manitoba
neuroscience
network

Connectomes across development reveal principles of brain maturation in C. elegans

SEMINAR & VISITING SPEAKER SERIES

WORLD WIDE NEURO PLATFORM

DATE

Monday, April 11, 2022
12:00 PM CST

WORLD WIDE NEURO LINK

This talk willl be hosted on zoom:
https://umanitoba.zoom.us/j/67908075022?pwd=TnV3Y2hnNjg5V1lKcitNYS9ybkFyZz09

MEETING ID & PASSCODE

None required

SPEAKER

Dr. Mei Zhen, PhD

Professor, Dept of Molecular Genetics, Dept of Physiology, Dept of Cell and Systems Biology, University of Toronto
Senior Scientist, Lunenfeld-Tanenbaum Research Institute

BIO

Dr. Mei Zhen is the Canada Research Chair in Brain and Behavior, Professor of Molecular Genetics at the University of Toronto, a Senior Scientist at the Lunenfeld-Tanenbaum Research Institute, and a Visiting Professor of Physics at Harvard University. Her work combines electron microscopy, genetics, optogenetics, and electrophysiology to explore how the nervous system develops and operates. Her work stems from the C. elegans model, and extends into rodent and stem cell models.

RESEARCH

Developmental connectomics reveals principles that underlie brain maturation. From birth to adulthood, an animal's nervous system changes as its body grows and its behaviours mature. The form and extent of circuit remodelling across the connectome is unknown. We used serial-section electron microscopy to reconstruct the full brain of eight isogenic C. elegans individuals across postnatal stages to learn how it changes with age. The overall geometry of the brain is preserved from birth to adulthood. Upon this constant scaffold, substantial changes in chemical synaptic connectivity emerge. Comparing connectomes among individuals reveals substantial connectivity differences that make each brain partly unique. Comparing connectomes across maturation reveals consistent wiring changes between different neurons. These changes alter the strength of existing connections and create new connections. Collective changes in the network alter information processing. Over development, the central decision-making circuitry is maintained whereas sensory and motor pathways substantially remodel. With age, the brain progressively becomes more feedforward and discernibly modular.

OBJECTIVES

1. Developmental connectomics: A connectome refers to the full wiring diagram of the nervous system. We used the C. elegans as a model to determine how and why the connectivity of neurons changes from birth to adulthood. We have completed the brain reconstruction from eight isogenic individuals from hatching to adulthood. Comparing them has told us how the normal brain matures. Our next goal is to examine how genetic and environmental factors affect this process.

2. Neural Coding of Behaviors: We use the compact C. elegans nervous system to address neural codes of behaviors and behavioral plasticity at the cell, circuit, and network level. By investigating the relationships between motor behaviors, the activity pattern of neurons, as well as the effect of perturbation of neuronal connections, we answer how neural circuits gather information to determine appropriate motor responses and how these motor responses adapt to changes in the body or environments.

3. Disease models: The ease of genetic manipulation and the collection of experimental tools--to examine the anatomy and activity of neurons and neuronal connections--allow for the system to model neurological disorders and address their defects across the synapse, cell, and circuit resolution. We have established and currently investigate neurological models caused by dysfunctional regulation of synapse development and neuronal excitability.

For more information:

T: 204-235-3939
E: info@manitobaneuroscience.ca

Health Sciences Centre Winnipeg   Hôpital St-Boniface Hospital RECHERCHE • RESEARCH   University of Manitoba