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Virtual SEMINAR SERIES

Wednesday, May 25th, 2022
Seminar Presentation: 11:00am – 12:00pm PDT

"Electrochemical Environmental Remediation and Resource Recovery: Concepts, Design, and Application"

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Abstract: Separation technologies form the basis of most environmental and chemical processes, ranging from water treatment and desalination, to chemical catalysis, to gas purification. Membranes are among the most efficient, cost effective, and safest technologies for separations. These materials are replacing conventional solvent and thermal-based separation while also being adopted across many new sectors. While superior to many conventional separations, membranes do not treat the contaminants they remove, they are limited by fouling, and suffer from low contaminant specificity. For example, in wastewater treatment, membranes purify the feed by simply concentrating a waste stream without degrading the harmful contaminants, thereby transporting the problem elsewhere. Moreover, a lack of contaminant specificity means that valuable contaminants (e.g. Au, pharmaceuticals) from mining, municipal, or industrial wastewaters cannot be easily retrieved. Furthermore, membranes are inert surfaces that do not actively engage in the separations or respond to their environments. Prof. de Lannoy and his research lab have pioneered the field of electrochemical membranes and porous thin-films for environmental remediation, membrane optimization, and resource recovery. These materials can variously perform conventional separations while also catalyzing reactions on their surface, sensing surface changes, and/or actively preventing fouling, and in many cases enabling separations that would not otherwise be possible. This talk will present some in-situ separations and electrochemical degradations and enhanced anti-fouling properties and mechanisms of the electrochemical membranes, as well as some resource recovery approaches recently developed.
Lab-based models are useful testing tools, but the prevalence of real-world contaminants impacting underserved communities necessitates action. In Canada, First Nations communities are disproportionately impacted by environmental degradation. In collaboration with Anthropologists, community leaders, biologists, local experts, and First Nations youth, Prof. de Lannoy and his lab have co-created research projects to establish baseline water quality and advanced remoted monitoring platforms for Frist Nations communities. These research projects are co-designed by local First Nations experts, guided by community needs and interests, and the generated data is wholly owned by the community. This talk will conclude with a description of these efforts, the challenges and successes, and visions for the future of co-created engineering research.

Biosketch:
Charles-François de Lannoy is an Associate Professor in Chemical Engineering and Adjunct Professor Chemistry at McMaster University currently leading a team of 12 students (2 PDF, 6 PhD students, 2 Master's students, and 2 undergraduate student researchers). His research focuses on environmental remediation using advanced separations. His lab is broadly categorized into three main themes: 1) nanomaterials and separations processes for environmental remediation and resource recovery, 2) co-created water research with First Nations communities, and 3) aerosol separation technologies.
He has published over 50 peer-reviewed publications in top journals in his field, he holds 4 patents, and has given 38 talks at international conferences. He has won several awards at conferences for his research, including the top research prize at the North American Membrane Society.
Before joining McMaster University, Charles was a visiting scholar in the Energy Materials & Systems Lab at PARC, a Xerox Company working in conjunction with X (Google's Moonshots Laboratory), on various technolgoies. Charles completed a Post-Doctoral Research Fellowship in the Department of Energy Resources Engineering in the School of Earth Sciences at Stanford University and he received his PhD from Duke University in 2014, in Civil and Environmental Engineering, with a Certificate in Nanoscience, under Prof. Mark R. Wiesner.
He is a skier (cross-country and downhill) in the winter, a canoer and camper in the summer, and a runner all the time. Currently, he and his wife live happily with their two cats and one new puppy in the waterfall capital of Canada.