF were assessed using Welch Two sample t-test or Wilcoxon rank sum test. Spearman's rank correlations were used to measure stability of attention from 9 months to 5 years. Results: There were no significant differences in TFFF between preterm and term infants at 9 months (all p>.38, mean differences 34-18ms, SDs 413-233ms). However at 5 years, preterms were significantly slower in the baseline condition: preterm m=843, SD=401; term m=634, SD=231; w=333, p=0.01. Preterms also showed no disengagement effect: preterm m=85, SD=509; term m=-157, SD=396; t=-2.12, p=0.04. Attention at 9 months was not correlated with attention at 5 years in the preterm (p>.43) nor the term (p>.36) groups. Conclusion: Previous work has shown that prematurity is associated with increased likelihood of ADHD diagnosis, and sub-clinical attention impairments. However we did not find indicators of attentional difficulties in preterm infants, though these became apparent at 5 years. These results raise questions about developmental stability of attention, and our ability to identify attentional difficulties in early life.

2-N-88 Higher quality neural representations of phonemes scaffold longitudinal reading gains in 5- to 7-year-old children

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The objective of this study was to investigate, using a brain measure of phonological awareness, whether phonological awareness is crucial for the development of reading skill (i.e. scaffolding hypothesis) and/or whether learning to read words refines phonological awareness (i.e. refinement hypothesis). We specifically looked at how different grain sizes of phonology and how two different phonological processes (i.e. phonological representation in the posterior superior temporal gyrus, STG, and phonological access in the dorsal inferior frontal gyrus, IFG) played a role in this bidirectional relation. 36 children completed a reading test outside the scanner and an auditory phonological awareness task inside the scanner which included both small (i.e. onset) and large (i.e. rhyme) grain size conditions. Children were tested when they were 5.5-6.5 years old (Time 1) and once again approximately 1.5 years later (Time 2). To study the scaffolding hypothesis, a regression analysis was carried out by entering brain activation for either small (onset>rhyme) or large (rhyme>onset) grain size in either STG or IFG at T1 as the predictor and reading skill at T2 as the dependent measure. Non-verbal IQ, phonological working memory and reading skill (all at T1) were entered as covariates of no interest. In order to study the refinement hypothesis, the regression analysis included reading skill at T1 as the predictor and brain activation for either small or large grain size in either STG or IFG at T2 as the dependent measure. Non-verbal IQ, phonological working memory and brain activation (all at T1) were entered as covariates of no interest. Our results provided the first neural evidence supporting the scaffolding hypothesis, by showing that the better the representational quality for small grain size phonology in the brain at T1, the larger growth of reading skill over time. This has important implications for early reading identification and interventions.

2-N-89 Investigating the relationship between bilingualism and perspective taking skills in adulthood.

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Introduction: The positive influence of a bilingual upbringing on the developing brain is highly debated, and there is conflicting evidence regarding the positive effect of bilingualism on the development of social cognitive abilities, such as perspective taking (PT). The disentanglement of the various manifestations of bilingualism, the various types of PT, and their interaction with executive functions (EF), may shed light on this debate. This study describes how different bilingual experiences in childhood shape the cognitive development of PT skills, expressed in adulthood. Methods: Participants completed a language history questionnaire, a visual PT task, a cognitive and affective PT task, a sustained attention (EF) task, and a non-verbal IQ test. The PT tasks provided a comprehensive picture of the three forms of PT (visual, cognitive, affective), each at two levels of complexity. The methods and analysis plan are available at https://osf.io/vjfnh/ Results:

The sample includes 96 participants (72% female), aged 19-59 years (M=28.5 years, SD=7.8 years). Twenty-six participants listed 2 languages, 37 listed 3 languages, 33 listed 4 languages or more, with a wide range of ages of acquisition (i.e. ages of acquisition for the second language range from 0 to 49 years), and a wide range of proficiencies in all languages. We will report on multiple linear regression analysis to measure the relation between bilingualism metrics (i.e. number of languages, age of acquisition) and PT scores. Conclusion: By deploying a multidimensional, continuous and naturalistic definition of bilingualism, this study reveals how the developing brain responds to language learning, influencing social cognitive abilities. The findings have implications for psychological theory, parents and professionals.

2-N-90 The role of gamma in successful word learning in elementary school-aged children

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Word learning from linguistic context is essential to academic success and language development in grade school (Maguire et al., 2018). It is a highly variable skill, and researchers argue that predictability plays a part in successful word learning (Wang et al., 2012). To identify the role of predictability in successful word learning in grade school, we studied differences in the engagement of gamma activity (30-50Hz) between good and poor word learners in elementary school (8-11 years) as they completed a word learning task. Gamma was of particular interest because increases in gamma are related to the predictability of upcoming words during sentence processing (Lam et al., 2016; Lewis & Bastiaansen, 2015). Thirty-nine right-handed third and fourth graders (ages 8;0-11;1) wore a 64-electrode EEG cap while silently reading 100 sentence triplets, each ending with a target novel word. After each triplet, participants reported the novel word's meaning, if possible. Participants were divided into two groups (low performers n = 19, high performers n = 21) based on their behavioral response scores using the median score as a cutoff (range: 0.1-0.9, median: 0.59). EEG data was epoched from 500msec before the onset of the first word of the sentence to 1500msec after the target word onset for each of the three sentences in each triplet. Only trials in which children correctly identified the target word were included in the analysis. Using EEGLAB's Monte Carlo permutation analysis, which accounts for multiple comparisons, we found significantly larger increases in gamma (30-50 Hz) for high vs low performers, especially in the first sentences. These findings indicate that good word learners may more actively predict upcoming language as they are processing sentences than their peers who learn fewer words in a word learning task. The results support previous findings that gamma band activity can fluctuate as a function of predictability of the target word (Wang et al., 2012).

2-N-91 Independent and Interacting Effects of Socioeconomic Status and Bilingualism on Infant EEG During the First Year of Life

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Socioeconomic status (SES) is strongly associated with children's cognitive development (Brooks-Gunn & Duncan, 1997). Past studies have reported SES-related disparities in cognitive skills (Noble et al., 2007) and brain function (Tomalski et al., 2013). In a separate line of research, bilingualism has been associated with cognitive advantages as early as 7 months (Kovács & Mehler, 2009). However, less is known about the interactions between SES, bilingualism, and brain function. The aim of the current study is to examine the joint and independent effects of family SES and bilingualism on resting brain activity during the first year of life. Resting EEG was collected from 59 infants (6 - 12 months of age) who came from diverse socioeconomic backgrounds and who were exposed to different degrees of bilingualism in their households. The bilingualism spectrum ranged from fully bilingual (equal infant exposure to both languages) to slight (5%) exposure to a second language. Initial results show that the income-to-needs ratio (ITN), a measure of SES, was positively correlated with left temporal gamma power (r=.278, p=.034). While level of bilingualism was not significantly associated with EEG power, there was a significant interaction between ITN and bilingualism in left temporal gamma power. Specifically, for monolingual participants, higher family ITN was associated with greater left temporal gamma power. In contrast, among

highly bilingual participants, there was no association between ITN and left temporal gamma power. Implications for early language exposure and development are discussed.

2-N-92 Reduced cortical thickness in the left superior temporal cortex in the neonatal period is associated with poorer receptive language abilities at 22 months in children with Congenital Heart Disease.

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Children with congenital heart disease (CHD) are at risk for impaired language development. Developmental language disorder is associated with altered structure and function in bilateral superior temporal cortex (STC) on MRI. Impaired auditory processing, mediated by bilateral STC, may underlie impaired language development. We tested the hypothesis that cortical morphology in the left and right STC prior to cardiac surgery is associated with receptive language at 22 months in infants with CHD. 39 children with CHD underwent MRI prior to surgery (median [range] age at scan=39.29 [35.14-41.57] weeks) and the Bayley Scales of Infant and Child Development-3rd ed. (median=22 [20-34] months). Mean cortical thickness, gyrification index and total surface area in the left and right STC were calculated. Bootstrapped linear regressions were used to assess the relationship between STC morphology and receptive language scores. Cognitive composite score, head coil, brain volume, presence of white matter injury, gestational age at birth, age at scan, corrected age at assessment, multiple deprivation index (a measure of socioeconomic status), and number of languages heard at home were included as covariates. The threshold for significance was set at p=0.0083 (0.05/6 comparisons). Poorer receptive language at 22 months (mean=9.2; SD=3.2) was associated with reduced neonatal cortical thickness in the left STC (B(SE)=5.858(1.415); 95%CI=0.528-9.486; β=0.488; p=0.000288) as well as lower cognitive scores (β=0.684; p=8.7x10-7) in children with CHD (F(10,28)=7.985; p=6x10-6; R2=0.740). There were no significant relationships between right STC morphology and receptive language abilities. Deficits in phonological processing, in which the left STC is particularly implicated, are reported in older children with CHD. Our data suggest that morphology of the left STC may be an early correlate of impaired language development in this population.

2-O-93 Physiological Evidence That Excessive Overflow Movement in ADHD Is Due to Motor System Immaturity

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Background: Children with ADHD show developmentally atypical levels of mirror overflow movements--unintentional movements that occur in the body part symmetrically opposite an intentional movement. Because mirror overflow correlates with ADHD behavioral symptoms, motor research may shed light on more complex cognitive control mechanisms in ADHD. We investigated evidence of developmental delay vs. deviant (atypical-at-any-age) brain physiology associated with mirror overflow. Movement-related suppression of the beta frequency band (18-28 Hz) on EEG is a well-studied index of motor cortical activation. Because it is shown to increase in magnitude with age, it is a plausible index of developmental processes. Based on the literature, we proposed that children with ADHD would show decreased magnitude of beta ERD compared with age-matched peers. Methods: We recorded EEG while 25 children with ADHD and 25 age-matched controls (p=0.36), ages 8-12, performed a unilateral finger-tapping paradigm. We measured overflow using electronic goniometers. Our primary relevant EEG measure was beta event-related desynchronization (ERD) magnitude. Results: Compared with TD children, children with ADHD showed increased mirror overflow (d=-0.883, p=0.003) and decreased magnitude of beta ERD (d=-0.629, p=0.031). There was a significant inverse correlation between beta ERD and overflow in TD children (r=-.51, p=0.008); the correlation reached trend level in the ADHD group (r=-0.33,

p=0.1). Moderation analysis revealed that this relationship between beta ERD and overflow was not affected by diagnosis (p=0.73). Conclusions: Children with ADHD show increased mirror overflow and decreased beta ERD compared with TD peers. These measures appear inter-related in both groups of children, with no effect of diagnosis in moderation analysis. The findings thereby suggest that increased mirror overflow in ADHD are due to delay, rather than deviance, in motor system development.

2-O-94 Dynamic neural correlates of fear conditioning in children exposed to trauma and associations with psychopathology

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Objective: One potential mechanism linking childhood trauma (CT) exposure to psychopathology is fear learning, a phenomenon that is well understood in adult but not developmental populations. This study aims to describe how the neural correlates of fear learning unfold over time in children, as well as how CT may disrupt patterns of neural response in ways that contribute to psychopathology. Methods: 147 children (aged 8-16 years) with and without exposure to CT underwent a differential fear conditioning procedure during an fMRI scan. Dynamic patterns of learning were examined in voxel-wise parametric modulation analyses and region-of-interest analyses, and functional connectivity was assessed with whole-brain task-based connectivity analyses. Multiple regression was used to examine associations with psychopathology symptoms. Results: In children, canonical salience network regions (including amygdala, insula, anterior cingulate cortex) were active to the CS+ relative to CS- and exhibited habituation across learning blocks. Default mode network regions (including hippocampus, frontal pole, vmPFC, and posterior cingulate cortex) were active to CS- relative to CS+, and increased activation across learning blocks. Children with CT display blunted habituation to CS+>CS- in right amygdala and insula and smaller increases in right hippocampus and frontal pole to CS->CS+. Additionally, children with CT showed greater functional connectivity of amygdala with fronto-parietal regions associated with attention direction and initiation of defensive responses to CS+>CS-, and less amygdala-hippocampus connectivity. Patterns of altered dynamic neural response were associated with depression, generalized anxiety, and externalizing symptoms. Conclusions: Alterations in fear learning processes and the dynamic communication between salience network and default mode network regions may be a key mechanism underlying the link between CT and psychopathology.

2-O-95 Exploring the relationship between shared conscious experiences and the development of executive function in late childhood

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The transition period from childhood to adolescence is marked by tremendous cognitive change. While different cognitive systems mature, the conscious experiences of these individuals also become richer and more elaborate. The aim of the current project was to investigate whether changes in cognitive abilities are associated with shared conscious experiences in children aged 7 to 12. To quantify shared conscious experiences, we used degree of neural synchronization as measured by inter-subject correlations (ISC) from fMRI data (the Healthy Brain Network Biobank) acquired while participants (N=132) watched a short-clip of the movie "Despicable Me". In addition to focusing on synchrony in the fronto-parietal network (FPN), which has served as an index of shared conscious experiences, we also examined synchrony across six other networks of interest. Shared conscious experiences were linked to executive processing based on performance on four cognitive tasks. When comparing ISC across the age cohorts, we found no significant differences in sensory areas (i.e., auditory and visual networks). In contrast, there was a quadratic relationship between age and ISC within the FPN and ventral attention network. We also found that the degree of ISC within the dorsal attention and limbic networks were significantly, and positively associated with cognition on the tasks that emphasized attention and processing speed. Working memory performance was not significantly related to ISC in any of the networks. Contrary to

our hypothesis, the degree of ISC within the FPN was significantly negatively related to attention and planning tasks, suggesting that greater ISC is predictive of worse performance on these two tasks. These preliminary results suggest that shared conscious experience is associated with cognitive performance, but this link is driven by ISC in the limbic and dorsal attention network, and not FPN as we had hypothesized based on previous findings in adults.

2-O-96 Neural Correlates of Social Influence on Preferences in Adolescents

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Adolescents are characteristically sensitive to the influence of both positive and negative peer behaviors (e.g., delinquency, volunteerism). However, adolescents are not susceptible to peer influences to the same extent. A recent perspective suggests individual differences in adolescent brain structure and function underlie sensitivity to peer influence (Schriber, & Guyer, 2016). Thus, we examined adolescents' neural response to social influence on preferences in a two-phase fMRI paradigm. Participants included 43 adolescents (23 females, Mage = 17.16, SD = 0.41) recruited from the California Families Project, a 10-year, longitudinal study of Mexican-origin youth. Using a task adapted from Mason et al., (2009), participants first viewed a series of 20 abstract symbols they were told 200 similarly-aged peers rated as being "popular" or "unpopular." Then, while undergoing fMRI, adolescents completed two runs of 90 trials in which they viewed multiple presentations of the 20 previously socially tagged symbols (popular, unpopular) as well as 10 novel symbols (no prior social information), one symbol at a time. Preliminary evidence showed greater activation in the left nucleus accumbens (NAcc; $p<.01$) when adolescents viewed "socially tagged" compared to novel symbols. Additionally, participants displayed increased activity in the dorsal anterior cingulate cortex (dACC; $p<.05$) when viewing symbols rated as "popular" relative to "unpopular." This is consistent with findings that these brain regions are implicated in peer influence and social decision-making (Sherman et al., 2016; Wellborn et al., 2015). Additional analyses will test if neural response to social influence moderates the link between adolescents' behavioral reports of resistance to peer influence and risk-taking behaviors. This will allow us to gain a better understanding of the neural mechanisms underlying why some adolescents engage in risky behavior in the context of peers.

2-O-97 Increased DLPFC activation across childhood is related to decreased aggression following negative social feedback

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Regulating aggression in the case of negative social feedback is an important prerequisite for developing and maintaining social relations. Prior studies on aggression regulation following social rejection in adults suggest that the dorsolateral prefrontal cortex (DLPFC) might serve as a regulating mechanism. However, when and how this emotion regulation mechanism develops remains largely unknown. In the current study we investigated the development of aggression regulation across childhood in a longitudinal fMRI study. 456 same-sex twins (228 families) underwent two fMRI sessions across the transition from middle childhood (7-9 years) to late childhood (9-11 years). Aggression regulation was studied using the Social Network Aggression Task: Participants viewed pictures of peers that gave positive, neutral or negative feedback to the participant's profile. Next, participants could blast a loud noise towards the peer as an index of aggression. Confirmatory region of interest (ROI) analyses showed increased activation after positive and negative feedback, relative to neutral feedback, in the anterior insula (AI), inferior frontal gyrus (IFG) and medial PFC (mPFC). The AI showed increased activation over time, specifically for neutral feedback, whereas the IFG and mPFC did not show developmental effects. Predefined ROI analyses of the left DLPFC also showed a time by condition interaction, with increased neural activation for neutral feedback over time. Exploratory whole brain-behavior analyses at wave 2 showed a negative association between aggression and bilateral DLPFC, with increased DLPFC activity related to decreased aggression. Follow-up analyses on change showed that larger increases in DLPFC activity over time were related to larger

decreases in aggression over time, highlighting the importance of the development of this emotion regulation mechanism across childhood.

2-O-98 Self-evaluative neural associations with inflammation and depression

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Immune functioning is associated with depression, but the reasons for this link are unclear. One important step is to investigate neural mechanisms, given that there is research showing a relationship between inflammation, brain activity, and depressed mood in adults. This has not yet been explored in adolescence, even though it is a sensitive developmental period of brain growth, especially in social-related networks. Negative self-evaluation in the social domain is associated with depression in early adolescents, but the role of immune-related brain networks is unclear. The current study aims to examine cross-sectional associations between inflammation, brain activity during self-evaluative social processing, and depression in girls. Participants are part of an established community longitudinal cohort of adolescent girls (N=189), mean age = 11.57 years (S.D. = 0.83). The current study measured brain activity during a self-evaluation task where participants judged positively and negatively valenced trait adjectives from social and non-social domains, and reported if the trait is self-descriptive, as well as several inflammatory markers in saliva, and self-reported depressive symptoms. We predict that girls with elevated levels of salivary inflammation will have more depressive symptoms and differences in brain activity in ROIs related to the extended medial network and the visceromotor network during self-evaluative social processing. The results from this study may identify specific neural networks implicated in physical and mental health from a developmental perspective.

2-O-99 Atypical functional coupling between the amygdala and prefrontal regions during recognition of a broad range of emotions links traumatic violence and externalizing problems in adolescence.

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Children who experience interpersonal violence are at markedly elevated risk of perpetrating violence later in development. This is concerning, given that one-third of American youth have been exposed to violence by the time they reach adolescence. Emotion perception, the ability to identify cues of another's emotional state, follows a prolonged developmental course such that adolescents demonstrate markedly less sensitivity to affective cues than adults (Thomas, De Bellis, Graham, & LaBar, 2007). Consistent evidence suggests that violence-exposed children are more likely to overidentify anger (Pollak et al., 2000). However limited research to date has examined whether interpersonal violence exposure impacts ability to recognize the full spectrum of negative and positive emotions in adolescents. To that end this study examined the impact of interpersonal violence exposure on the development of emotion recognition, and its neural bases, as a mechanism linking interpersonal violence exposure and externalizing problems. Using fMRI, we assessed emotion recognition using a task designed to measure behavior and neural function during observation and identification of both negative (angry, scared, sad) and positive (excited, happy, calm) emotional stimuli in 50 adolescents (14-19 years, 25 with violence exposure). Planned analyses will examine group differences associated with both violence exposure and aggressive behavior during negative and positive affect recognition conditions in accuracy, reaction time, and functional recruitment of brain areas involved in emotional processes and their regulation, including the amygdala and medial PFC. Results will highlight the importance of considering atypical processing of a broad range of emotions in models of the developmental consequences of violence exposure in children.

2-O-100 Association between Internalizing Symptoms and Substance Use from Early to Late Adolescence: The Moderating Role of Neural Response to Social Exclusion

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Internalizing symptoms heighten risk for substance use in adolescents. One potential moderator is neural response to social exclusion, in that neural sensitivity to negative social interactions confers risk for concurrent substance use (SU). We tested if internalizing symptoms predict SU and how that pattern differs by neural response to exclusion. Adolescents (N = 165, M age = 17.16, 49% female, all Mexican-origin) from a sub-study of the California Families Project underwent fMRI during Cyberball, and completed questionnaires. Neural response to social exclusion was assessed at 16, and symptoms of anxiety, anhedonic depression, general distress, and substance use (alcohol, marijuana, and cigarettes) were assessed at 14, 16, and 18. Analyses were hierarchical linear regressions with interactions. Findings indicated that age 16 SU was correlated with concurrent internalizing symptoms, but largely not neural response. Age 18 SU was correlated with age 14 internalizing symptoms, and somewhat with neural response. Anterior insula (AI) at age 16 positively related to age 18 marijuana ($r = .23$, $p < .01$). Regressions (both concurrent and prospective) showed main effects of internalizing issues, and neural response, such as subgenual ACC. Interactions were only found for a few, like sgACC and anxiety in SU; and in simple slopes, low sgACC had a positive trend ($p = .06$) while high was nonsignificant ($p = .28$). Age 18 SU with earlier age 14 internalizing was similar, but with stronger effects. For example, age 18 marijuana use was predicted by activity in the AI at age 16 ($\beta = 0.33$, $p = .01$) and general distress at age 14 ($\beta = 0.27$, $p = .046$); but not the interaction ($\beta = 1.54$, $p = .14$). Conclusions center on how neural response to exclusion predicts SU; but not necessarily by moderating the influences of internalizing symptoms. Still, neural representation of negative treatment by others has implications for comorbidity of internalizing disorders and SU.

2-O-101 Brain activation during arithmetic in children with combined math and reading disability: The presence of reading disability modulates activity in the bilateral superior parietal lobules

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Math disability (MD or dyscalculia) and reading disability (RD or dyslexia) are characterized by poor accuracy and fluency in arithmetic or reading, respectively. It is unclear how arithmetic processing is affected by the presence of RD in children who have both disabilities (MD+RD). Behavioral and neuroimaging studies have found that children with RD have poor retrieval-based arithmetic (e.g., addition) due to their language-based impairments, but normal procedural arithmetic (e.g., subtraction). Therefore, brain function in left perisylvian regions would be expected to differ between children with MD and MD+RD during retrieval-based arithmetic. To test this hypothesis, we measured brain activity during addition and subtraction with fMRI in 16 Controls (age=10.1), 15 MD (age=10.6), and 25 MD+RD children (age=10.3). We focused the analyses on predetermined regions of the arithmetic network in both hemispheres: hippocampi, superior parietal lobules, intraparietal sulci, angular, supramarginal, inferior and middle frontal gyri. Group (Control, MD, MD+RD) x Task (addition, subtraction) x Hemisphere (left, right) ANCOVAs were conducted in these seven bilateral regions (with IQ as a covariate). No region showed a Group x Task x Hemisphere interaction, but there was a Group x Task interaction in the superior parietal lobules (SPLs), $F(2,52)=3.6$, $p=.033$: Control and MD groups had greater activation for subtraction than addition, whereas the MD+RD group had similar activity for both operations. There was also a main effect of Group in the angular gyri, $F(2,52)=5.6$, $p=.019$, where Controls had greater activation than the MD and MD+RD groups for both operations. These findings suggest that the presence of RD in MD+RD interferes with the SPLs' preference for subtraction over addition (observed in Controls and MD, but not MD+RD). Further, these results indicate MD and MD+RD have distinct as well as shared functional differences in the arithmetic network.

2-O-102 Individual Differences in Human Frontoparietal Plasticity

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Neural networks are thought to have unique critical windows of plasticity in development, though mechanisms underlying these windows in humans remain poorly understood. The frontoparietal network (FPN), which supports complex cognition and executive functioning, is thought to be especially plastic. Understanding individual differences in FPN plasticity could inform the design of cognitive interventions by determining their appropriate developmental timing and expected efficacy. Prior work has shown reductions in task activation and increased connectivity in the FPN following long-term cognitive training. However, long-term training may be shaped by differences in practice, sleep, and stress. Here, we measure neural and behavioral changes following short-term working memory (WM) training to understand individual differences in FPN plasticity. MRI scans were collected on 47 healthy adults before and after one hour of practice on an adaptive n-back task. Both MRI sessions included T1 and T2 structural scans, one n-back task, one resting state scan, and diffusion tensor imaging. Participants also completed a battery of learning assessments and questionnaires about life experiences. N-back accuracy increased significantly after training, $t(46) = 2.73$, $p < .001$. In a whole-brain analysis ($z > 3.1$, $p > .05$), WM training was associated with decreases in task activation throughout the FPN (lateral prefrontal cortex, intraparietal sulcus, cerebellum), consistent with greater neural efficiency. Individuals who showed greater learning showed greater increases in caudate activation, consistent with a transfer from cortical to subcortical processing. Our results suggest that short-term learning is sufficient to drive changes in FPN functional activation, and that individuals differ substantially in learning gains and neural activity. Future analyses will examine how individual differences in early life experiences relate to individual differences in learning and brain plasticity.

2-O-103 Real-life influences on the development of adolescent trust

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Social relationships increase in importance during adolescence, and an imperative component in establishing these relationships is trusting others. Research shows that neural mechanisms underlying trust behavior change across development and suggest age-related increases in trust levels. Experimental paradigms such as the trust game have been used to gain insights into trust behavior within dynamic social interactions. Social experiences during adolescence may influence the way in which trust develops and is adapted during interactions. These previous experiences can be examined through an adolescent's position within their social network, such as the position within their school class. We are conducting a 3 year longitudinal fMRI study in which 84 young adolescents (T1=12 years old) perform a fMRI trust game. We are also collecting peer nomination data from the participants and their classmates in order to assess their real-life social relationships. Currently, we are analyzing data of the first wave using both social network analysis and fMRI methods. The objective is to examine the relationship between adolescents' social network position and their trust behavior during repeated social interactions, as well as the underlying neural mechanisms. Based on our previous work we hypothesize that adolescents with a more peripheral position in their social network will be more responsive to the behavior of others during social interactions requiring trust. Their reduced influence within their social group requires them to be more adaptive to the thoughts and intentions of others to fulfill their own social needs, thus placing more trust in others. Furthermore, we expect differences in trust behavior related to social network position to be reflected in increased activation in areas previously associated with mentalizing such as the MPFC and TPJ. These findings will increase understanding of how real-life relationships impact neural and behavioral trust development.

2-O-104 Neural effects of autonomous choice on appetitive self-regulation during the transition to college

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The transition to college is marked by increased independence, but also increased engagement in health-risking behaviors (HRBs; e.g., alcohol, marijuana consumption). This transition and associated reductions to external regulatory

scaffolding may represent an inflection point in the development of self-regulation, such that individuals who have internalized self-regulatory behaviors and exert them autonomously may be better equipped to cope with this transition and less likely to engage in problematic HRBs. To investigate the relationship between autonomy and self-regulation during this transition, we conducted a longitudinal fMRI study in which 117 incoming college freshman performed a craving reappraisal task, used here as a model of appetitive self-regulation, during the summer before freshman year. In this 2 x 2 within-subject task with Action (look or regulate) and Choice (controlled or autonomous) as factors, participants either viewed personally-craved foods or reappraised their desire to eat these foods by focusing on the negative consequences of consumption. On controlled choice trials, participants were instructed whether to look or regulate, whereas on autonomous choice trials, participants freely chose whether to look or regulate. After the scanning session, participants completed quarterly surveys reporting their engagement in HRBs. All MRI data have been collected and the quarterly surveys will be completed in June. We will use univariate and multivariate machine learning methods to assess the degree to which controlled and autonomous regulation are distinguishable neurally. Then for each subject, we will generate multivariate pattern expression values for autonomous and controlled self-regulation separately and compare their ability to predict individual change in HRBs across freshman year. We expect that autonomous self-regulation will be associated with lower levels of HRBs at baseline and smaller increases in HRBs during the transition to college.

2-O-105 Contributions of Cumulative Parent Cortisol, Language in the Home, and Socioeconomic Status to 3-Month Infant Baseline EEG Power

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Prior research has found differences in infant neural activity based on socioeconomic status (SES). Two separate but related pathways by which environments of risk are thought to be associated with disparities in early neurocognitive development are through caregiver stress and language exposure. Research has yet to examine the effects of chronic parental stress and language exchanges in the home on infant brain activity within the first few months of life. Here we present preliminary findings from a sample of socioeconomically and ethnically diverse caregivers and their 3-month-old infants. Data from this preliminary analysis (N = 29) come from an ongoing longitudinal study with caregiver-infant dyads through the first year-and-a-half of life (final N = 100). Families visited the lab where maternal hair samples were collected and later assayed for cortisol (as a measure of chronic parental physiological stress), and 5-minutes of baseline electroencephalography (EEG) was recorded from the infant. In order to obtain a measure of the home language environment, caregivers were given the LENA home audio recorder and measures of adult words to the child, infant vocalizations, and conversational turns were analyzed. Frontal alpha power was examined as a neural indicator of brain maturation and early attentional abilities. Regression results showed no associations between SES (education or income) and infant alpha power. However, results indicated a negative, trend-level association between maternal hair cortisol and infant alpha power. Results also demonstrated a significant positive association between conversational turns and infant alpha power, with more dyadic reciprocal verbal interactions in the home linked to increased brain activity. Findings held even after controlling for SES. These results highlight the importance of the early home environment, over and above SES, on infant neural functioning.

2-O-106 Neural Networks Supporting Long-term Memory-Guided and Cued Attention in Children: Associations with Socioeconomic Status

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Background: Family socioeconomic status (SES) is associated differences in brain structure and function including in networks that support memory and attention. It remains unknown whether variation in SES is associated functional differences in regions that support long-term memory (LTM)-guided attention. LTM-guided attention is intact in children

as young as five and is critical for adaptive behavioral and academic functioning as it allows children to rely on their previous experiences to orient to relevant information in the environment. LTM-guided attention preferentially recruits the posterior nodes of the cognitive control network (CCN) compared to cued attention in adults. We sought to investigate the neural correlates of LTM-guided and cued attention in children and whether variation in SES is associated with functional differences during these two types of attention. Methods: Children (6-8 years) from a wide range of SES performed LTM-guided and cued attention tasks while undergoing functional MRI scanning (n = 78). Results: Unlike in adults, the posterior nodes of the CCN were not preferentially activated for LTM-guided compared to cued attention and activation patterns were largely overlapping for the two tasks including large swaths of both the CCN and dorsal attention network. Higher income was associated with greater activation in anterior nodes of the CCN including the middle frontal gyrus and dorsal anterior cingulate during cued attention. Higher parental education was associated with greater activation of the posterior nodes of the CCN, including the mid-cingulate and lateral intraparietal sulcus during both LTM-guided and cued attention. Discussion: This study highlights that SES is associated with differences in neural function for both attention and tasks that require cooperation between attention and memory. Future work will investigate whether these neural differences are a mechanism explaining SES-related differences in academic achievement.

2-O-107 Associations between brain function and cortisol reactivity during a stress task

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The Trier Social Stress Test (TSST) is a laboratory task used to study physiological responses to stress, including hypothalamic-pituitary-adrenal (HPA) axis activity (Kirschbaum et al., 1993). In adults, the Montreal Imaging Stress Test (MIST; Dedovic et al., 2005, 2009) implicated the anterior insula, ventral anterior cingulate, and ventrolateral and dorsomedial prefrontal cortex in the cortisol response. To date, the neural response corresponding to HPA axis activation has not been examined in adolescents, in part because no imaging task, including the MIST, elicits a reliable cortisol response. We introduce the Minnesota Imaging Stress Test in Children (MISTiC), a modified TSST that evaluates the neural correlates of stress responses in youth. Twenty-four 11-13-year-olds (M = 12.73) completed the MISTiC which includes giving a speech and completing math problems in front of two judges in an MRI scanner. Participants also completed another set of problems without judges present. Cortisol samples were collected before, during, and after scanning to assess participants' stress responses and was related to brain activity during the math portion of the task. Positive associations between brain activation and cortisol production were found in the paracingulate, superior frontal, and middle frontal gyri while negative associations were evident in the precuneus, bilateral angular gyrus, and left hippocampus during math with judges (p's < .005; cluster corrected p < .05). Contrasting math with judges greater than math without judges revealed a positive relationship between right opercular cortex and left postcentral gyrus activity and cortisol production (p < .005; cluster size > 100 voxels). Our results suggest the MISTiC paradigm reliably activates the HPA-axis in the MRI environment allowing concurrent collection of brain imaging and salivary cortisol data and providing a tool for studying neural activity related to the stress response during adolescence.

2-O-108 The role of gonadal hormone administration on social anxiety and amygdala response to threat faces in transgender youth

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Objective: Previous studies have demonstrated a link between puberty onset and increases in anxiety disorders - particularly among females. However, the role specific hormonal changes play in this increased risk are not fully understood. In the present study we examined the impact of chronic exogenous administration of both testosterone and estradiol on anxiety symptoms and patterns of brain activation in a group of adolescents at increased risk for internalizing disorders. Method: In this ongoing study, youth receiving different doses of testosterone or estradiol treatments for

clinical management of gender dysphoria, performed a version of the Hariri face matching task while undergoing functional MRI. Participants also completed the Leibowitz Social Anxiety Scale outside the scanner. Results: Preliminary results indicate that significantly greater amygdala activation occurred in youth receiving testosterone compared to youth receiving estradiol treatments. In addition, amygdala activation to angry faces demonstrated a significant dose-related increase in response to testosterone but not estradiol treatments. In contrast, overall levels of anxiety were higher in the group receiving estradiol than testosterone treatments and dose-related decreases in anxiety symptoms were reported for both hormones. Conclusions: The present results suggest that gonadal hormone administration may differentially impact activation of amygdala and experience of anxiety symptoms in gender dysphoric adolescents. This study adds to the growing literature on the impact of gonadal hormone exposure on activation of brain circuits and emotional experiences relevant for psychosocial development during adolescence.

2-O-109 Brain mapping during movie viewing using a new high density diffuse optical tomography system for preschool-age children

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Functional magnetic resonance imaging (fMRI) studies in children have provided much insight into the development of the brain's functional organization, but participant compliance remains a challenge in younger children. While children older than 4 years may be trained to remain calm and still and cooperate during tasks while alone inside an MRI scanner, younger children must usually be imaged while asleep. Other methods like functional near infrared spectroscopy (fNIRS) can be used in a more open scanning environment with awake children of any age, but the resulting data have much poorer spatial resolution. High density diffuse optical tomography (HD-DOT) is a high performance optical neuroimaging modality that uses a dense array of overlapping measurements to enhance image quality over traditional fNIRS and has been validated in adults using fMRI as a gold standard. Despite prior work in adults and neonates, children in between these two age groups have yet to be studied by HD-DOT and require age-appropriate optimization of the technology. Here we present a new HD-DOT system for preschoolers, featuring a 128-source by 125-detector console supporting the largest number of channels (>6700 source-detector pairs within 5cm) of any DOT system, lighter fiber optics, a child-sized cap with an expanded field-of-view, and new structural features for improved wearability and photometric registration, all housed in a child-friendly imaging suite. We validate the system in adults, showing expected cortical activations for visual, auditory and motor tasks, and then illustrate the feasibility of imaging 2-5 year-olds (n = 11 have tolerated >20 minutes of imaging so far). Because head motion, notorious for creating artifactual findings in developmental neuroimaging studies, is reduced in young children during movie viewing, we present on the reproducibility of cortical responses to movies as measured by our system and also map regions responding to movie features such as speech.

2-O-110 Neurocognitive development of inhibitory control and substance use vulnerability

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Recent work from our group indicates that adolescent substance use risk is associated with poor inhibitory control. However, it remains unclear whether youth at risk for substance use may follow divergent patterns of inhibitory control development. In the present study, we characterized developmental trajectories of inhibitory control performance and brain function in a large sample of adolescents at risk for substance use. As part of the National Consortium on Adolescent Neurodevelopment and Alcohol study (NCANDA), functional neuroimaging data during an antisaccade task were collected from 113 participants longitudinally for up to three time points (baseline ages 12 to 21 years). We tested the hypothesis that inhibitory control limitations associated with substance use risk factors would vary across development. Thus, at both the trial-level and within individual task-epochs (cue, preparation, response), we examined

whether substance use risk factors, such as dimensional psychopathology measures (externalizing, internalizing) and family history of substance use disorders, were associated with developmental differences in inhibitory control performance and BOLD activation. Results showed that, on average, externalizing and internalizing psychopathology predicted poor antisaccade performance. However, only externalizing psychopathology moderated age-related improvements in antisaccade performance, where greater externalizing risk was associated with a speed-accuracy tradeoff in early development that stabilized by adulthood. Mirroring this result, neuroimaging revealed that greater externalizing scores were associated with age-related increases in the posterior parietal cortex. Taken together, our findings indicate that risk for substance use, specifically trait-level externalizing psychopathology, is associated with inhibitory control limitations that are most evident in early adolescence, suggesting disinhibition may uniquely underlie risk for early substance use.

2-O-111 Examination of developmental effects of mirror overflow and speed during sequential finger tapping in children with and without ADHD

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Objective: Overflow movements (OF) are a developmental motor sign known to be increased in children with attention-deficit/hyperactivity disorder (ADHD). While OF has been shown to diminish with age in school-aged children, few studies have examined developmental effects in younger children. The objective is to examine the effects of age, diagnosis, sex, and their interactions on OF in children with ADHD and typically developing (TD) peers ages 5-12 years old. Methods: The study included 163 children (51 longitudinal, 54 girls, 88 ADHD) and 230 total data points. Total and phasic overflow (TOF; POF) and tap time were measured using finger twitch transducers. Linear regressions and linear mixed effects models examined effects of diagnosis (Dx), age, and sex and their interactions on TOF, left hand finger sequencing TOF (LTOF), right hand finger sequencing TOF (RTOF), POF, LPOF, RPOF, mean tap time (mTT), and standard deviation tap time (sdTT). Results: Linear regression analyses revealed significant effects of age ($p<0.001$) and Dx (all, $p<0.05$) on TOF, LTOF, RTOF, POF, LPOF, and RPOF, but no significant effect of sex. There was a significant effect of age ($p<0.001$) on mTT, but no significant effects of Dx or sex. There was a significant effect of age ($p<0.001$) on sdTT, a weak effect of Dx ($p=0.098$), and no significant effect of sex. Mixed model analyses revealed that for TOF, LTOF, RTOF, POF, LPOF, RPOF, and mTT there was a significant effect of age (all, $p<0.003$), but no significant effects of Dx, sex, or their interaction effects. The overall sdTT regression model was not significant ($p=0.52$). There was, however, a significant effect of age ($p<0.001$), but not of Dx, sex, or their interaction. Conclusions: Replicated prior findings in school-aged children with ADHD showing more OF than TD. New findings show OF decreasing across age, with no effect of diagnosis, suggesting that ADHD is associated with increased OF across a wide range of childhood development.

2-P-112 Functional connectivity at rest is similar across youths and adults and varies with genetic similarity

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Identifying a neural fingerprint (a characterization of brain function that can distinguish individuals from one another) is a major interest in neuroimaging research, as this could help develop targeted behavioral interventions. The current project applied support vector machine classifiers to resting state functional MRI (rs-fMRI) data (N=109, ages 8-35 yrs) in 2 datasets of twins (1 adult, 1 pediatric) and 2 datasets of repeat-scan individuals (1 adult, 1 pediatric). The classifiers were trained on spatial patterns of functional connectivity and used to predict individuals and co-twin pairs from independent data. The classifiers identified individuals from a previous scan with 100% accuracy, even when scans were

separated by months. In twin samples, classifier accuracy decreased as genetic similarity decreased: Accuracy of pediatric identical (MZ) twins was 52% (chance=6%, p<.001), but only 24% for fraternal (DZ) twins (chance=5%, p<.001). Similarly, classifier accuracy in the adult sample was 56% for MZ pairs (chance=4%, p<.001) and 22% for DZ pairs (chance=4%, p<.001). We then identified critical functional connections for each subgroup and combined them into adult and child sets. To assess the similarity of neural fingerprints across age groups, we retrained classifiers using connections identified in the opposite age group (i.e., group-common pediatric connections to identify adults). Classifier accuracies using opposite-age connections decreased by an average of 31% but remained significantly above chance in all but the adult DZ twins. Our results demonstrate that patterns of functional connectivity, identified using pattern classification of rs-fMRI data, are stable within individuals and families, and are similar over a few decades of life. Moreover, the degree to which these patterns of connections predict siblings' patterns of connections varies by genetic relatedness, suggesting a genetic influence on rs-fMRI data that is established early in life.

2-P-113 EEG Connectivity as a Biomarker for Predicting Schizophrenia Based on Machine Learning

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Background：Clinical neuroscientists increasingly postulate that schizophrenia is a neurodevelopmental disorder with abnormal network connectivity, which may be a diagnostic biomarker early in life before behavioral symptoms are evident. The nonlinear complexity of electroencephalography (EEG) is thought to contain information on the neural network. Early detection of brain abnormalities using EEG may act as a biomarker for schizophrenia, and therefore may provide a unique opportunity to forestall or ameliorate the poor social and cognitive functioning. This paper aims to demonstrate that the machine learning algorithm computed on the basis of brain network characteristics from P50 EEG data can be used as a biomarker of normal brain development and distinguish four groups of individuals, including those with first-episode schizophrenia (FESz), individuals at ultra high-risk (UHR), individuals at high-risk (HR), and healthy controls (HCs). Methods：Using whole-brain connectivity matrices as feature vectors, a machine learning algorithm XGBoost was used for the classification of the four groups, including 44 patients with FESz, 34 individuals at UHR, 19 individuals at HR and 39 HCs. Notably, the features were extracted from source-level P50 data as measured by standardized low-resolution brain electromagnetic topography (sLORETA) in an auditory sensory gating task. Results：The four groups (FESz, UHR, HR and HCs) showed successively decreased EEG connectivity in the gamma band of P50 components. Furthermore, the multiclass classification accuracy reached up to 85.7% of the four groups. Conclusion：This preliminary study suggests that brain network connectivity in the auditory sensory gating EEG signals may be a useful biomarker for early detection of risk for schizophrenia. The findings also indicate that a combination of machine learning and graph theoretic methods may assist in early objective diagnosis of neurodevelopmental disorders like schizophrenia.

2-P-114 Associations Between Infant Reactivity and Resting State Functional Connectivity

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Objective: Negative reactivity, a temperament characterized by distress and avoidance of novelty, emerges in infancy and predicts later behavioral inhibition (Fox et al, 2015). While early temperament is associated with disruptions in amygdala functional connectivity in adulthood (Schwartz et al, 2012), it is unclear whether this pattern emerges when temperamental reactivity first emerges. In the current study, we aim to evaluate the relations between infant reactivity and resting state functional connectivity (rs-fc). Methods: We will assess infant reactivity at 4 months by presenting infants novel stimuli and recording behavioral responses. Rs-fc will be assessed at 4 months using fMRI during 10 minutes of natural sleep. Our final sample size will be n=40. Analysis Plan: To evaluate temperament we are coding motor activity and affect during the presentation of novelty. We extract the sum of motor activity, positive affect, and negative affect. We then utilize support vector machine learning to estimate a hyperplane that maximally separates negative and positive

reactivity groups. To do so, we train a classifier using data from a previous cohort (n=291) and project the new sample's data onto the normal vector of this hyperplane, thus producing continuous factor scores of reactivity. To evaluate rs-fc, we use the infant resting state pre-processing pipeline developed for the Baby Connectome Project. We will then perform a seed-based analysis. We will select the amygdala as our seed and correlate the average BOLD time course in the amygdala with the insula (aI), dorsal anterior cingulate, and prefrontal cortex. We hypothesize that stronger amygdala-aI connectivity will be associated with negative reactivity. Implications: We will replicate and expand studies of rs-fc and fearful behavior (Graham et al, 2016; Rogers et al, 2017) and add rich behavioral phenotyping of temperament. Results will provide novel evidence about the mechanisms that support temperament.

2-P-115 Altered cortico-cerebellar connectivity in 6-week-old infants at high risk for ASD

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Objective/Methods: Cerebellar abnormalities are one of the most consistent findings in autism spectrum disorder (ASD), a neurodevelopmental disorder characterized by social and communicative deficits. At birth, cerebellar injury increases the risk for ASD by 36-fold, thus carrying the largest environmental risk. While the cerebellum is traditionally known for its role in motor control, it is also involved in many non-motor aspects including higher order cognition, language, and social learning. Children and adolescents with ASD show altered functional connectivity in cortico-cerebellar networks, but little is known about how cerebellar connectivity develops in early infancy. Here, we use resting-state fMRI to characterize functional connectivity in cortico-cerebellar networks in 6-week-old infants at high (HR) and low familial risk (LR) for developing ASD. Results: Whole-brain correlation maps generated from the cerebellum seed demonstrated reliable functional connectivity between the cerebellum and the thalamus, basal ganglia, and sensorimotor cortex in both groups. Compared to the HR group, LR infants exhibited greater connectivity between the cerebellum and subcortical regions. Interestingly, within the HR group, greater connectivity between the cerebellum and sensorimotor cortex at 6 weeks of age was associated with both decreased initiation of joint attention and more severe ASD symptomatology on the ADOS-T at 18 months. Conclusion: These results are consistent with previous findings in children and adolescents with ASD showing hyperconnectivity between sensorimotor cortex and the cerebellum compared to typically-developing controls. Taken together, these findings demonstrate that functional connectivity of cortico-cerebellar networks can be detected in early infancy and may provide a possible biomarker of ASD risk and future behavioral outcome.

2-P-116 Bilateral Frontal Aslant Tract Development and its Relation to Inhibitory Control in 4- to 7-Year-Old Children.

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The frontal aslant tract (FAT) is a recently discovered, bilateral long association fiber pathway (Catani et al, 2012) in the frontal lobe that is thought to play an important role in verbal fluency and speech production (Dick, Bernal, & Tremblay, 2014). The FAT is most commonly thought to connect the left hemisphere inferior frontal gyrus (pars opercularis and pars triangularis) to pre-supplementary motor area (pre-SMA) and supplementary motor areas (SMA) (Broce et al, 2015; Catani et al, 2013). Given its connectivity, many studies have focused on the FAT's relation to verbal fluency, but more recent work indicates that the FAT, primarily the right FAT, could play a role in executive control as well (Garic et al, 2018, Dick, Garic, Graziano, & Tremblay, 2019). Our study aims to expand on these previous findings by using diffusion tensor imaging to examine the relationships between both left and right hemispheric segments of the FAT and inhibitory control in a developing sample. The results indicate linear age-related decreases in both left FAT and right FAT, with decreasing mean diffusivity with age, which is not seen in whole brain mean diffusivity in this narrow age range. Additionally, mean diffusivity of the FAT in both hemispheres predicts better performance on the Head-Toes-Knees-Shoulders (HTKS) task,

even after controlling for confounding factors (age, sex, whole brain microstructure, parental income, movement in the scanner, and non-verbal IQ). Interestingly, only the right FAT predicted improved performance on the NIH flanker task, possibly indicating that the right FAT is more involved in the visuo-spatial domain of executive function. The study replicated previous findings that the FAT is related to inhibitory control and provides further insight into possible domain specialization across hemispheres.

2-P-117 Unique effects of age and pubertal development on amygdala-PFC connectivity during face processing

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Processing facial expressions of threat (anger) and distress (fear) is linked to psychopathology and is thought to be mediated, in part, by connectivity between the amygdala and regions of the prefrontal cortex (PFC). Though resting-state approaches have found that amygdala-mPFC connectivity strengthens with age (Gabard-Durnam et al., 2014), and several task-based studies suggest that amygdala-mPFC connectivity shifts from positive to negative connectivity with increasing age (Gee et al., 2013), there have been no studies to parse the effects of age from correlated pubertal development. The current study examined the overlapping and distinct effects of age and puberty on amygdala-PFC connectivity during emotion processing. Participants were from the Michigan Twin and Neurogenetics Study (N=265; Age=8-18 years), a population-based sample of twins (Burt & Klump, 2013). We used a large prefrontal mask of Brodmann's Areas 9,10,11,24,25,32, and 47 to characterized amygdala connectivity patterns with multiple prefrontal regions during an implicit emotional faces matching task. We examined changes in connectivity during angry and fearful face versus shapes conditions using Generalized Psycho-Physiological Interactions (McLaren et al., 2012). Perceived pubertal development was measured with the Pubertal Development Scale (Peterson et al., 1998). Covariates included gender and child race. Although both advancing pubertal development and chronological age were associated with greater right amygdala - right orbitofrontal (BA 11) and right amygdala - right medial prefrontal (BA 9) connectivity during fearful face processing, only pubertal development exerted unique effects (i.e., after accounting for age). Pubertal development was also associated with condition-specific changes in amygdala connectivity during angry face processing, where chronological age was not. Measures of pubertal development should be integrated into developmental studies of corticolimbic maturation.

2-P-118 Functional Development of the Social Brain in Middle Childhood

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The adult brain is finely tuned for social interactions, yet relatively scant research has explored how the social brain develops. In middle childhood, peer interactions increase in frequency and complexity. Thus, we might expect brain regions involved in social interaction (i.e. mentalizing, reward, and salience networks) to become more selective for social interaction and more integrated within functional networks. We investigated age-related differences in brain activation and functional connectivity (FC) during a peer interaction task. Forty-nine typically developing children aged 8-12 completed an fMRI task in which they alternately made predictions about a perceived-live social partner (Peer condition) or story character (Character condition). We measured activation during the prediction period and FC using beta-series correlation analysis. We derived mentalizing, reward, and salience ROIs from Neurosynth and, for each ROI, calculated the mean strength of correlations between the ROI and others in the same network (within-network FC). The activation contrast between Peer and Character conditions (P-C) decreased with age in right temporoparietal junction (RTPJ)--a core mentalizing region--and several reward and salience ROIs. In RTPJ, this effect was driven by greater activation to the Character condition in older vs. younger children. In contrast, P-C within-network FC increased with age across ROIs. We found a significant negative correlation between activation and within-network FC in left orbitofrontal cortex and negative trends in several mentalizing, reward, and salience ROIs. While our FC results indicate that social brain regions

become increasingly integrated within networks over middle childhood, our activation results do not suggest increasing selectivity for social interaction. Activation and FC showed a qualitatively inverse pattern, though this was not systematic across ROIs; we suggest further research into the relation between these measures.

2-P-119 Relating corticostriatal connectivity to goal-directed learning across adolescence

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Across adolescence, individuals must learn to make autonomous choices that are likely to yield rewarding outcomes. Theoretical and empirical work on reinforcement learning distinguishes between two strategies that may be deployed in learning. Model-free strategies involve learning through simple trial-and-error feedback and are thought to support habitual behavior. Conversely, model-based strategies, which involve a computationally demanding consideration of possible outcomes associated with each choice, are proposed to underlie goal-directed behavior. In adults, model-based learning is associated with stronger connectivity between the caudate, a region of dorsomedial striatum, and prefrontal cortex (PFC). Although recent studies have found that model-based learning increases with age, it is unclear how such behavioral changes relate to developmental changes in connectivity of corticostriatal circuitry. In the present study, we will examine how caudate-PFC connectivity changes with age and whether such changes predict age differences in goal-directed learning. Participants ages 8-25 underwent a resting-state functional connectivity scan and completed a task that assesses the degree to which they engage in model-based relative to model-free learning. We hypothesize that caudate connectivity with ventromedial and dorsolateral PFC regions increases with age, and that caudate-PFC connectivity strength mediates the relationship between age and model-based learning. Results from this study will improve our understanding of the development of goal-directed learning, as well as an array of motivated behaviors such as risk taking and impulse control that are also associated with corticostriatal function.

2-P-120 Striatal dopamine contributions to the development of frontostriatal connectivity in a reward learning context

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Developmental changes within the mesolimbic dopamine system are thought to contribute to heightened motivation and risk taking in adolescents. Initial studies indicate developmental decreases through adolescence in connectivity between reward striatal and executive prefrontal systems, possibly reflecting animal models of pubertal changes in dopamine (DA). However, the role of DA in developmental changes in frontostriatal reward processing is not understood in vivo in humans. Using direct and indirect measures of DA processing within the context of reward learning, we tested the hypothesis that there is heightened nucleus accumbens (NAcc)/ventromedial prefrontal cortex (vmPFC) connectivity associated with increased DA in the adolescent period versus adults. A Siemens 3T mMR was used to obtain MR (12-30 yo) and PET (18-30 yo) measures in 115 participants. Background connectivity, a measure of context-dependent changes in functional connectivity, was assessed by regressing out task-related components during a reward learning task. R2' was used to measure tissue iron changes as a non-invasive indirect measure of striatal DA processing. PET [11C]dihydrotetrabenazine (DTBZ) in adults provided a measure of presynaptic vesicular DA storage. Linear mixed-effects models revealed that during a state of reward-guided decision-making, functional coupling between the NAcc-and ventral anterior cingulate ($t=2.79$, $p=0.006$), subgenual cingulate ($t=2.29$, $p=0.02$), and posterior medial orbitofrontal ($t=2.24$, $p=0.03$) cortices decreased from adolescence to adulthood. These age-related decreases in NAcc-vmPFC connectivity were mediated by R2' indices of NAcc dopamine levels that were confirmed to be associated with PET DTBZ. These results provide new in vivo evidence of DAergic changes in adolescence underlying reward processing frontostriatal connectivity.

2-P-121 Predicting vulnerability to risk behaviors in a large cohort of children

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The prevalence of risky behaviors and substance abuse increases during adolescence. Using a data-driven approach, we sought to develop behavioral and neural models of vulnerability to risky behaviors in childhood. To identify a behavioral indicator of risk for use, responses to substance use-related questions were assessed in 11,875 nine- and ten-year-olds participating in the Adolescent Brain and Cognitive Development (ABCD) study (Casey et al., 2018; Lisdahl et al., 2018). A principal components analysis of responses revealed two orthogonal components that loaded highly on child knowledge of and intention to use substances (i.e., PC1) and familial factors related to substance use (i.e., PC2). Component loadings were validated across twenty-one sites to determine the reliability of dimensions associated with risk. Behavioral components were used to generate connectome-based predictive models (CPM; Shen et al., 2017) of risk based on resting-state neural connectivity. Individual differences in PC1 scores were significantly predicted in left-out subjects using CPM; however, neural models were not predictive of PC2 scores. These findings suggest that substance use-related risk factors can be quantified and predicted prior to initiation. Moreover, they may distinguish risk associated with child intent from familial risk that may emerge later in development. These findings set the groundwork for future prediction of early substance use initiation and chronicity.

2-P-122 Early-life Dentine Manganese Concentrations and Intrinsic Functional Brain Connectivity in Adolescents and Young Adults

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Early-life manganese (Mn), an essential nutrient and neurotoxicant, is associated with impaired cognitive and motor control and changes in the prefrontal cortex (PFC) and basal ganglia. We examined associations between early-life Mn concentrations and intrinsic functional connectivity (iFC) of the brain in adolescents and young adults, focusing on the PFC and basal ganglia. Measuring Mn in deciduous teeth allows a direct measure of fetal exposure and insight into early-life windows of vulnerability. 60 participants (33 girls; 15-23 years) from Northern Italy completed a resting state functional Magnetic Resonance Imaging (fMRI) scan and provided deciduous teeth. We used laser ablation inductively coupled plasma mass spectroscopy (LA-ICP-MS) to determine prenatal (2nd trimester - birth), early postnatal (0-1 years) and childhood (1-6 years) dentine Mn concentrations. We performed seed-based correlation analyses (FDR-corrected $p<0.05$) of associations between natural log-transformed Mn concentrations and iFC of 6 basal ganglia seed regions (left and right putamen, caudate, pallidum) and 1 PFC seed region (bilateral middle frontal gyrus) from Harvard-Oxford Structural Atlases, adjusting for socioeconomic status, age and IQ. Higher prenatal Mn was associated with: 1) reduced connectivity between the middle frontal gyrus and superior parietal lobule (ß = -0.21, FDR-corrected p = 0.001); 2) Increased connectivity between the right putamen and cerebellum (ß = 0.18, FDR-corrected p = 0.013). Higher early postnatal Mn was associated with: 1) reduced connectivity between the middle frontal gyrus and medial prefrontal cortex (ß = -0.24, FDR-corrected p = 0.009); 2) increased connectivity between the left pallidum and precuneus (ß = 0.13, FDR-corrected $p< 0.001$). Higher prenatal and early postnatal Mn concentrations are associated with altered iFC of brain areas involved in cognitive and motor control in adolescents and young adults.

2-P-123 Gender effects in the relationship between parenting and resting-state functional connectivity in the ABCD Study

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Objective: To determine how gender may affect the relationship between parenting and resting-state functional connectivity (rsfc) in a large sample of preadolescent children. Methods: We utilized data from the Adolescent Brain Cognitive Development (ABCD) study to examine potential gender differences in the relationship between parenting and rsfc among the frontoparietal network (FPN), default mode network (DMN), and amygdala. Parenting measures included the Acceptance scale of the Children's Report of Parent Behavior Inventory (CRPBI; Schludermann & Schludermann, 1988), which measures the child's perception of parental warmth and emotional acceptance, and the Conflict subscale of the Family Environment Scale (Moos & Moos, 1994). Generalized additive mixed models were run using the 'gamm4' package in R on the ABCD Interim Annual Release 1.1, which includes data on 4521 children ages 9-11 years. CRPBI-Acceptance scores were examined separately for maternal and paternal acceptance. Results: For maternal acceptance, there was a main effect of gender in the prediction of rsfc between the DMN and left amygdala (b=0.12, SE=0.05, p<.03) that was qualified by an interaction (b=-0.04, SE=0.02, p<.04) such that the relationship between maternal acceptance and rsfc was significant for boys but not girls. There was additionally a main effect of paternal acceptance on FPN to DMN rsfc (b=-0.01, SE=0.01, p<.04). A main effect of family conflict was found for FPN to left amygdala rsfc (b=0.004, SE=0.001, p<.02). There were also main effects on FPN to DMN rsfc for both conflict (b=0.002, SE=0.001, p<.01) and gender (b=0.01, SE=0.003, p<.01), but these were qualified by an interaction (b=-0.002, SE=0.001, p=.04) that indicated an effect for girls but not boys. Conclusions: The data support the presence of gender differences in the effects of maternal acceptance and family conflict on rsfc. We will test these effects again in the entire ABCD sample when the dataset is released.

2-P-124 Regulatory ability in infancy mediates the association between newborn amygdala connectivity and future internalizing symptomology

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The ability to modify the duration or intensity of emotions begins to emerge during infancy (regulatory ability) is essential for mental and physical health across the lifespan. However, the neurobiological underpinnings of early emerging regulatory abilities and implications for subsequent behavioral outcomes remain poorly understood. The aim of the current study is to examine how newborn amygdala connectivity relates to early emerging regulatory ability and future internalizing symptomology (INT). Methods: High quality resting state functional MRI data collected in 70 neonates (scan age 22.5±9.1 days) was used to analyze amygdala connections implicated in negative emotionality (amygdala-insula and amygdala-medial prefrontal cortex). Regulatory behavior and emotionality at 6-months-of-age were rated during a laboratory stress task, the still-face episode of the Still-Face Paradigm, using a previously established coding scheme. Latency to express negative emotionality (termed latency to distress; LTD) was examined as an indicator of infant's regulatory ability. INT was assessed using the Child Behavior Check List at 24-months-of-age. The mediating effect of LTD on the association between newborn amygdala connectivity and emerging INT was examined using regression analyses adjusting for infant gestational age at birth and scan age, and maternal depressive symptomology. Results: Stronger newborn Am-MPFC connectivity was associated with longer LTD ($\beta = 75.12 \pm 26.83$, $p < 0.01$), conceptualized as indicative of greater regulatory ability. Furthermore, longer LTD mediated the association between stronger connectivity and lower INT at 2-years-of-age ($\beta = -3.71$, 95% CI [-10.06, -0.57]). Conclusions: Regulatory ability during infancy mediates the association between newborn amygdala connectivity and future internalizing symptomology. These results have implications for identifying etiology of future psychopathology and improving early risk assessment.

2-P-125 Stress exposure in early childhood relates to altered midbrain functional connectivity

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Exposure to early life stress has been linked to disruptions in reward processing. Previous studies suggest that these deficits in reward processing may be mediated by impaired functioning in dopaminergic pathways originating in the ventral tegmental area (VTA) and substantia nigra (SN) in the midbrain, and terminating in the nucleus accumbens, hippocampus, amygdala, and medial prefrontal cortex. Recent work in rodent models has found that exposure to early life stress induces transcriptional changes in VTA that increase stress susceptibility later in adulthood (Peña et al., 2017). This suggests that early stress exposure can set up latent vulnerability in reward circuitry that may not become visible until later in life. Currently, it is unknown whether parallel stress-related vulnerabilities in reward circuitry are detectable in young children. To address this question, we conducted a resting-state functional connectivity analysis with 4- to 7-year-old children (n = 79), using a probabilistic midbrain atlas definition of the VTA and SN as the seed (Murty et al., 2014). To assess stress exposure, parents were asked to report on their child's experiences with stressful life events during the previous year. In a whole-brain analysis (cluster-defining threshold $p < .001$, FWE-corrected threshold $p < .05$), we found that greater exposure to stressful life events is associated with decreased functional connectivity between the midbrain (VTA and SN) and dorsal medial prefrontal cortex (dmPFC). Our findings suggest that the connectivity between key reward regions may begin to show stress-related functional changes even in young children. Future work will investigate how early stress-induced changes in midbrain dopaminergic projections impact cognitive and affective development.

2-P-126 A history of maternal childhood maltreatment is associated with neonatal amygdala and hippocampal resting state functional connectivity

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Childhood maltreatment (CM) confers deleterious, long-term, mental, and physical health consequences, and growing evidence suggests some of these effects may be transmitted across generations. Children with mothers exposed to CM have an increased risk for emotional and behavioral problems, which may reflect underlying altered amygdala and hippocampal functioning. Therefore, we examined the association between maternal CM exposure and her offspring?s amygdala and hippocampal connectivity. Maternal CM history was assessed during pregnancy using the Childhood Trauma Questionnaire (CTQ) in 65 women. Shortly after birth (M=38.95±1.43 days), their offspring underwent a resting state functional connectivity (rsFC) MRI scan during natural sleep. A whole-brain grayordinate regression model was performed with the total CTQ score predicting offspring amygdala and hippocampal connectivity. Gestational age at birth and infant age at scan were included as covariates to account for neonatal brain maturity. Higher maternal CM was associated with stronger neonatal left amygdala connectivity to anterior insula rsFC ($p=.042$) and dorsal anterior cingulate cortex (dACC; $p<.01$). CM was also associated with stronger hippocampal to orbitofrontal cortex connectivity ($p<.01$), an area associated with emotional appraisal. Maternal CM history is associated with altered neonatal amygdala and hippocampal connectivity. As prior work has highlighted transgenerational effects of CM, the path by which children of CM-exposed mothers might see increased risk for affective disorders might be through these affected circuits. Since alterations in amygdala and hippocampal connectivity are observed shortly after birth, this effect is likely to have originated during the child?s intrauterine period of life. Future work aims at identifying environmental and maternal biologic and physiologic factors that might mediate such a relationship during pregnancy.

2-P-127 Developmental Variations in Corticostriatal Thalamocortical Circuits and their Relationship to Psychopathology

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Detailed characterizations of brain development are essential to understanding factors underlying the emergence of psychopathology and its progression. Corticostriatal thalamocortical (CSTC) circuits are central to current models of both externalizing and internalizing psychopathologies. However, our understanding of their development and the impact of pathologic processes on these circuits is primarily limited to regional structural properties and specific disorders (e.g., Attention Deficit Hyperactivity Disorder). As such, there is a need for a more comprehensive examination of CSTC circuit development and its relations to psychopathology. The overarching goals of the proposed work are to characterize the development of CSTC circuits using structural MRI and resting state functional MRI, and to link variations in their trajectories to the emergence of psychopathology. We will model developmental trajectories of structural morphology and functional interactions within seven CSTC networks defined based on their connectivity with large-scale cortical networks and relate deviations to externalizing and internalizing behaviors. Specifically, we will use the Healthy Brain Network, a large developmental sample, (n = 1379) for the purposes of delineating trajectories for the seven CSTC networks. We train age-prediction models for each of the networks and pool their predictions to generate multivariate CSTC maturity profiles for each individual. These profiles will be used to subtype individuals into neurobiologically homogenous subgroups, which are expected to differ with respect to dimensional measures of psychopathology calculated using the bifactor model framework (i.e. general psychopathology [p-factor], internalizing, externalizing). We aim to estimate the developmental trajectories of seven CSTC networks and determine associations between CSTC network maturity profile subtypes and dimensions of psychopathology.

2-P-128 Functional Brain Network Development During Early Childhood

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Early childhood is a time of rapid growth in cognitive skills, yet the accompanying changes in brain network architecture are not well understood. In this work, we examine the development of canonical functional systems in a sample of 47 children ages 4-10. We find that average within-network connectivity is positively associated with age ($\beta=0.25$, $p < 0.001$). Specifically, we observe positive associations between age and within-network connectivity in the visual ($\beta=0.27$, $p = 0.047$) network, consistent with evidence that sensory networks develop earliest, as well as in the default mode network (DMN) ($\beta=0.27$, $p = 0.027$). The DMN is detectable in utero, but continues to develop through late adolescence. Future work is necessary to characterize whether developmental changes in the DMN in early childhood differ qualitatively from those observed in other stages.
 We observed a weak negative relationship between age and average between-network connectivity ($\beta=-0.04$, $p < 0.001$), which varied across systems. Visual to dorsal attention connectivity was positively associated with age ($\beta=0.26$, $p = 0.022$). DMN to ventral attention network connectivity was negatively associated with age ($\beta= -0.34$, $p < 1 \times 10\text{-}4$), as was DMN to dorsal attention connectivity ($\beta= -0.17$, $p = 0.022$). All analyses controlled for motion, sex, and average network weight. These findings suggest continued development of the dorsal stream in early childhood, as well as increased segregation between externally directed attention processes and internally oriented cognition. However, our sensitivity to developmental changes in early childhood may be limited by the use of an adult-derived parcellation and network partition. Our ongoing work with the ABCD sample examines how these findings change with the use of developmentally specific parcellation. This work yields valuable insight into the development of functional network architecture in early childhood.

2-P-129 Functional subdivisions of the hippocampus defined in individuals

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The hippocampus and prefrontal cortex have protracted development. Interactions between the hippocampus and executive function (EF)-related cortical regions support memory-guided, goal-oriented behaviors. Studies show the hippocampus is functionally connected to the default mode network (DMN), which is important for self-referential thinking, memory and social/affect processing, but not for EF. Given the diverse role of the hippocampus, it is unclear how the hippocampus is functionally correlated to other networks. Candidates include the parietal memory (PMN) and the fronto-parietal (FPN) networks. The PMN is associated with a novelty vs. familiarity signal in memory encoding and retrieval, whereas the FPN is thought to underlie EF. Recent work demonstrates individual-specific features of network organization in the cortex and cerebellum. As a first step in understanding the development of hippocampal network organization within individuals, we used a dataset of 10 adults with 300 minutes of resting-state fMRI data per subject (Midnight Scan Club) to precisely characterize hippocampal functional subdivisions. A winner-take-all analysis using 15 infomap-generated cortical networks demonstrated an anterior-posterior split in hippocampal network connections, such that DMN was connected to anterior hippocampus, but PMN and FPN connected to posterior hippocampus. Functional connectivity maps generated from seeds placed in the hippocampal functional subdivisions respect cortical network boundaries. Individual-specific description of hippocampal functional subdivisions has revealed previously undescribed associations with the PMN and FPN. The presence of both memory-associated (DMN, PMN) and EF (FPN) networks suggests the hippocampus has a broader network of functional associations than previously thought. Future studies will investigate how individual differences in hippocampus functional organization plays a critical role in memory and EF development.

2-P-130 The Human Coparental Bond Implicates Distinct Corticostriatal Pathways: Longitudinal Impact on Family Formation and Child Well-Being

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The coparental bond - a relationship of solidarity and commitment between two adults who join their effort to care for children - is a central contributor to children's well-being and sociality. Here, we followed 84 first-time co-parents (42 couples) across the first six years of family formation, including opposite-sex and same-sex couples, measured brain response to coparental stimuli, observed collaborative and undermining coparental behaviors in infancy and preschool, assayed oxytocin (OT) and vasopressin (AVP), and measured coparenting and child behavior problems at six years. Across family types, coparental stimuli activated the striatum, specifically the ventral striatum and caudate, striatal nodes implicated in motivational goal-directed social behavior. Whole brain PPI indicated that caudate functional connectivity patterns differentiated distinct corticostriatal pathways associated with two stable coparental behavioral styles; Caudate-vmPFC connectivity strengthened as collaborative coparenting increased and was associated with OT, while caudate-dACC connectivity tightened with the increase in undermining coparentingand correlated with AVP. Finally, parental caudate-vmPFC connectivity in infancy predicted lower child externalizing symptoms at six years as mediated by collaborative coparenting in preschool. Findings indicate that the coparental bond is underpinned by striatal activations and corticostriatal connectivity similar to other human affiliative bonds; highlight specific corticostriatal pathways as defining distinct coparental orientations that underpin family life; chart brain-hormone-behavior constellations for the mature, child-orientated coparental bond; and demonstrate the flexibility of this bond across family constellations and its unique contribution to child well-being.

2-P-131 A multisample, multimethod study of connectivity mechanisms linking pubertal development and depression in adolescence

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Earlier pubertal timing is associated with depression risk (e.g., Keenan et al., 2014) and brain white matter alterations in adolescence (Chahal et al., 2018). There remains a need to elucidate neurobiological mechanisms linking pubertal timing and depression. Pubertal development may have enduring effects on functional (FC) and structural (SC) connectivity of emotion regulatory regions, contributing to depression. We tested associations between pubertal timing, connectivity, and depressive symptoms in two longitudinal cohorts. In Study 1 (68 boys and girls from the California Families Project) and Study 2 (107 girls from the Pittsburgh Girls Study), pubertal development was reported annually (age 9-16). Depression symptoms were assessed annually (age 10-16 in Study 1; age 10-19 in Study 2). Resting fMRI was collected at age 16 in Study 1, and diffusion MRI at age 19 in Study 2. Gompertz Growth Modeling was used to estimate pubertal timing; multilevel growth modeling was used to estimate depressive intercept and slope. Subnetworks associated with pubertal timing and depression were identified. Moderation of regional brain connectivity on the association between pubertal timing and depression was tested. In both studies, earlier pubertal timing was associated with higher initial depressive severity (age 9), and later pubertal timing with higher depressive slope (age 9-16/19; ps<.05). Overlapping frontal-subcortical (e.g., frontal gyri with insula) regions showed higher SC and FC with earlier pubertal timing and depression in both studies. Node strength (sum of connections) of affective regions (e.g., insula) moderated the relation between pubertal timing and depression. The findings are the first to demonstrate that individual differences in pubertal maturation are associated with depression course and brain connectivity in adolescence. Connectivity of specific regions offers insight as to who shows greater risk for depression, via pubertal development.

2-P-132 Covariance regression as a method to investigate age, ADHD, and overflow-related changes in resting-state functional connectivity

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Covariance regression (CR) identifies brain subnetworks that demonstrate population or individual variation in functional connectivity (FC). Unlike standard pairwise FC methods which require separate models for every pair of regions/networks, CR avoids large numbers of univariate tests. By applying CR to independent components (ICs) from group ICA, we can reconstruct principal component (PC) brain maps comprised of orthogonal groupings of ICs associated with variables of interest. Here we used CR to estimate FC patterns associated with an objective measure of motor control among 8-12 year-olds with attention deficit/hyperactivity disorder (ADHD) (n=57, 14 girls) and their typically developing (TD) peers (n=45, 15 girls), namely overflow movements. Age-inappropriate overflow is thought to reflect immaturity in brain systems involved in inhibiting extraneous movement. Behavioral results confirm that overflow decreases with age (p=.008) and that greater overflow is observed among children with ADHD (p=.005). We modeled a three-way interaction between diagnosis, sex and overflow, with age and handedness as covariates, and found two PC FC groupings associated with age and overflow. For PC1, FC between somatomotor/visual attention areas and subcortical/parietal association areas decreased with age and overflow among TD boys. Holding age constant, ADHD boys also showed greater FC among these networks, consistent with a developmental delay model of ADHD. For PC2, FC between supplementary motor/opercular regions and visual attention/executive control regions increased with age and showed a diagnosis x sex interaction: ADHD girls showed stronger FC, whereas ADHD boys showed weaker FC, compared to sex-matched TD children. In this study, CR revealed patterns of FC related to diagnosis, motor signs, and demographics

that are masked by typical pairwise FC methods. This is further evidence that CR is useful for investigating complex relationships associated with brain development.

2-P-133 Altered brain connectivity in children with autism spectrum disorder is associated with reaction time variability

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Objective: Research shows that many types of psychopathology are characterized by variable reaction times1. The literature is mixed with regards to whether reaction time variability (RTV) is characteristic of autism spectrum disorder (ASD)2, and few studies have investigated the neural signature of RTV in ASD. Our objectives were to 1) identify networks preferentially engaged by children with ASD, 2) determine whether network engagement was associated with RTV, and 3) identify hubs within the network that significantly correlated with RTV. Method: fMRI resting state (two 5-minute scans, eyes open) and go/nogo task data were acquired from 15 children with high-functioning ASD (M=10.2, SD=0.9 years; 80% male; IQ M=109.1, SD=9.0) and 12 typically developing children (M=10.9, SD=1.2 years; 42% male; IQ M=112.2, SD=13.1). Whole-brain connectivity was compared for the ASD and control groups3. Connectivity values were extracted from the subnetwork in which the ASD group had greater connectivity than controls, and the total strength of connectivity for each participant was correlated with RTV on the go/no go (i.e., ex-Gaussian indicator, tau). Results: Children with ASD had greater connectivity than controls in a diffuse network spanning both hemispheres. Although the groups did not differ significantly on tau (ASD M=108.9, SD=55.3; control M=111.2, SD=72.4), tau had a significant positive correlation with the strength of connections in the ASD>control network (r=.628, p=.009). Hubs (nodes with >90th percentile for eigencentrality) within the network were localized to left parietal cortex, fusiform, and caudate, and right superior fronto-parietal cortex. Conclusions: These findings suggest that the strength of connections in the network that was preferentially engaged for children with ASD were associated with greater RTV. This is consistent with literature suggesting executive dysfunction in ASD may be related to compromised workings of the fronto-parietal networks4.

2-P-134 Social cognition deficits associated with psychotic-like experiences and functional dysconnectivity in salience and cognitive control networks in adolescence

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Previous findings suggest that dimensions of psychopathology can be mapped onto patterns of altered functional network connectivity (FNC: temporal coherence of specific brain regions averaged over an entire resting state scan), with focused dysconnectivity of the cognitive control and default mode networks (DMN). However, it is unknown how these associations interrelate with cognitive deficits, which often accompany psychopathology. Here, we investigate relationships between FNC, cognition, and psychopathology in youth. Parallel independent component analysis (pICA) is a multivariate approach able to capture associated clusters of alterations from different input modalities. pICA was performed on measures of FNC, composite scores of memory, executive function, complex cognition, social cognition, and dimensional measures of psychopathology in 581 individuals aged 8-22 years from the Philadelphia Neurodevelopmental Cohort (PNC). Increased connectivity of the cognitive control network with the salience network and DMN, and decreased connectivity between the salience network and subcortical areas were significantly correlated with a social cognitive component (Pearson's r=0.16, t=3.85, p=0.0001). The cognitive component was also significantly negatively associated with a psychopathology dimension that encompassed symptoms such as magical thinking, grandiosity, and acoustic hallucinations (Pearson's r=-0.13, t=-3.06, p=0.003). However, the association between FNC and the psychopathology component did not reach significance. Social cognition exhibited a positive association with core networks of social processes, and a negative association with psychotic-like symptoms, corroborating previous reports of

altered social cognition in individuals with overt psychotic illness and those at-risk. This analysis expands on previous findings of network dysconnectivity associated with cognition and psychopathology in adolescence.

2-P-135 Association of default mode network functional and structural connectivity with social responsiveness in autism

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Autism spectrum disorder (ASD) is characterized by deficits in social communication and interaction. Previous research suggests that aberrant functional connectivity (FC) of the default mode network (DMN) may play a significant role in these deficits, but few studies have investigated both structural connectivity (SC) and FC concurrently in children with ASD. We investigated associations between both FC and SC of the DMN, specifically the posterior cingulate cortex (PCC) and the medial prefrontal cortex (mPFC), with social responsiveness measured by the Social Responsiveness Scale (SRS) in a group of children with ASD (n = 23) and typically developing (TD) children (n = 34). DMN regions-of-interest (ROIs) in the PCC and the mPFC were identified using group independent component analysis (ICA). FC was measured as the correlation of the BOLD signal between the PCC and mPFC, while SC was measured as the fractional anisotropy (FA) of the cingulum bundle connecting the PCC and mPFC ROIs. We found that FC and SC were not significantly different between groups, and were not significantly correlated with SRS subscales across groups. These null findings may be due to the relatively small sample size and resulting limited power. Ongoing data collection efforts will increase the sample size and permit investigation of these relationships in a larger sample.

2-P-136 PTSD- and IPT-related differences in intrinsic connectivity in a pilot sample of female adolescent survivors of sexual assault with PTSD

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Background: Gender, trauma-type and age of trauma exposure each contribute to PTSD risk, symptomatology and neural correlates. Although adolescent girls are particularly vulnerable to sexual assault and PTSD, little is known about neural correlates of PTSD and treatment in this group. The current study examines PTSD- and treatment-related changes in resting state functional connectivity (RSFC) in adolescent girls with PTSD following sexual assault. Regions of interest include limbic areas, previously associated with PTSD, and nodes of the DMN, which are important for social cognition, the targeted mechanism of change in IPT. Methods: Six female adolescents with PTSD resulting from sexual assault and 5 same-aged female healthy controls participated in a pilot study at the University São Paulo, Brazil. PTSD symptoms were assessed using the CAPS. RSFC was examined using SPM 12 and the CONN toolbox. Results were found using a whole-brain voxel-wise threshold of $p<0.001$, with a cluster-size FDR corrected threshold at $p < 0.05$, two-sided. Results: Participants who completed treatment no longer met criteria for PTSD. Replicating previous studies, PTSD patients had decreased connectivity between the right hippocampus and the PCC, a key node of the DMN, before treatment, (peak MNI: -22, -58, 12, cluster size: 89 voxels). Symptom improvement following treatment was associated with increased connectivity between limbic seeds and DMN nodes (amygdala - lateral parietal cortex (LP), peak MNI: 40, -54, 16, cluster size: 33 voxels), and DMN seeds and limbic regions (left LP and right hippocampus: peak MNI: 22, -26, -31, cluster size: 31 voxels; right LP and right hippocampus: peak MNI: 24, -28, -12, cluster size: 46 voxels). Conclusions: Adolescent girls who develop PTSD following sexual assault can be treated using group IPT for PTSD. Symptom improvement is associated with changes in RSFC in DMN nodes, consistent with IPT's focus on making positive changes in social interactions.

2-P-137 Underconnectivity between the rostral prefrontal cortex and sensorimotor cortex associated with better fine motor skills in toddler with autism spectrum disorders

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Introduction Among the first symptoms of autism spectrum disorders (ASDs) early in life are abnormal processing and responsivity to sensory stimuli, and atypical motor patterns, including gross and fine motor delays. Atypical functional connectivity of the salience network (SN) - a brain network that receives convergent input from multiple sensory modalities - has been previously reported in adolescents with ASDs. However, little is known about functional connectivity between SN and sensorimotor networks early in life in autism. Methods Anatomical MRI and resting state fMRI data were acquired during natural sleep from 19 toddlers with ASDs (9 females; age 28.2 ± 6.8 months) and 20 typically developing (TD) toddlers (6 females; age 27.2 ± 7.1 months). Region of interest (ROI) functional connectivity analysis was conducted with SN and sensorimotor and visual ROIs extracted from the HCP dataset. Average pairwise correlations were Fisher's z-transformed and directly compared between ASD and TD groups with two-tailed independent-sample t-tests. Results Toddlers with ASDs displayed weaker connectivity between SN (right rostral prefrontal cortex [RPFC]) and sensorimotor (superior sensorimotor cortex) regions ($p < .01$, FDR corrected). A positive correlation with age was observed in toddlers with ASDs ($r=0.36$) but not in TD children. Further, the connectivity between SN and sensorimotor cortex was positively correlated with better fine motor skills, as measured with the Mullen Fine Motor Scale, in TD toddlers ($r=0.32$), but negatively correlated with fine motors skills in toddlers with ASDs ($r=-0.36$). Conclusions The age-associated increase of the underconnectivity between one of the SN nodes and sensorimotor cortex observed in toddlers with ASDs suggests delayed maturation of this circuit. The differential correlation with fine motor skills suggests that atypical SN-sensorimotor brain connections may play a role in motor delays observed in the first years in ASDs

2-P-138 Salience Network Connectivity Relates Differently to Sensory Over-Responsivity in Males vs. Females with Autism Spectrum Disorder

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Objective:Individuals with an autism spectrum disorder (ASD) have higher rates of sensory over-responsivity (SOR) compared to their typically developing peers (Liss et al., 2005). These atypical behaviors are related to abnormal connectivity in the Salience Network (SN), suggesting that sensory stimuli are overly salient for individuals with ASD (Green, 2016). However, most studies examining the neurological basis of sensory processing have been done with primarily male samples, so little is known about sex differences in the neurobiology of SOR in ASD. Methods:The relationship between SOR and SN resting-state functional connectivity (rsFC) was examined and compared between 33 boys and 11 girls with ASD, age 8-17, using 8-minute resting-state fMRI scans. SOR was measured with parent-report on the SenSOR Inventory (Miller, 2004). SOR was correlated with parent report of anxiety ($r=.30$, $p<.05$), as measured by the SCARED (Birmaher, 1999), so anxiety was covaried in rsFC analyses. The anterior insula (AI; Seeley, 2007) was used as the seed in these analyses and its functional connectivity with the whole brain was correlated with SOR (thresholded at $Z>2.3$; corrected for multiple comparisons at $p<.05$). Results:There were no sex differences in SOR. SOR positively correlated with connectivity between the AI and prefrontal regions in females but correlated with connectivity between the AI and somatosensory/auditory regions in males. Connectivity with these sensory regions was negatively correlated with SOR in females. Conclusions:Results suggest that the underlying mechanisms of SOR in ASD are sex-specific, with SOR symptoms potentially impacting higher level processing differently in males and females and conferring unique profiles of impairment/adaptation. SOR may be more related to increased salience of extraneous sensory information in males and increased regulation of social-attentional engagement in females, emphasizing the importance of studying the sexes separately.

2-P-139 Distinct forms of childhood adversity are associated with differential patterns of intrinsic connectivity in reward-related neural networks

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Alterations in reward processing are associated with increased risk for psychopathology following childhood adversity (CA; Sheridan et al., 2018). CA is associated with altered reward-related neural function (Hanson et al., 2015), but it remains unknown whether CA impacts connectivity of the fronto-striatal valuation network at rest. Typically developing youths exhibit positive connectivity among reward processing regions (i.e., nucleus accumbens, NAcc; and ventral medial prefrontal cortex, vmPFC) at rest (DiMartino et al., 2008). Reduced connectivity of this network is associated with increased impulsivity and reward sensitivity (Crane et al., 2017). Given that CA is associated with alterations in both neural and behavioral markers of reward processing, we examined the association of distinct forms of CA on the intrinsic connectivity of this network at rest among 127 participants aged 8-17. We defined seeds in bilateral NAcc and performed a whole brain resting-state functional connectivity analysis. We examined whether different forms of CA (i.e., violence, food insecurity, and caregiver neglect) were associated with altered connectivity with the NAcc. Results revealed distinct patterns of connectivity across different adversity types. Specifically, violence-exposed youths exhibited greater NAcc connectivity with left putamen, visual cortex, cuneus, and lateral occipital cortex compared to non-exposed youth. Youths who experienced food insecurity exhibited greater connectivity between the NAcc and superior parietal lobule compared to non-exposed youths, who exhibited greater connectivity with the frontal pole and superior frontal gyrus. Neglect was not associated with distinct patterns of connectivity. These findings highlight differential patterns of reward network connectivity as a function of CA type. Future work will further explore alterations in the connectivity of this network as a mechanism underlying associations of CA and reward processing behaviors.

2-P-140 Effects of methylphenidate on response control and intrinsic whole-brain functional network organization in children with attention-deficit/hyperactivity disorder

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ADHD is the most commonly diagnosed developmental disorder of childhood and is associated with cognitive control deficits that lead to long-term behavioral problems. These cognitive control deficits are thought to result from dysfunctional whole-brain network organization. Indeed, children with ADHD have a more segregated brain network organization compared to typically developing (TD) children, a feature that is related to poorer cognitive control in adults. An estimated 60% of children with ADHD take stimulant medication, which has been found to normalize dysfunctional brain activity and connectivity between specific pairs of regions, but its effects on whole-brain network organization are unclear. Thus, this study aimed to quantify the effects of stimulant medication on intrinsic functional network organization in medication-naïve children with ADHD. Resting state fMRI scans were acquired from children with ADHD and TD children (8-12 years old) over 2 sessions, and participants completed a Go/No-Go (GNG) task afterwards. Children with ADHD underwent a randomized, placebo-controlled, double blind protocol; they received methylphenidate before one session and a placebo before the other. Functional connectivity and graph theory network analyses were conducted, and modularity (Q, as a measure of network segregation) and participation coefficient (PC, as a measure of network integration) were calculated. Behaviorally, children with ADHD showed improved performance on the GNG task with methylphenidate compared to placebo (increased d' and lower RT variability). Under placebo, children with ADHD showed greater network segregation (Q) and lower integration (PC) than TD children, consistent with prior research. With methylphenidate, network organization in children with ADHD was comparable to TD children. These results suggest that stimulant medication may normalize dysfunctional network organization in children with ADHD, leading to improvements in behavior.

2-P-141 Top-down modulation of sensory cortex in the developing human brain

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Unlike associative cortex, the structure and functional organization of sensory cortex are thought to mature relatively early in life. However, it is unknown whether the representation of information in sensory cortex changes with development. In the adult brain, top-down signal from associative cortex plays an important role in shaping representations in sensory cortex, resulting in sharpened representation for task-relevant features at the expense of task-irrelevant features. However, given ongoing development of association cortex--prefrontal and parietal regions in particular--it is possible that child sensory cortex might be less modulated by the top-down signals coming from these regions. If so, it is possible that the child sensory cortex represents more task-irrelevant information as compared with adult sensory cortex. In the present study, we ask how top-down signal modulates neural representations in the child sensory cortex. We will measure brain activity using fMRI while adults and children (8-years) are performing a one-back task in which they are directed to attend to either the motion or the object present in a complex display where both objects and motion are always present. To examine how these features are represented in the child and adult brain, we will use the multivoxel pattern analysis and compare decoding accuracy of task-relevant and task-irrelevant features. In addition, the top-down signal will be measured in adults and children by comparing how functional connectivity between association and sensory cortices differs with task demands. Connectivity patterns will be related to decoding measure to understand how top-down signals are related to the representation of task-relevant and irrelevant information in sensory cortex. In sum, this research will show how sensory cortex in the developing brain represents information from the world, with implications for understanding how children process information and how this changes with development.

2-P-142 Sleepy, Disconnected, and Inattentive: ADHD symptoms in children reflect greater behavioral vulnerability to partial sleep deprivation through compromised brain connectivity

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Sleep problems are often associated with ADHD symptoms, yet it is unknown whether ADHD symptoms affect children's resilience to sleep loss. We combined fMRI with a behavioral response-inhibition task to test whether ADHD symptoms relate to vulnerability to behavioral and neural consequences of short sleep. 13 children (7F; 11.7±1.3 years) characterized for ADHD symptoms (Conners-3 T-scores) slept at home for 1 week (9.5h in bed) and two consecutive nights in the lab: baseline (9.5h in bed) and partial sleep deprivation (4h in bed). A fMRI session each morning involved a go/no-go task and a resting-state scan to assess brain connectivity. A behavioral metric of response-time variability (tau) in this task was derived by an ex-gaussian fit of reaction times for go-trials. A whole-brain index of network-connectivity (modularity) was derived from resting-state analyses. Regression assessed independent associations for ADHD symptoms, brain modularity, and response-time variability following sleep loss. Sobel-Goodman mediation tested whether neural changes after sleep loss explain associations between ADHD and response-time variability after short sleep. Whole-brain modularity was reduced after sleep loss ($t(12)=-2.79$, $p=.016$); more ADHD symptoms were associated with progressively greater decreases in modularity ($b=-.0036$, $p=.008$). Greater behavioral response-time variability after sleep loss was associated with ADHD symptoms ($b=3.25$, $p=.038$) and the degree of modularity reduction ($b=-839.0$, $p=.002$). Decreased modularity fully mediated (89.9%; $z=2.001$; $p=.045$) the association between ADHD symptoms and response-time variability. These data indicate elevated ADHD symptoms mediate children's response-time profiles after sleep loss through compromised brain connectivity. These preliminary findings underscore the importance of sleep in children with ADHD, and further the understanding of the neurobiology of inattention following short sleep.

2-P-143 The Cognitive Architecture of the Developing Brain: An ABCD Study

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Although more variable in their performance, children can engage the same cognitive processes as adults. Paralleling this behavioral observation, the functional networks that support cognitive processes in adults are present in childhood. However, within- and between- network functional connectivity (FC) demonstrates a protracted development into adulthood, supporting maturation of cognitive abilities. Nevertheless, we still lack a basic understanding of how functional networks support general and specific factors of cognition. This study identifies the functional network architecture supporting common and specific dimensions of cognition among children in the ABCD dataset. We performed an exploratory bi-factor analysis on primary scores from ten neuropsychological tests (N=4525). Parallel analysis indicated a four-factor solution, with components reflecting common (general cognitive ability, GCA), and specific (executive functioning, EF, memory, crystallized intelligence, CI) cognitive dimensions. In a subset of subjects (N=684, 9-10 yr. olds), we correlated FC with each factor and determined statistical significance using enrichment analysis. Distinct patterns of FC, respecting known network architecture, were related to each behavioral factor: (1) individuals with higher GCA exhibited stronger FC anticorrelations between the default-mode network (DMN) and dorsal attention (DAN) networks; (2) individuals with greater EF exhibited greater FC between the frontoparietal (FPN) and DAN, and within the visual (Vis) network; (3) individuals with higher memory scores exhibited greater FC between the DAN and Vis network and between the Vis network and parietal memory networks; and (4) individuals with greater CI exhibited greater FC between the FPN and motor networks. These results indicate that distinct FC patterns, following established functional network topography, support general and specific domains of cognition during childhood.

2-Q-144 Within-person fluctuations in sleep duration and regularity predict future stress exposure and anxiety and depression symptoms in adolescents

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Short sleep duration and irregularity of sleep timing are associated with cognitive impairment and elevated risk for metabolic and psychiatric disorders. Greater understanding of the relationship between sleep and mental health in adolescence is important, as this developmental stage is characterized by large changes in the timing and structure of sleep as well as increased vulnerability to anxiety and mood disorders. Prior work has relied primarily on self-reported sleep behavior and brief study periods, precluding finer-grained investigation of the directionality of sleep-psychopathology relationships within individuals over extended periods of time. In the present study, 30 adolescents 15-17 years old provided clinical and sleep data for one year. Participants completed 12 monthly in-lab assessments of affect, exposure to stressors, and symptoms of anxiety and depression, and wore an actigraphy wristband for continuous monitoring of sleep over the year. Multilevel models with a fitted autocorrelation structure tested for concurrent and lagged sleep-psychopathology relationships over time. Between-subject results showed a bidirectional relationship of sleep regularity with stress and clinical symptoms, such that higher average sleep irregularity predicted higher levels of stress exposure, depression, and anxiety, and vice versa. Within-person results showed that when adolescents got less sleep than normal, they reported increased concurrent symptoms of anxiety, while greater sleep irregularity predicted increased subsequent negative affect. Moreover, increases in anxiety symptoms predicted more irregular sleep in subsequent weeks, while increases in symptoms of depression and interpersonal stressors predicted longer sleep duration in subsequent weeks. These results suggest dynamic relationships between different dimensions of sleep and affect, stressors, and clinical symptoms, with implications for sleep-related interventions for adolescents.