

The Sackler Institute for Developmental Psychobiology

Weill Cornell Medical College

2014-2015

Overview. The Sackler Institute at Weill Cornell Medical College uses an interdisciplinary approach to examine sensitive periods of learning and development, especially during adolescence, when mental illnesses peak and when the brain is particularly sensitive to the environment. Characterizing sensitive periods will allow for more precise targeting of treatments to the biological state of the atypically developing brain (Lee et al 2015; Casey, Glatt & Lee 2015; Gee & Casey, 2015). Specifically, we are examining how experiential and genetic factors can extend or shorten sensitive periods of learning and development using interdisciplinary approaches that bridge the wide translational gaps from mouse to human, to more rapidly move novel discoveries from the bench to practice (see *Highlights of Scientific Investigations*). Our methodological approaches range from state-of-the-art human brain imaging, optogenetics, calcium imaging, human and mouse genetics, psychophysiology, computational modeling and behavioral studies. These investigations have culminated into numerous awards (see *Grants and Awards*) and over 60 publications this year in prestigious journals including *Science*, *Nature Neuroscience*, *Neuron*, *Nature Communications*, *The Proceedings of the National Academy of Sciences* and *Psychological Science* (see *Publications*). Training remains a high priority with the graduation of five doctoral candidates this year and placement of Sackler fellows across the years in prestigious institutions worldwide from Yale and Harvard to Utrecht and Zurich in addition to training of over three dozen national and international fellows and under represented minorities each year (see *Education and Training*). Outreach activities involve the translation of the latest scientific discoveries for the media (*NPR*, *Nature*, *Science*, *The New York Times*, *Philadelphia Inquirer* and *Psychology Today*), the public and through efforts to change policies to ensure the mental health and well being of our youth (See *Policy and Outreach Activities*).

Academic Faculty and Staff

Sackler Affiliated Faculty

B.J. Casey, Ph.D., Director and Sackler Professor of Developmental Psychobiology, WCMC and Adjunct Professor, The Rockefeller University

Charles E. Glatt, M.D., PhD., Associate Professor of Psychiatry, WCMC

Cate Hartley, Ph.D., Assistant Professor of Psychology in Psychiatry

Rebecca Jones, Ph.D., Assistant Professor of Psychology in Psychiatry

Francis S. Lee, M.D., Ph.D., Sackler Professor of Molecular Biology in Psychiatry and Vice Chair of Research, Department of Psychiatry, WCMC

Conor Liston, M.D., Ph.D., Assistant Professor, Brain and Mind Research Institute, WCMC

Michael Posner, Ph.D., Professor of Psychology in Psychiatry, Emeritus, Oregon University

Nim Tottenham, Ph.D., Adjunct Associate Professor of Psychology in Psychiatry, Columbia

Sackler Staff

Danielle Dellarco, Research Coordinator

Tracy Shi, Part-time Research Assistant

Alisa Powers, Part-time Research Assistant

Melanie Silverman, Research Assistant

Sackler Predoctoral and Postdoctoral Fellows

Ali Cohen, 3rd year Neuroscience Ph.D. student

Hugo Decker, M.D., Ph.D. tri-institutional student (defended April 2015)

Michael Dreyfus, M.D., Ph.D. tri-institutional student

Andrew Drysdale, M.D., Ph.D. tri-institutional student (defended April 2015)

Rob Fetcho, M.D., Ph.D. tri-institutional student

Dylan Gee, Weill Cornell Psychology Intern

Aaron Heller, Ph.D., Postdoctoral Clinical Fellow

David Johnson, 5th year Neuroscience Ph.D. student (defended March 2015)

Anfei Li, M.D., Ph.D. tri-institutional student

Frederico Lourenco, 5th year Neuroscience Ph.D. student (defended December 2014)

Alisa Powers, M.A., Sackler affiliated fellow

Theresa Teslovich, 5th year Neuroscience Ph.D. student (defended summer 2014)

Collaborative Efforts Worldwide

Part of the Sackler Institute's mission is to network with national and international entities in fulfilling our vision and mission to understand and treat mental illness and promote mental health. Beyond our scientific collaborations around the world, the Institute has organized and hosted several joint meetings of the Sackler Institutes and Centers over the years. This year, as part of the Mortimer D. Sackler M.D. prize celebrations for recipient Dr. Huda Zoghbi, the Institute organized a public symposium entitled *The origins of the mind and mental illness from genes to circuits to behavior* at the American Museum of National History that included seven international Sackler affiliated centers. The symposium reflected scientific discoveries and novel approaches to understanding and treating mental illness and was attended by the lay public and scientific community.

In addition to the public symposium at the American Museum of National History, Drs. Casey and Lee coauthored a call-to-action paper in *Science* entitled *Adolescent Mental Health: Opportunity and obligation* that has received significant attention. This article highlights adolescence as a sensitive period of risk and opportunity when the brain is more plastic than it will ever be again and thus more amenable to change with interventions and treatment.

An essential form of networking for the Institute is in training the next generation of physician and basic scientists. Our training efforts have placed Sackler fellows, in whom the Sackler Institute vision and mission are instilled, around the world from Los Angeles to Boston to London to Zurich. Together these efforts are increasing our commitment and obligation to reduce the unacceptably high burden of mental illness on youth today and are helping to ensure a healthier society tomorrow.

Locally, the Sackler Institute plays a pivotal translational role in bridging the human neurodevelopmental research at the Sackler Institute under the leadership of Dr. BJ Casey with the basic animal and human studies of Sackler faculty Drs. Francis Lee, Conor Liston, Cate Hartley, Rebecca Jones and Charles Glatt together with clinical research and practice in: 1) the Division of Child and Adolescent Psychiatry under the leadership of Dr. John

Walkup; 2) the Center for Autism and the Developing Brain (CABD) under Dr. Cathy Lord's direction; 3) the Borderline Personality Disorder program under the leadership of Dr. Otto Kernberg; and 4) the Program for Anxiety and Traumatic Stress Studies (PATSS) under the direction of JoAnne Difede. These collaborative ties have been the catalyst for novel research specific to personalized treatments for children with autism, anxiety and special needs to move basic scientific discoveries more quickly to clinical practice.

Sackler Infant Psychiatry Program

The Sackler Institute for Developmental Psychobiology's Infant Psychiatry Program at Weill Cornell Medical College was founded in 1998 as the result of a generous gift from the Mortimer D. Sackler, M.D. family. A basic premise of the program's clinical training and research is how essential parent-child attunement is to the mental and physical health of the family. This program began as a training program for child and adolescent psychiatry residents and fellows on the variation in parent-infant interactions of typically and atypically developing children and interventions for parents and mother-infant dyads. Under the leadership of Dr. Theodore Shapiro the annually appointed Sackler fellow and weekly seminars have expanded over the years to include psychology interns, fellows and faculty (see attached separate report by Dr. Theodore Shapiro).

With the recent additional gifts for this program, we have been able to expand this program. First, we appointed Dr. Rebecca Jones as a joint Sackler Institute and CABD faculty member and Dr. Dylan Gee, PhD as a Sackler Institute clinical fellow. Both of these young scientists focus on early child development and the importance of parent interactions and treatments being targeted to the child's developmental capacities. Second, in 2015 the Department of Psychiatry established the Sackler Infant Psychiatry grand rounds to honor distinguished scientists whose work exemplify the importance of parent-child interactions in mental illness and health. The inaugural speaker will be Dr. Nim Tottenham of Columbia University whose work has highlighted the effects of orphanage rearing on the child's brain, behavior and emotions and on how mothers can buffer young children from anxiety and fear.

Highlights of Scientific Investigations

The overarching scientific objectives of the Institute are: 1) to uncover the biological mechanisms underlying cognitive and affective processes across development and species; 2) to discover how they go awry in neurodevelopmental and neuropsychiatric disorders; 3) to determine the efficacy of innovative therapies and preventive strategies for these disorders as a function of the biological state of the developing brain and environmental and genetic effects inferred from mice and humans; and 4) to inform and direct policies. Below are highlights from our preclinical and clinical studies in these areas specific to the understanding and treatment of Anxiety and Stress-related disorders, Eating disorders, and Delinquency, Behavioral and Personality disorders.

Anxiety and Stress-related Disorders

The Institute is involved in a rich set of preclinical and clinical studies of affective and cognitive processes impacted by stress and anxiety. This work merges rodent, computational and human imaging and clinical research. These studies lay the critical groundwork for the identification, treatment and ultimate prevention of mental illness.

Role of Endocannabinoid System in Fear Regulation and Anxiety. Collaborative cross-species research involving Drs. Lee, Glatt, Hartley and Casey and Sackler doctoral students Andrew Drysdale and David Johnson has led to a *Nature Communications* paper showing parallel imaging work in genetically altered mice and in humans shedding light on how genetic variants with the endocannabinoid system leads to circuit changes that result in behavioral phenotypes relevant to anxiety disorders and addiction. This paper received the Weill Cornell Graduate School Rachele Prize for best paper by a graduate student and serves received coverage from *NPR* and the *NY Times*.

Persistently attenuating fear memories in Adolescence. Casey and doctoral student, David Johnson published their finding that reconsolidation update alters fear memories in adolescents (Johnson & Casey, 2015, *Scientific Reports*). This procedure consists of retrieving and updating fear memories prior to extinction, bypassing the need for prefrontally-mediated extinction processes, that are immature in the adolescent. The

findings have implications for the timing of exposure based therapy for adolescents with anxiety and stress related disorders.

Predicting Fear Recovery following Extinction. Dr. Hartley, in collaboration with Dr. Sam Gershman at MIT, have been using computational approaches to examine how differences in memory formation during extinction learning predict the subsequent recovery of fear. This work has been accepted for publication in *Learning and Behavior* and has important implications for understanding cognitive mechanisms that might confer vulnerability to anxiety disorders.

Genetic biomarkers to optimize treatment of PTSD. Francis Lee and Charles Glatt are performing translational studies of trauma interactions with social behaviors in mouse models of human polymorphisms relevant to anxiety and stress related disorders. The proposed studies are part of a DOD grant submission that will examine the effect of stress on social behaviors in a humanized knock-in mouse model.

Using GPS mobile technology to predict cognitive and affective function. In ongoing research by Dr. Cate Hartley and former Sackler fellow, Aaron Heller, they are using GPS-mobile technology to characterize the relationship between daily activity patterns and neural correlates of hippocampal neurogenesis, structure, and function, and testing whether variability in movement patterns predicts behavioral measures of cognitive and affective function. By establishing a link between everyday behaviors and adaptive or dysregulated cognitive and emotional function, this work holds the potential to improve our understanding of how our everyday behavior contributes to individual differences in well being, as well as to improve the monitoring and clinical treatment of mood and anxiety disorders.

Active fear regulation in adolescence: In ongoing research by Dr. Cate Hartley, she will test whether active coping can attenuate fear more effectively than passive fear extinction during adolescence and elucidate the neurocircuitry underlying active versus passive fear regulation during this developmental stage. This work is the basis of a NIH U01 grant submission (coPI: Hartley) and will inform the development of novel therapeutic approaches that teach

behavioral strategies to actively cope with fear, as well as improve our understanding of what forms of fear regulation might be most effective at a given developmental stage.

Predictors of CBT response in Anxiety Disorders. In collaboration with clinical psychologist, Dr. Shannon Bennett, we are examining how fear extinction learning predicts treatment response to CBT therapy. Ultimately Dr. Bennett will test the effectiveness of basic CBT exposure therapy versus CBT that builds on the reconsolidation work in adolescents by Casey and Johnson to test novel CBT methods for those who do not respond to traditional CBT exposure.

Understanding PTSD in Veterans with TBI. In collaboration with Judith Cukor we are examining extinction learning in veterans with brain trauma and PTSD to understand mechanisms by which individuals with traumatic brain injury may be more vulnerable to PTSD. This work is in collaboration with Dr. Joann Difede and neuroscience student, Dave Johnson.

Imaging Biomarkers Define Neurophysiological Subtypes of Depression. Dr. Conor Liston in collaboration with MD PhD student, Andrew Drysdale and Casey are examining how brain connectivity can be used to subtype different forms of Depression to better target treatments to the individual (i.e., precision medicine). This work has been presented and well received by the Director of the NIH, Dr. Tom Insel and has been submitted for publication.

Transcranial magnetic stimulation (TMS) and Depression. Dr. Conor Liston in collaboration with Dr. Mark Dubin and MD PhD student, Andrew Drysdale, are examining the impact of repetitive TMS on activity in prefrontal networks implicated in depression and their relation to treatment response. Preliminary findings have been published in *Biological Psychiatry* this year.

Eating Disorders

The Institute is involved in a number of collaborative NIH studies on eating problem behavior led by Dr. Casey that lay the critical groundwork for the identification, treatment and prevention of eating disorders.

Neural Correlates of Delay of Gratification. Dr. Casey with Drs. Walter Mischel and Kevin Ochsner of Columbia University are examining the development of neural mechanisms that enable us to regulate the appetitive pull of potentially unhealthy substances (e.g., fattening foods or drugs) and the aversive push of unpleasant emotions that might motivate one to seek these substances in the first place. This work is funded by NICHD (PI: Ochsner).

Genetic Studies of Obesity. Dr. Casey, together with Drs. Rosenbaum and Mayer (PIs) from Columbia New York State Psychiatric Institute, received a five year R01 grant entitled *Functional imaging and eating behavior among FTO genotypes in pre-obese children.* This joint institution collaboration involves a genetic imaging study of obesity in children focusing on the effect of the FTO gene and neural circuitry underlying sensitivity to food cues in children using behavioral paradigms developed at the Institute.

Role of Negative Affect on Impulsivity in Bulimia. Dr. Casey and MD PhD student Michael Dreyfuss are collaborating with investigators at Columbia (PI: Drs. Allegra Broft and Tim Walsh) on an NIMH funded study of Bulimia Nervosa to examine the aversive push of unpleasant emotions toward eating related behaviors.

Behavioral and Personality Disorders

The Institute is involved in a number of studies on decision making, cognitive control and learning relevant to behavioral and personality disorders. These studies are led by Drs. Casey, Hartley, Jones and Liston and lay the critical groundwork for understanding the emergence of cognitive and behavioral problems throughout development.

Capacities relevant to juvenile delinquency. Dr. Casey is the PI of a multi-site (WCMC, UCLA, Temple, Penn, Columbia, NYU and OSHU) MacArthur Law and Neuroscience Research Network funded study to examine capacities relevant to criminal responsibility under circumstances in which individuals often commit antisocial acts (e.g., emotional arousal, peer presence, etc.). PhD candidate Ali Cohen is providing evidence from this study that may bear on important legal questions regarding culpability and punishment of adolescents. This work has received significant attention from the media by NPR and is also part of The Institute's program on outreach and policy.

Instructed versus experiential learning across development. In recent work with MD PhD student Hugo Decker and Frederico Lourenco, Dr. Hartley has been examining developmental changes in the efficacy of learning about rewards and punishments through instructions versus experience. This work has been accepted for publication in *PLOS One* and *Cognitive, Affective and Behavioral Neuroscience* and has potential implications for public health informational campaigns that rely upon instruction to deter adolescents from risky behavior.

Goal-directed and habitual action selection across development. Recent work conducted by Dr. Hartley and MD PhD student Hugo Decker has examined how the balance between goal-directed versus habit-driven action changes across development. Habitual action has been implicated as a mechanism in the etiology of substance abuse, as well as in other disorders that involve habit-like compulsive thoughts and actions related to stress. This work forms the basis of a recently awarded NIDA R03 Imaging Science Track Award for Research Transition (I/START) grant (PI: Hartley).

Novel Studies of Attention and Working memory. Imaging studies led by Drs. Casey and Liston suggest that deficits in prefrontal connectivity in ADHD might arise from a common etiologic mechanism. This mechanism is thought to involve altered modulation of synaptic potentiation (plasticity) and pruning by dopamine and other factors during development that might persist into adulthood. Liston is testing this hypothesis using state of the art optogenetic and microendoscopic imaging tools- never before used to examine the development of prefrontal connectivity and function.

Bayesian Learning and Autism. Dr. Jones is examining how Bayesian learning varies in young children with autism, their nonaffected siblings and typically developing children and how this capacity impacts treatment response to Applied Behavioral Analysis, the most common form of treatment for autism and based on principles of reinforcement learning. This work is being supported in part by collaborative grants with Dr. Cathy Lord from the DOD and Simons Foundation.

Borderline Personality Disorder. Drs. Casey, Glatt, Hartley and Liston are collaborating with Drs. Otto Kernberg and John Clarkin to examine neural correlates and predictors of treatment

responses in individuals with Borderline Personality Disorder. The studies focus on negative affect and impulsivity in addition to basic learning mechanisms implicated in expectations of others that are targeted by psychotherapy.

Education and Training

A significant objective of the Institute is in training, education and outreach. The Institute's network has international collaborations established with the Netherlands in addition to national ones with Cornell, Columbia, NYU, UCLA, OHSU, Penn, Temple University, University of Pennsylvania, Rockefeller and Vanderbilt. Highlights of the Institute's training activities are provided below.

Mortimer D. Sackler, MD Summer Institute. Last year the Mortimer D. Sackler, M.D. Summer Institute co-directed by Drs. Casey, Bill Fifer and Declan Murphy representing 3 of the 7 Sackler Institutes around the world. This year's course will be co-directed by Drs. Casey and Sackler Infant Psychiatry postdoctoral fellow, Dr. Dylan Gee on the topic of stress effects on development and mental health. In 2016 the summer institute will focus on law and neuroscience, especially with regard to juvenile justice reform and policy.

NIMH Summer Institute for Psychiatry Residents. Drs. Lee and Liston presented at the annual NIMH Summer Institute for Psychiatry residents on the Cold Spring Harbor campus in NY directed by Dr. Tom Insel.

Residency Education. Drs. Lee, Casey, Hartley, Jones and Liston play significant roles in teaching both adult and child psychiatry residents at Weill Cornell Medical College as part of the Residency program curriculum. Lectures span from a developmental cognitive neuroscience approach to mental illness and health to new discoveries in autism spectrum disorders.

Medical Students. Drs. Casey and Hartley played significant roles this year in teaching medical students at Weill Cornell and Weill Qatar about developmental and cognitive neuroscience by providing lectures and labs for the students that have resulted in participation of the medical students in Sackler seminars.

Neuroscience Students. Drs. Casey and Hartley played significant roles this year lecturing to neuroscience graduate students of the Weill Cornell Biomedical Graduate Program on brain and behavior as part of the Neuron to Brain and Neurobiology of Addiction graduate school courses.

Tri-institutional MD PhD Students. Dr. Casey helps teach the MD PhD 2nd Year Scientific Frontiers course, exposing them to neuroscientific discoveries and currently mentors three MD PhD students.

Clinical Psychology Interns. The Sackler Institute provides opportunities for Psych Interns to carry out research while completing their clinical psychology requirements in the training program directed by Dr. Susan Evans. Last year intern, Dylan Gee, joined the group and then began postdoctoral fellowship at The Institute with Dr. Casey on novel approaches for treating anxiety in children and adolescents

Recruitment of Under-represented Minorities. Dr. Casey participates in the Gateway and Access programs that provide summer mentorship for underrepresented minorities who may be potential MD, PhD and PhD applicants to Weill Cornell.

Summer Volunteers and Interns. Each year numerous volunteers from local high schools and colleges take part in research opportunities at The Institute. These opportunities provide them with additional credentials for applying to subsequent undergraduate, graduate and medical programs.

Policy and Outreach Activities

This year has been a significant one for outreach related activities in local, national and international settings. We provide a few examples of these efforts below.

Media Publicity. Research by Casey, Lee and others at the Sackler Institute has been covered by the *New York Times* (*Why Teenagers Act Crazy* and *The Feel Good Gene*), *Nature* (*Teen Drug use gets Supersize Study*), *Psychology Today* (*Adolescence and the College Search*), *Philadelphia Inquirer* (*Teens' Immature Brains pose all sorts of problems*); and by *NPR* (*This*

is a 12 year old brain on peer pressure and *The Feel Good Gene*). For links to these articles and more see http://www.sacklerinstitute.org/cornell/sackler_in_the_news/.

Public Symposia. Casey organized a public symposium on *The origins of the mind and mental illness from genes to circuits to behavior* at the American Museum of Natural History that included seven international Sackler affiliated centers, as part of the Mortimer D. Sackler M.D. prize celebrations for recipient Dr. Huda Zoghbi. The symposium reflected scientific discoveries and novel approaches to understanding and treating mental illness and was attended by the lay public and scientific community.

Special Issue of Developmental Neuroscience on The Teen Brain. Dr. Casey co-edited a special issue of *Developmental Neuroscience* with colleagues Pradeep Bhide and Barry Kosofsky that highlights what we have learned about the teen brain from imaging and nonhuman animal studies. Work from this special issue by MD PhD student, Michael Dreyfus, was highlighted by *NPR*.

Mental Health Research and Policy. Casey and Lee coauthored a call-to-action paper in *Science* on adolescence being a sensitive period of risk and opportunity when the brain is perhaps more plastic than it will ever be again and thus more amendable to treatment and interventions.

Neuroscience and the Law. Casey has given numerous lectures to city, state and federal officials this past year including presentations to the Washington State Supreme Court, the National Bar Association's Judicial Conference, the NYC Department of Probation and on Capital Hill as part of VERA Institute of Justice sponsored activities. She is a member of the MacArthur Foundation Research Network on Law and Neuroscience.

Exposing young people to science. The Sackler Institute faculty and fellows have participated in several outreach programs to get young people interested in science including: 1) the *New York Hall of Science Mentorship* program; 2) *Brain Awareness* week activities at public schools throughout the New York metropolitan area; 3) The Rockefeller University's *Science Saturday*, teaching children about brain anatomy with art projects; and 4) The *Weill Cornell's Children's Health Council Family Science Day*.

Invited and Keynote Addresses. Drs. Casey, Lee, Liston and Hartley have given invited keynote addresses and special lectures at the American Psychological Society, Biological Psychiatry, NIH, Utrecht, Calgary, World Congress on Brain, Emotion and Behavior in Brazil, Organization for Human Brain Mapping, Society for Neuroscience, American Museum of Natural History, Capital Hill and many others.

Grants and Awards

Dr. Dylan Gee is a finalist for a NIH Director's Early Independence Award on novel mechanisms of fear reduction targeting the biological state of the developing brain.

Dr. Gee received the ADAA Career Development Leadership Program Fellow this year and a ADAA Career Development Travel Award.

Dr. Gee received the 2015 Samuel W. Perry III, M.D., Distinguished Award in Psychiatric Medicine from Weill Cornell.

Dr. Hartley received A NIDA R03 grant to examine the neurocognitive mechanisms underlying the development of habitual versus goal-directed action selection.

Dr. Hartley is a finalist for a Frueauff Foundation "equipment grant" to acquire specialized olfaction equipment for her developmental studies of olfactory aversive conditioning and extinction.

Dr. Hartley received the Bohmfalk Charitable Trust Research Grant to examine controllability of stress in human adolescents.

Dr. Jones received a DOD grant with Dr. Lord on how implicit learning abilities predict treatment response in Autism Spectrum Disorders.

Dr. Jones is a Finalist for Hartwell Foundation award for her research on autism.

Dr. Lee received a NINDS R01 to identify specific proteins that regulate aberrant variant BDNF (Val66Met) trafficking, and to examine the in vivo consequences on hippocampal structure and function.

Dr. Lee is a co-I on two collaborative R01s with NYU faculty. The first (PI: Moses Cho) examines the impact of a common BDNF SNP on stroke-induced plasticity using the knock-in mouse Lee developed in 2006. The second (PI: Ipe Ninin) is designed to identify the synaptic basis of altered

Dr. Liston received an NIMH R00 grant to determine how circadian glucocorticoid oscillations affect synaptic remodeling in a medial prefrontal / amygdala circuit.

Dr. Liston received an NARSAD Young Investigator Award to examine how stress affects the development of postsynaptic dendritic spines in prefrontal cortical pyramidal cells and medium spiny neurons in the dorsal striatum during adolescence.

Dr. Liston received a Whitehall 3-Year Research Grant to investigate how PFC microcircuits support working memory, and to test whether low- vs. high-dimensional circuit dynamics mediate different aspects of cue registration, memory maintenance, and response selection.

Dr. Liston received a Dana Foundation Neuroimaging Award to develop neuroimaging biomarkers for diagnosing subtypes of depression in a large, retrospective, multisite dataset.

Dr. Liston received a Hartwell Biomedical Research Award to investigate how PFC microcircuits support working memory, and to test whether low- vs. high-dimensional circuit dynamics mediate different aspects of cue registration, memory maintenance, and response selection of relevance to disorders of autism and ADHD.

The Institute directly, and in collaboration with others, has grants and awards from diverse sources including the NIMH (Casey, Liston), NIDDK (Casey), NICHD (Casey), NIDA (Hartley), NINDS (Lee), NSF (Cohen), the Dana Foundation (Liston), Dewitt Wallace Readers Digest, DOD (Jones), The Hartwell Foundation (Liston), the MacArthur Foundation (Casey) and the Whitehall Foundation (Liston). This funding supplements the generous gifts by the Mortimer D. Sackler, M.D. family and the continued support by the Department of Psychiatry (see Financial Statements).

Pending Grants

Dr. Casey submitted a NIH U01 proposal in response to the NIH's call for research proposals to undertake the largest study ever on the effects of substance use on adolescent cognitive, emotional, behavioral and brain development. The current proposal will recruit and track over 1000 9-10 year olds in the New York City boroughs over a 10 year period, as part of a larger longitudinal study of 10,000 teens across the nation.

Dr. Casey submitted a MacArthur Research Network Law and Neuroscience proposal on the impact of race on impulsive decision making under threat.

Dr. Hartley submitted a NIMH R21 application to examine the development of olfactory aversive conditioning and extinction.

Dr. Hartley submitted a NIH U01 grant application to examine amygdala-prefrontal circuitry in self-regulation.

Dr. Hartley submitted a NARSAD Young Investigator Award on facilitating adolescent fear regulation through active coping.

Dr. Hartley submitted an American Psychological Foundation, Esther Katz Rosen Fund Grant application to examine the neural and cognitive mechanisms underlying the early maturation of goal-directed learning in gifted children.

Dr. Hartley submitted an American Psychological Foundation, Visionary Grant to examine GPS mobile technology assessment of movement variability as a predictor of adaptive cognitive and affective function.

Dr. Jones has submitted a Siomons Foundation grant to measure social interactions via wearable cameras in young children with ASD.

Dr. Jones submitted a NIMH/NICHD application to examine adolescent brain and behavioral development in autism.

Drs. Lee and Glatt have submitted a DOD grant to examine the effects of stress on social behaviors in a human SNP mouse model relevant to PTSD.

Publications

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Douet, V., Chang, L., Pritchett, A., Lee, K., Keating, B., Bartsch, H., Jernigan, T., Dale, A., Akshoomoff, N., Murray, S., Bloss, C., Kennedy, D., Amaral, D., Gruen, J., Kaufmann, W., Casey, B.J., Sowell, E., and Ernst, T. (2014). Schizophrenia-risk variant rs6994992 in the neuregulin-1 gene on brain developmental trajectories in typically-developing children. *Transl Psychiatry*, 4, e392; doi:10.1038/tp.2014.41.

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