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(I) Noble gas MRI: A Decade of Progress Towards Clinical Translation

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Inhaled hyperpolarized gas lung MRI was proven to be useful for the observation and treatment planning of several pulmonary diseases including chronic obstructive pulmonary disease, asthma, COVID-19 and lung cancer. The combined economic burden of COPD and asthma in Canada, Ontario being \$5.7 billion (2011). While these statistics are alarming, they don't fully reflect the impact on economic growth and the opportunity costs that stem from such a large number of chronically ill Canadian adults and children. Moreover, both asthma and COPD are progressive and punctuated by sudden, acute worsening of symptoms or "exacerbations" that require immediate medical care – a source of enormous stress on our healthcare system. Lung cancer caused the premature deaths of 21,100 Canadians in 2017 (with an additional 28,600 being diagnosed), accounting for 26% of all cancer related deaths in Canada. People who are diagnosed with lung cancer are most likely to survive if the tumour can be surgically removed. However, nearly 1 in 4 Canadians who have their lung tumour surgically removed have lung complications following surgery called "postoperative pulmonary complications." Presently, there is very little effort to predict these complications. So, it is not surprising that there has been a growing interest in developing new lung imaging techniques such as hyperpolarized ^{129}Xe MRI to better understand various disruptive pulmonary, cardiac & neurodegenerative chronic diseases. In Canada, four research sites (London, Hamilton, Toronto, and Thunder Bay) have started a ^{129}Xe MRI program, and two other sites (Vancouver, Montreal,) are in the preparation stage. Collectively, these Canadian sites urgently need novel ^{129}Xe MR imaging methods as well as an advanced hardware package including a static-cell xenon polarizer, RF coil asymmetric unshielded rigid transmitter and multi-channel phased array receiver. Thinking about ^{129}Xe 's place in MRI research globally, it is known that presently, ^{129}Xe lung MRI is translating towards a clinical tool, and it has recently been approved and used as a clinical tool in the UK and USA. This opens door for better diagnoses, treatment planning and treatment assessment of patients with chronic lung, COVID-19, cardio and neuro diseases.

Author: Prof. OURIADOV, Alexei (The University of Western Ontario)

Presenter: Prof. OURIADOV, Alexei (The University of Western Ontario)

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