BIOENGINEERING & BIOMEDICAL ENGINEERING

RESEARCH SEMINAR

REIMAGINING DRUG DELIVERY: THE ROLE OF AI AND AUTOMATION

Prof. Christine Allen, PhD
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University of Toronto

1:30PM - November 3, 2023
Zoom ID: 830 7128 8396

The formulation of therapeutic agents in advanced drug delivery systems such as nanoparticles and microparticles can significantly improve their safety and efficacy. However, the design and development of advanced formulations remains expensive, labour-intensive and time consuming with a heavy reliance on the expertise of the formulation development team and composition of formulations that have been approved to date. In the design of these systems, there are a plethora of parameters that must be considered in relation to the drug, material(s) or excipient(s) as well as processing variables. Experimental evaluation of every combination is intractable and at this time it is not possible to predict the performance of specific formulations a priori. As a result, it is likely that some of the formulation candidates that have moved forward to clinical development are not optimal but rather the best that could be achieved with the time and resources available.

Machine learning (ML) has led to significant advances in various fields, such as drug discovery and materials science. In recent years, we have explored integration of ML to discern the relationships between composition, property and performance with a goal towards fast-tracking innovative drug formulation development. In this work, we have identified a lack of robust datasets in the published literature to apply data-driven methods. This has led us to consider strategies such as experimental automation, and more recently to the concept of a materials acceleration platform (MAP), or self-driving laboratory (SDL), that combines automated experimentation with ML-guided experiment planning for the design of advanced drug delivery systems. The integration of such technological advancements in the pharmaceutical sciences has the potential to fast-track preclinical research, improve efficiency in drug development pipelines and thus improve patient access to effective medicines.

Dr. Christine Allen is a full Professor at the University of Toronto and internationally recognized leader in drug formulation and development with more than 160 publications. She has received numerous career awards and is a fellow of the American Institute for Medical and Biological Engineering, Canadian Academy of Health Sciences, Controlled Release Society (CRS), and the Canadian Society for Pharmaceutical Sciences (CSPS). She has held senior leadership roles including President of CRS (2022 - 2023), President of CSPS (2020 – 2022), Vice-President Ecosystem Development at adMare Bioinnovations (2022 – 2023), Associate Vice-President and Vice Provost Strategic Initiatives at UofT (2019 – 2022) and Interim Dean, Leslie Dan Faculty of Pharmacy (2018 – 2019). She is the co-founder and CEO of a start-up that is transforming pharmaceutical drug development through integration of AI, automation and advanced computing. She is committed to promoting and actioning equity, diversity, inclusion and accessibility in research and innovation.

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