

World first in imaging technology developed for PET/MRI scanners

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Scientists at Lawson Health Research Institute, in collaboration with Ceresensa Inc., have produced the first commercial imaging product available in the world for PET/MRI scanners. The novel PET-transparent MRI head coil provides unparalleled images to advance the study, diagnosis and treatment of a wide range of diseases.

Lawson installed Canada's first whole body PET/MRI scanner at St. Joseph's Hospital, part of St. Joseph's Health Care London, in 2012. This hybrid imaging scanner combines [magnetic resonance imaging](#) (MRI) and positron emission tomography (PET) into one powerful and simultaneous whole-body system, with substantial and innovative results. Patient diagnosis is faster and overall information available from the scan is better and more detailed.

"With only 50-60 PET/MRI scanners installed worldwide, Lawson's Imaging program has made significant early contributions to this young technology and pioneering system," says Dr. Jean Théberge, Lawson Imaging Scientist and Physicist in Diagnostic Imaging at St. Joseph's.

During scans, a [coil](#) is positioned around the head. The coil contains several elements, called channels, which detect the MRI signals being emitted. No gamma rays are used in standard MRI and so the components are not designed to avoid absorbing this radiation. For PET [images](#), participants are injected with a radioactive material which emits gamma rays. The problem is that in a hybrid PET/MRI scanner, the PET gamma rays are absorbed by the MRI head coil, resulting in a loss in the

quality of data at the level used for research.

"Our challenge was to create a MRI head coil with 32 channels for research-grade scans that would be transparent to gamma rays," explains Adam Farag, Scientific Director and co-founder of Ceresensa.

Together, Dr. Théberge and Farag arrived at a design that solved the problem, making possible advanced and highly effective neuroimaging with both MRI and PET. This was done through significant changes to the geometry of the existing coil and, thanks to the wide array of imaging equipment at Lawson, careful testing and selection of materials. With PET-friendly geometry and PET-friendly materials, the result is simultaneous acquisition of images and information from both the PET and MRI scans - giving a more complete picture of the area being studied.

The coil is so transparent to the PET process that it can be used without correction for attenuation. Attenuation is any reduction in the strength of a signal leading to image noise, artifacts or distortion that may decrease the scan's accuracy. "The number of [gamma rays](#) lost due to attenuation within the coil is less than two per cent, a figure that is not matched by any other published designs," notes Farag.

For research in the areas of neuropsychiatry and neurodegenerative diseases, the scan provides a more complete set of brain markers that can be studied - all from a single exam. In clinical settings, the high degree of transparency of the coil paired with a PET/MRI scan greatly increases the effectiveness and accuracy of the information provided to physicians as part of a patient's diagnosis and treatment. Work is underway for the development of coils for other parts of the body, including the heart and prostate.

"Simultaneous PET/MRI has changed what we can dream of for brain

imaging research and clinical applications," says Dr. Théberge. "PET/MRI has proven to deliver uncompromised quality compared to standalone PET or MRI scanners. Our brain imaging coil extends this quality to advanced neuroimaging applications, attracting neuroscientists previously specialized in only PET or MRI. This opens up considerable possibilities for collaboration and synergy."

At Lawson, the coil will be used for research in schizophrenia and depressive disorders, Alzheimer's Disease and Fronto-Temporal Dementia, and the study of brain damage resulting from chronic dialysis. The PET-transparent MRI head coil, and its design and implementation, are the subject of a provisional patent (USA).

Provided by Lawson Health Research Institute

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