Developmental Neuroscience

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Overview

The Department of Developmental Neuroscience was established at NYSPI in 1984. It was the first department in a medical school to focus its basic research program on the development of brain and behavior as a basis for understanding the early origins of psychiatric illness. There are primary investigators in the department interested in understanding how natural events and stressful experiences interact with genetic mechanisms to shape the course of normal and abnormal development.

This work is driven by the belief that the study of developmental processes provides important clues about the origins of a wide spectrum of clinical conditions. Ongoing studies use a variety of novel animal models to investigate the neurobiological substrates of attachment, separation anxiety, fear responses, aggression, emotion regulation, and maladaptive eating behaviors. These models include targeted gene deletion of neurotransmitter receptors in mice, programming of early nutritional and other environmental experiences, and selective breeding for behavioral traits in infancy.

Studies involving human subjects examine the role of pre- and post-natal experiences on fetal, infant, child and maternal behavior and physiology. Work in the division has revealed networks of neurobiological and behavioral processes within the fetal and early postnatal maternal environments which regulate the course of development and can shape adult outcome and vulnerability to a number of clinical conditions. Research activities in the division are augmented by a close working relationship with the Sackler Institute for Developmental Psychobiology headed by Dr. Jay Gingrich.

Current Research

Research in this department covers a wide range of topics related to brain and behavior development and vulnerability to disease. A major goal of much of this work is to determine as early as possible whether individuals are at risk for subsequent neurobehavioral disorders. Recent papers from the laboratories of Drs. Myers and Fifer (Myers et. al., Clin Neurophysiol. 2012; Isler et. al, Dev Sci. 2012) have focused on measures of brain electrical activity as promising new ways to assess the maturational and functional activity of the cerebral cortex as markers of infant well being. Other work by these scientists is focused on understanding how adverse exposures during the prenatal period increase vulnerability to fetal and
infant mortality, as well as neurobehavioral deficits at later stages of life. Of particular note in the regard are findings from a recent article in collaboration with colleagues in Pediatrics showing that infants born even a few weeks early are at risk for poor school performance. (Noble, K. G., Pediatrics, 2012).

In a major NIH collaborative network (Prenatal Alcohol and SIDS, PASS), 12,000 mothers and babies are being studied. As of May of this year, 7,500 have been enrolled at several sites in the Northern Plains as well as in Cape Town, South Africa. The physiological and behavioral data, as well as the biological specimens collected in this study are expected to provide a wealth of new information about how early adverse exposures shape vulnerability to subsequent physical and mental disorders. The study is schedule to be completed in 2016.

Investigators in the division are also conducting translational studies focused on assessing the effectiveness of early interventions in a highly vulnerable population of infants, those born prematurely. Prematurely born infants are at increased risk for numerous forms of developmental disorders and now represent over 10% of births in the USA. These new studies are based on a rich history of animal model work conducted in the division and are an exciting new dimension of this work. These studies, which are lead by Drs. Welch and Myers, are conducted in collaboration with investigators in the Department of Pediatrics. Nearing completion is a large randomized controlled trial investigating the potential benefits of a nurture-based intervention in the Neonatal Intensive Care Unit (NICU) at Columbia. The study is focused assessing the short and long-term effects of repeated experience with calming interactions on the physiology and behavior of prematurely born infants and their mothers. Preliminary results support the hypothesis that enhancing early mother infant interactions can have positive effects on brain development and neurobehavioral outcomes.

Another major focus of basic research in Development Neuroscience is on the regulation of serotonin, a neurotransmitter involved in modulating nearly all aspects of central nervous system function. Serotonin selective reuptake inhibitors (SSRIs) are widely administered for the treatment of depression, anxiety, and other neuropsychiatric disorders, but response rates are low, and side effects often lead to discontinuation. Using mouse models Drs. Gingrich and Ansorge and their collaborators have recently shown that chronic blockade of the serotonin transporter during adulthood, but not during development, reduces content and metabolism of another critical neurotransmitter (dopamine). Based on this work, they are now working to test the hypothesis that drugs which enhance dopamine activity might reduce side effects and increase efficacy.

**Education and Training**

New Appointed Postdoctoral Research Fellows:
Julie Spicer, PhD – appointed on 4/01/12
Alla Landa, PhD – appointed on 7/1/12
Alexandria Wise, PhD – appointed on 11/1/12
Honors and Awards
Dr. Myron Hofer received the Paul Hoch Award, 102nd Annual Meeting of the American Psychopathological Association, 2012

Publications (Selected)


Divisional Highlights

Mark Ansorge, PhD received an R01 grant from NIMH for his work on Development origins of aggressive and impulsive behavior. Although most neuropsychiatric disorders have developmental origins, knowledge about early risk factors remains scarce. Mark’s group has identified a critical developmental period around adolescence, during which brain development is vulnerable to abnormal monoamine signaling, permanently altering aggressive behavior and dopamine function. In the new studies he will narrow down the critical period, expand the analysis of behaviors affected and study the underlying mechanism, to improve diagnosis, prevention, and treatment strategies in psychiatry.

The Einhorn Family Charitable Trust (EFCT) has supported the research of Martha G. Welch M.D. since 2006, under the name Brain Gut Initiative (BGI). The Brain Gut Initiative, now under the joint leadership of Martha G Welch and Michael M Myers received a gift in the amount of $1.8 million for the calendar year 2012-13. The gift supports research aimed at translating preclinical and clinical nurture science into
effective family intervention models and to help implement and disseminate these parenting practices and interventions to improve the health and well-being of children and families. One major effort supported by this gift has been a large study investigating the potential benefits of a nurture-based intervention in the Neonatal Intensive Care Unit (NICU) at Columbia. The study is focused assessing the short and long-term effects of repeated experience with calming interactions on the physiology and behavior of prematurely born infants and their mothers. The project has reached its target enrollment of 150 prematurely infants and findings are soon to be disseminated.