



THE HUMAN BRAIN

The human brain has been described as one of the most complicated and fascinating objects in the known universe. Because of its complexity, research and study of this most intriguing organ has only scratched the surface. During the last 100 years or so, we have discovered much about the brain's anatomy, structure and function. Thanks to advances in imaging technology, we can also recognize what a healthy brain looks like and identify diseased or damaged brains. Despite all we've learned about the healthy brain, conditions like dementia, Parkinson's and stroke still pose a major threat. What's more, neuropsychiatric disorders and traumatic brain injuries are the main causes of disability and death in western countries. To truly understand the nature of development and how to prevent and treat brain disease and damage requires a highly integrated and interdisciplinary approach to brain research. This insight is the impetus for a revolutionary new neuro-research partnership between Dalhousie and Ben-Gurion Universities.



A FOCUS ON **FOUNDATIONAL RESEARCH**

Dalhousie's nationally recognized Brain Repair Centre (BRC) is a research institute committed to fundamental science, clinical research, and drug and technology development. It serves as a neuro-research hub in Atlantic Canada, uniting academics, disciplines, government agencies and community groups from across the region to work towards a common goal. Research clusters in the areas of traumatic brain injury, neurodegeneration and neurodevelopment at the BRC bring together some of the region's top expertise into collaborative groups. The BRC's research program focuses on the following areas:

- The nervous system and how it helps us learn, remember, move and experience the world
- The basis for common brain disorders including traumatic brain and spinal cord injury, Alzheimer's disease and dementia and neurodevelopmental disorders
- The impact of various stressors on the brain and nervous system and strategies to protect against and recover from these traumas
- How genetics and environmental factors contribute to brain disorders and how this can help us detect, diagnose and treat these conditions
- The development of new technologies and approaches to diagnostic tests and therapeutic treatments such as surgery, rehabilitation and pharmaceuticals



A FOCUS ON **APPLIED RESEARCH**

Ben-Gurion University of the Negev's (BGU) Zlotowski Centre for Neuroscience, home to the BGU Brain Trust, has earned an international reputation for its interdisciplinary approach to the field. The BGU Brain Trust is committed to turning scientific findings and research results into new treatments and therapeutic interventions. An international team of researchers, medical doctors and clinician-researchers at the BGU Brain Trust have created collaborative groups that each focus on one of three research themes.

- The Neurobiology of Disease Group studies basic mechanisms of brain diseases, focusing on the role of blood vessels and the immune system in common disorders, including stroke, epilepsy, Parkinson's and Alzheimer's diseases.
- The Motor Control, Robotics and Neuro-Rehabilitation Group studies how the brain controls movement in health and disease and develops new diagnostic and therapeutic devices.
- The Stress-Related Illnesses Group is working towards a better understanding, diagnosis and prevention of stress-related brain disorders.

COMPLEMENTARY COLLABORATION

DALHOUSIE UNIVERSITY AND BEN-GURION UNIVERSITY OF THE NEGEV wish to formalize a research partnership by establishing The Canada-Israel Trans-Atlantic Collaboration for Brain Studies. This collaborative effort will help to close the knowledge gap in key areas of brain disorders by creating the opportunity for students and researchers at both institutions to collaborate and share knowledge, resources and data. The brain-health focused research programs at the universities examine similar topics, taking different approaches. By working together, they will create a knowledge base with greater breadth and depth and accelerate the rate of progress. Dalhousie and Ben-Gurion Universities have identified three key areas where their collaboration can have the greatest impact.

TRAUMATIC BRAIN INJURY (TBI)

Recent research has identified TBI as the major cause of temporary and long-term disability in industrialized and developing countries. In Israel, due to war and terrorist attacks there are a large number of trauma injuries among young people. Canada's aging population means that there is a heightened risk of TBI from falls among the elderly. Furthermore, globally, there is an increased focus on sports-related TBI. Both Dalhousie and BGU have strong brain-imaging centers with complementary interests, infrastructure and expertise. They are already working together to develop and test new imaging protocols. We believe that by building on this collaboration, which joins the expertise of the BGU's imaging centre and Robotics and Neuro-Rehabilitation Group with Dalhousie's BRC's expertise in traumatic brain injury, a specific imaging protocol for early diagnosis of brain injuries will be imminent. The ability to use images to diagnose individuals at high risk for neurodegenerative brain diseases will be a breakthrough with global impact. It is also the first critical step in developing novel therapeutics for the prevention of debilitating conditions like epilepsy, Parkinson's and Alzheimer's.

MOTOR CONTROL AND REHABILITATION

Unlike many parts of the human body, the brain and spinal cord have a limited capacity to heal themselves after injury. This means that the discovery of new interventions or therapies is critical to facilitate patient's recovery and restore function. Dalhousie's expertise on basic disease mechanisms and molecular signaling, combined with BGU's expertise in translational studies and clinical research in humans promises to create a research team with a holistic perspective that doesn't currently exist anywhere else in the world.

This critical research will drive the development of new and more effective approaches to rehabilitation for those recovering from and living with spinal cord and brain diseases affecting movement.

NEURODEVELOPMENT

Understanding how the brain enables us to learn, develop skills and function is key to diagnosing and treating a wide-range of disorders. Dalhousie and BGU share a particular interest in neurodevelopment as it relates to autism and stress-related diseases like Post-Traumatic Stress Disorder (PTSD).

Researchers at Dalhousie are looking at the very origins of the nervous system – how it develops in utero. Their research is at the most fundamental, molecular level and aims to chart the mechanisms of neurodevelopment. At BGU, researchers are focusing on the genetic aspects of brain development. They take a clinical approach to research, patients and specific populations. The two approaches are different, but closely connected and complementary.

Investigators at both universities are committed to finding ways to treat and prevent PTSD, and believe that the neurodevelopment process may hold the key to achieving this goal. At Dalhousie, there is a focus on investigating how stress in young children affects neurodevelopment. These findings guide the development of new therapies. Because war and terrorist attacks are part of the reality of life in Israel, the Stress-related Illnesses Group at BGU is studying PTSD in adults and children living under the threat of war. They are seeking to understand the other mental and neurological disabilities that arise as a result of PTSD.

REVOLUTIONIZING BRAIN RESEARCH

The Canada-Israel Trans-Atlantic Collaboration for Brain Studies will spark new insights, approaches and ideas of the mechanisms, diagnostics and therapeutics of common brain diseases. It will fuel research that will advance our understanding of the brain and its associated systems and help develop effective treatments for a wide range of neurological injuries, diseases and disorders.

The vision is for on-going, joint research projects between the universities. Interdisciplinary researcher teams, including principal investigators, post-docs and graduate students will travel between Dalhousie and Ben-Gurion Universities, benefiting from the expertise, facilities and culture at each institution. The outcomes will have a profound impact on the field and create a new talent pool of brain researchers who have an interdisciplinary and holistic perspective. It will mean new therapies will go from bench to bedside sooner.

A TRANSFORMATIVE VENTURE

A \$5-million investment in The Canada-Israel Trans-Atlantic Collaboration for Brain Studies will revolutionize the care and treatment of patients living with brain injury and disease. It will provide the resources to launch this new collaboration and fund activities for the first six years. Funds will be shared equally between the two universities, each receiving \$2.5 million. The project budget is included below:

Period	Project #1	Budget	Project # 2	Budget	Total
Year 1	3 Post-doc Fellows	\$150K	Research, travel, meetings, symposium	\$100K	\$250K
Year 2	6 Post-doc Fellows	\$300K	Research, travel, meetings, symposium	\$200K	\$500K
Year 3	6 Post-doc Fellows	\$300K	Research, travel, meetings, symposium	\$200K	\$500K
Year 4	6 Post-doc Fellows	\$300K	Research, travel, meetings, symposium	\$200K	\$500K
Year 5	6 Post-doc Fellows	\$300K	Research, travel, meetings, symposium	\$200K	\$500K
Year 6	3 Post-doc Fellows	\$150K	Research, travel, meetings, symposium	\$100K	\$250K

With the support of the community, **The Canada-Israel Trans-Atlantic Collaboration for Brain Studies** will help individuals achieve a better quality of life, while engaging research to broaden rehabilitation potential. Further, because of Dalhousie and BGU's expertise, this project will enhance the influence of both institutions as world-class centers of research and innovation.