CHILD & BRAIN DEVELOPMENT

Explores the core question of how social experiences and settings affect developmental biology and help set early trajectories of lifelong development and health.

The primary focus of the program continues to be the examination of how genes, social environments and brain circuitries interact to determine the dramatically different health and developmental trajectories among children from different social classes and ethnicities. The program is preparing for a prestigious Marbach Conference in April 2018 in partnership with the **Jacobs Foundation** to address novel challenges in the field that demand fresh and profoundly multidisciplinary insights. The conference will focus on three key themes: gene-environment interactions on brain development; understanding big data with the advent of new "omics" technologies in neuroscience; and developing needed metaphors and similes to describe how the brain develops in a constant, two-way interaction with its genes and early social and physical environments.

The program explored a number of themes this year, ranging from neurodevelopmental disorders and brain-immune interactions in development to the intergenerational effects of trauma and adversity. Three program meetings were held. The first focused on the most recent research on brain activity related to child development, and included guests from Boston Children's Hospital and Harvard University. Fellows discussed recent knowledge of brain activity patterns, brain responses to stimuli and social influence from a developmental angle, in addition to potential applications to neurodevelopmental disorders.

The second meeting explored the role of brain-immune interactions in development and recent advances in the field of developmental psychoneuroimmunology. Special attention was given to social and environmental factors that affect the development of the immune system and associated psychological, behavioural and physiological health outcomes. The program also welcomed the Martin Family Initiative, including former Canadian Prime Minister the Right Honourable Paul Martin, to discuss an intervention for mothers and young children in Indigenous communities.

The third meeting focused on intergenerational transmission — research on mechanisms for the transfer of trauma and stressors experienced by the parents to their offspring.

RESEARCH HIGHLIGHTS

Weston Fellow **Marla Sokolowski** (University of Toronto) and Senior Fellow **Michael Meaney** (McGill University) reported that an allele of a dopamine receptor gene differentially affects dietary behaviour and predisposes to obesity. Children with a specific variant of this gene in disadvantaged socioeconomic conditions had the highest fat intakes within the sample, whereas those with this same variant but raised in advantaged conditions had the lowest. This work is an example of how gene variation can render children particularly sensitive to influences of positive and negative social settings.

- Silveira PP, **Sokolowski MB**, **Meaney MJ**, et al. 2016. Genetic differential susceptibility to socioeconomic status and childhood obesogenic behavior: Why targeted prevention may be the best societal investment. JAMA Pediatr. 170(4): 359-364.

Work by Fellow **Michael Kobor** (University of British Columbia) and colleagues identified epigenetic sites of DNA methylation that can distinguish children with fetal alcohol spectrum disorder (FASD) from those without. Their findings also indicate a substantial overrepresentation of genes linked to neurodevelopmental conditions, such as anxiety, epilepsy, and autism, among the epigenomic sites identified in the FASD children.

- Portales-Casamar E, **Kobor MS**, et al. 2016. DNA methylation signature of human fetal alcohol spectrum disorder. Epigenet Chromatin. 9: 25.

Fellow **Steve Suomi** (National Institutes of Health) determined that maternal social rank within a troop of rhesus macaques was associated with a reliable epigenetic signature in the placenta of pregnant females. Further analysis showed an overlap between genes associated with

AT A GLANCE

FOUNDED: 2003

MOST RECENT RENEWAL: 2012

PROGRAM DIRECTORS: W. Thomas Boyce, University of California, San Francisco, and Marla Sokolowski, University of Toronto

FELLOWS, ADVISORS AND CIFAR AZRIELI GLOBAL SCHOLARS: 25

INSTITUTIONS REPRESENTED: 17, in 5 countries

FIELDS AND SUBFIELDS REPRESENTED: behavioural, developmental, molecular and evolutionary biology; behaviour genetics; epigenetics; cognitive and developmental neuroscience; biological, cognitive and developmental psychology; psychiatry; biological anthropology; epidemiology; public and environmental health; social biomedical science

MEETINGS: 3; in Cambridge, USA, and Vancouver and Toronto, Canada

RELEVANT KNOWLEDGE USERS: mental health practitioners; early childhood educators; judges and practitioners specialized in juvenile justice

SUPPORTERS: The Alva Foundation | George Weston Limited Great-West Life, London Life and Canada Life | The Joan and Clifford Hatch Foundation | The W. Garfield Weston Foundation | (1 Anonymous Donor)

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social rank and those related to perinatal stress in newborn humans and rhesus monkeys.

- Massart R, **Suomi SJ**, Szyf M, et al. 2017. The signature of maternal social rank in placenta deoxyribonucleic acid methylation profiles in rhesus monkeys. Child Dev. 88: 900-918.

CIFAR Azrieli Global Scholars **Kieran O'Donnell** (McGill University) and **Ami Citri** (Hebrew University), and Fellows **Anna Goldenberg** (The Hospital for Sick Children, University of Toronto), **Sara Mostafavi** (University of British Columbia) and **Michael Kobor** (University of British Columbia), are developing a pediatric "epigenetic growth chart" using genome-wide patterns of DNA methylation — an epigenetic mark — from biosamples of thousands of children. This Catalyst-funded project could lead to the development of a novel biomarker for childhood exposures to trauma and adversity.

Senior Fellows Mario Luis Smalls and Candice Odgers answer audience questions at the Change Makers: Building Neighbourhoods That Thrive event.

Other Notable Publications and Outputs

- Lee, HHC, **Hensch TK**, et al. 2017. Genetic Otx2 mis-localization delays critical period plasticity across brain regions. Mol Psychiatr. 22: 680-688.

IDEAS EXCHANGE

In March 2017, CIFAR partnered with the City of Toronto's Child & Family Network to host **Building Neighbourhoods That Thrive: Improving Neighbourhood Settings to Promote Child and Family Well-being Outcomes**. The workshop explored how social inequalities within and between neighbourhoods can impact social capital networks and, in turn, neighbourhood outcomes.

Participants discussed what neighbourhood settings best support the well-being of children and families, and how to work collectively to improve outcomes. Social Interactions, Identity & Well-being Fellow **Mario Luis Small** (Harvard University) and Child & Brain Development Fellow **Candice Odgers** (Duke University) gave plenary talks alongside a local community leader from the United Way.

GLOBAL ACADEMY

The program welcomed its first two CIFAR Azrieli Global Scholars in 2016/2017: **Ami Citri** (Hebrew University) and **Kieran O'Donnell** (McGill University).

Co-funding by CIFAR and the Alva Foundation supports two postdoctoral fellows over two years to help facilitate high-risk collaborative research projects among program members. **Marie Aristizabal** and **Rebecca Reh** are based in the labs of Weston Fellow **Marla Sokolowski** (University of Toronto) and Senior Fellow **Janet Werker** (University of British Columbia), respectively.