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EDITORIAL

Epilepsia®

An interview with Nicholas Couturier, 2019 *Epilepsia* Prize Winner for Basic Science Research

1 | WHO ARE YOU?

I am a PhD candidate in the Department of Biomedical Engineering at Case Western Reserve University. I started my epilepsy research in 2011 as an undergraduate student in the lab of Dr Dominique Durand, head of the Neural Engineering Center. Subsequently, I transitioned into the master's degree and PhD programs. Since the beginning of my time in Dr. Durand's lab, I have worked on novel treatments for refractory epilepsy. I received my BS and MS in Biomedical Engineering from Case Western Reserve University.

2 | WHAT GOT YOU INTERESTED IN EPILEPSY RESEARCH?

For as long as I can remember, I have been fascinated with the human brain. As an eager biomedical engineering undergraduate student, I knew I wanted to focus specifically on the brain, so I began pursuing research opportunities at the Neural Engineering Center. Dr Dominique Durand was working on a project involving temporal lobe epilepsy at the time, and he graciously offered me an opportunity to pursue an independent project within his lab. I decided to work on a noninvasive method of stimulating the brain to treat refractory mesial temporal lobe epilepsy. Watching my undergraduate project progress through the translation process into clinical trials was incredibly rewarding and motivated me to pursue projects involving other forms of refractory epilepsy.

3 | EXPLAIN FOR OUR GENERAL READERSHIP WHAT QUESTION YOUR STUDY ADDRESSED AND HOW DID YOU GO ABOUT DESIGNING YOUR STUDY?

Our lab has been working on an alternative to current deep brain stimulation (DBS) techniques for the treatment of refractory epilepsy. Current DBS techniques rely on stimulating cell bodies at high frequencies to abort seizures. Our previous work has demonstrated that by stimulating fiber tracts at low frequencies, it is possible to lower the excitability of a larger portion of the brain. We developed a method of suppressing seizures in the hippocampus bilaterally through low-frequency electrical stimulation of the hippocampal commissure fibers. This stimulation paradigm was translated into humans and has demonstrated an efficacy of 90% suppression in patients with temporal lobe epilepsy. My goal was to develop an analogous technique to treat patients with cortical epilepsies. I hoped to determine if stimulating the fibers innervating the cortex could affect a larger amount of tissue with a smaller number of electrodes as compared to currently available DBS therapies. I tested this hypothesis using a controlled animal model.

4 | WHAT WERE THE RESULTS AND HOW DO YOU INTERPRET YOUR FINDINGS?

Instead of discovering that I could activate the entire cortex with a single pair of electrodes, I actually found that the functional organization of the corpus callosum rendered an unexpected degree of specificity. To suppress seizures in the motor cortex, I stimulated the corpus callosum within a specific area corresponding to the fibers that reciprocally innervate both the right and left motor cortices. Using this technique, seizures were successfully inhibited at a rate of over 90%.

5 | WHAT NEXT STEPS IN EPILEPSY RESEARCH ARE YOU TAKING AND WHAT ARE YOUR CAREER GOALS?

In my current research, I am comparing the efficacy of US Food and Drug Administration (FDA)–approved DBS techniques for suppressing seizures to a low-frequency corpus callosum stimulation method. I hope this research will allow the epilepsy research field to make more meaningful determinations about what works and does not work when it comes to DBS and seizure suppression. My future professional goals include starting my own lab as both a clinician and researcher, specifically with the aspiration of developing neurotechnologies capable of addressing each patient's specific symptoms.

6 | WHAT DOES THE *EPILEPSIA* PRIZE MEAN FOR YOU, YOUR LABORATORY, RESEARCH INSTITUTE, AND YOUR FUTURE?

Receiving the 2019 *Epilepsia* Prize has been a profoundly validating experience, especially as a student whose career in research is just getting started. I want to thank my mentor, Dr Dominique Durand, for his consistent support and encouragement. I am hopeful that this award will open new doors to opportunities in research, education, and collaboration with other scientists and clinicians who are dedicated to this important work.

Read the winning article "Corpus callosum low-frequency stimulation suppresses seizures in an acute rat model of focal cortical seizures."

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