Slice-less Immunohistochemistry of Living Brains

Imagine visualizing brain proteins inside the skull in a similar manner to how a pathologist sees them on tissues slices. This cut-free immunohistochemistry is possible with a highly sensitive, non-invasive imaging technology known as positron emission tomography, or PET. For PET to be effective, it requires a "stain" that binds selectively and with high affinity to the protein target under investigation. My role as a radiochemist at the Lawson Health Research Institute's Cyclotron and Radiochemistry facility is to translate high quality radiopharmaceuticals for human use, develop novel/better radiopharmaceuticals, and to discover improved radiolabeling methods.

The isotopes I commonly work with have short half-lives (^{18}F = 110 min, ^{11}C = 20 min, ^{13}N = 10 min, ^{15}O = 2 min). In a sense, I'm trying to bake cookies but every __ min, half are disappearing. Careful ingredient measuring and pristine equipment cleanliness becomes paramount because the mass of radioisotope is miniscule (10^{-12} g vs water droplet = 10^{-3} g) and tiny contaminants can ruin your day. As high levels of radioactivity are generally not great for your health, this work must be behind 5 cm of lead, requiring minimal manual input or full automation. Although these challenges can make radiochemistry frustrating, there is an effervescent joy from creating a molecule which nature could never produce. To have your creation then used to solve real-world health problems keeps my enthusiasm gas pedal firmly pressed to the floor.

PET imaging is a highly interdisciplinary effort involving chemistry, biology, physics, engineering, and imaging scientists at both a preclinical and clinical level. As such, we have many collaborators spread throughout the city utilizing PET for oncological, cardiological, and neurological investigations. With Canada's first installed hybrid PET-magnetic resonance imaging (PET/MRI) located alongside the cyclotron, there are countless opportunities for leading edge medical imaging science. In addition, on-site animal imaging facilities and the one-of-a-kind ImPaKT Facility on UWO campus (CL2+/3 with preclinical PET/MR scanner) creates unique local potential for bench-to-bedside translational medical science. I hope to become a vital collaborator in investigator-initiated projects to take full advantage of the state-of-the-art imaging equipment in London for the mutual benefit of scientists, clinicians, and patients.

For more information on Dr. Justin Hicks, please visit his webpage at
https://www.lawsonresearch.ca/scientist/dr-justin-hicks