Protecting the brain

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Dr. Alon Friedman (right) with Gay Dennis, Sarah Dennis and Cassidy Megan following an epilepsy symposium earlier this year. Credit: Denise Sooley

Neuroscience is a big field, populated by experts around the world. They search for treatments for people with brain and spine injuries, seek cures for neurodegenerative diseases and research diagnostic and prevention methods for the body's most intricate—and delicate—of systems.

Halifax welcomed an internationally-known name in neuroscience in July of this year: Dr. Alon Friedman. As the William Dennis Chair in Epilepsy Research at Dalhousie University, Dr. Friedman is one of the medical school's top recruits for epilepsy research in Maritime Canada.

Detecting damage to the brain

Dr. Friedman's research focuses of detecting and treating damage to blood vessels in the brain. He's particularly interested in the shield that these vessels form around the brain—a type of security system called the blood-brain barrier. It's a natural, almost non-permeable layer separating the brain from circulating blood.

But damage to it—caused by anything from brain infections to strokes to high blood pressure—can create leaks in the barrier, letting neurotoxins in our blood seep into the brain tissue. This can trigger epileptic seizures and slowly progressive, irreversible damage.

"We're focusing on how vascular pathology, that is, the breakdown of the blood-brain barrier, leads to brain dysfunction and neuropathology," says Dr. Friedman. "To our surprise, we discovered that when brain tissue is exposed to these substances it becomes epileptic."

Dr. Friedman's developing methods to better diagnose damage to the blood-brain barrier. Ultimately, this will lead to better patient care.

"Assuming our hypothesis are valid, our research will help identify patients in risk of epilepsy, neuropsychiatric and neurodegenerative disorders. Diagnosis of these patients will allow for preventative, disease modifying treatments."

Staying ahead of neurodegenerative disorders

Just recently, Dr. Friedman and his research partners at Ben-Gurion University Brain Imaging Research Center and Soroka University Medical Center made a breakthrough in early detection and diagnosis methods of leaky blood-brain barriers.

The breakthrough, published in *JAMA Neurology*, came after an advanced magnetic resonance imaging (MRI) diagnostic approach identified damage to the blood-brain barrier in pro football players after unreported brain trauma.

The results of the study are surprising, and could warrant a head-check after a tousle on the field. It confirms that repeated mild, traumatic brain injuries—commonly referred to as mild concussions in sports reporting—can have serious long-term neuropsychiatric effects, including brain damage.

"The study shows, for the first time, that blood-brain barrier pathology can be reliably detected in athletes, even when other, currently existing magnetic resonance protocols do not show any damage," explains Dr. Friedman.

Dr. Friedman sees the study having big implications for athlete safety. It will improve decision-making on when a player can return to play and become a measurable way to identify players who are at a high-risk of developing delayed complications after concussive events.

And with the capability of visualizing the severity and location of damage to the blood-brain barrier, Dr. Friedman hopes for better treatment options, too.

"Such early detection will allow treatment that targets vessels, facilitates blood-brain barrier repair and prevent the devastating injury and pathology of the neuronal network."

"Together, with colleagues in neuroradiology, epileptology and imaging specialists, we hope to continue to develop this method at Dalhousie and test different populations of patients."

Utilizing Dalhousie's Brain Bank

Coming from Israel's Ben-Gurion University of the Negev, Dr. Friedman was attracted to Dalhousie because of its vivid basic research and active clinical community. He credits Halifax as having an open and collaborative translational research environment that he believes will be crucial to the success of his work in brain disease prevention.

Dalhousie also hosts one of the few brain banks in the country. The Maritime Brain Tissue Bank gives students and researchers hands-on access to the organ. For Dr. Friedman, having real, human tissue samples to study is essential to understanding neurological diseases.

"The brain bank offers a unique opportunity to search for blood-brain barrier pathology in the brains of patients with epilepsy, Alzheimer's and other disorders. Data from patients' brain at different stages of their disease is critical for our team's success."

Dr. Friedman will be able to cross-reference what he sees from scans of live patients' brains with diseased—and healthy—brain tissue, supplied by the brain bank. It's a resource that he believes has enormous potential for testing new hypotheses on the causes of brain disorders.

More information: "Imaging Blood-Brain Barrier Dysfunction in Football Players." *JAMA Neurol.* 2014;71(11):1453-1455. DOI: 10.1001/jamaneurol.2014.2682.

Provided by Dalhousie University

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