PoND Research Day 2021

Friday, May 14
6:45 am – 3:00 pm, Pacific Daylight Time
With Plenary Speaker Dr. Shirley Wu

Time	Session		Chair/Moderator
6:45 – 7:00 am	Welcome and introductions		Prof. Matt Moffitt
7:00 – 8:00 am	**Plenary speaker:** Xiao Yu (Shirley) Wu, PhD, FAAPS, Killam Research Fellow Chief Scientific Officer & Co-Founder, Nanology Labs Professor & Director of Advanced Pharmaceutics & Drug Delivery Laboratory, Leslie Dan Faculty of Pharmacy, University of Toronto		Prof. Matt Moffitt
8:00 – 9:20 am *8:00 – 8:20 am* *8:20 – 8:40 am* *8:40 – 9:00 am* *9:00 – 9:20 am*	**Long student talks:** Lubabah Ahmed (Allen lab) Bakr Noor (Oh lab) Anup Singh Khokhar (Moffitt lab) Guanqiao Wang (Bohne lab)		Prof. Afsaneh Lavasanifar
9:20 – 9:30 am	Break		
9:30 – 10:20 am	**Short student talks** (3 min each) – *see next page for order of presenters* (6 speakers, 7 min Q&A; 6 more speakers, 7 min Q&A)		Prof. Cornelia Bohne
10:20 – 10:30 am	Break		
10:30 – 11:20 am	**Short student talks** (3 min each) – *see next page for order of presenters* (6 speakers, 7 min Q&A; 6 more speakers, 7 min Q&A)		Prof. Magdalena Bazalova-Carter
11:20 – 11:45 am	Lunch		
11:45 am – 12:45 pm	**Industry talks (10 min each)**		Prof. John Oh
11:45 – 11:55 am	Medicago	Pooja Saxena, Manager, Research Partnerships, Research & Development	
11:55 am – 12:05 pm	Inversago	Michael Harvey, Senior Vice President, Drug Development	
12:05 – 12:15 pm	Pharma *in silica*	François Arcand, President Myriam Laprise-Pelletier, Researcher Xiaolei Hu, Intern & PoND student	
12:15 – 12:25 pm	Ceapro	Paul Moquin, Director, Scientific Affairs & New Business Development	
12:25 – 12:35 pm	Precision NanoSystems	Samuel Clarke, Director of Reagents R&D	
12:35 – 12:45 pm	Evonik	Mehrdad Bokharaei, Associate Scientist	

Time	Session	Chair/Moderator
12:45 – 1:45 pm	**Student/industry networking** *Students to rotate based on assigned groups (see next page); industrial partners to remain in assigned rooms*	**Student moderators:**
12:45 – 1:05 pm	*Session i: Effects of COVID-19 on industry* Group 1 in Room A (Pharma *in silica* & Precision Nano.) Group 2 in Room B (Inversago & Medicago) Group 3 in Room C (Evonik and Ceapro)	Nasim Sarrami Devon Richtsmeier Xiaolei Hu
1:05 – 1:25 pm	*Session ii: Differences between academia and industry* Group 1 in Room B (Inversago & Medicago) Group 2 in Room C (Evonik and Ceapro) Group 3 in Room A (Pharma *in silica* & Precision Nano.)	Sun Kly Ankur Awasthi Liza Silverman
1:25 – 1:45 pm	*Session iii: Entering industry after a graduate degree* Group 1 in Room C (Evonik and Ceapro) Group 2 in Room A (Pharma *in silica* & Precision Nano.) Group 3 in Room B (Inversago & Medicago)	Helia Hosseini Zongyi Liu Constantine Georgiou
1:45 – 2:00 pm	Break	
2:00 – 3:00 pm	**Industry panel** Topics: • EDI (equity, diversity and inclusion) • Start-up companies & knowledge transfer • Future of nanomedicine	Kamal Bawa (Oh lab) Valerie Facca (Reilly lab) Sree Talluri (Bohne lab)

Short student talks

Short student talks 9:30 – 10:20 am	
Round i	*Round ii*
1. Mahdokht Akbari Taemeh (Fortin lab) 2. Samila Leon Chaviano (Fortin lab) 3. Zongyi Liu (Fortin lab) 4. Yuanfeng Wang (Oh lab) 5. Talita de Francesco (Moffitt lab) 6. Constantine Georgiou (Reilly lab)	7. Helia Hosseini (Bohne lab) 8. Xiaolei Hu (Oh lab) 9. Sophie Lemay (Fortin lab) 10. Sun Kly (Moffitt lab) 11. Rella Liu (Reilly lab) 12. Mariia Kiseleva (Fortin lab)
Short student talks 10:30 – 11:20 am	
Round iii	*Round iv*
13. Kamal Bawa (Oh lab) 14. Valerie Facca (Reilly lab) 15. Souheib Zakraoui (Fortin lab) 16. Sree Talluri (Bohne lab) 17. Devon Richtsmeier (Bazalova-Carter lab) 18. Nasim Sarrami (Lavasanifar lab)	19. Liza Silverman (Moffitt lab) 20. Sirazum Munira (Lavasanifar lab) 21. Lucy Wang (Allen lab) 22. Ankur Awasthi (Bohne lab) 23. Kadambari (Oh lab) 24. Derek Blevins (Wulff lab)

Student/industry networking breakout room groups

Group 1	Group 2	Group 3
Nasim Sarrami	Devon Richtsmeier	Xiaolei Hu
Sun Kly	Ankur Awasthi	Liza Silverman
Helia Hosseini	Zongyi Liu	Constantine Georgiou
Valerie Facca	Sree Talluri	Kamal Bawa
Talita de Francesco	Anup Singh	Guanqiao Wang
Derek Blevins	Lubabah Ahmed	Sirazum Munira
Kadambari	Bakr Noor	Yuanfeng Wang
Rella Liu	Mariia Kiseleva	Sophie Lemay
Samila Leon Chaviano	Mahdokht Akbari Taemeh	Souheib Zekraoui
Lucy Wang	Minou Behboudi*	Parnian Mehinrad*
Alessandra Menandro*	Gustavo Camelo*	

*Non-PoND students

Abstracts

Lubabah Ahmed

Investigation of the Chemotherapeutic Potential of Cannabinoids in Vitro with Emphasis on Cannabidiol and Ovarian Cancer

Lubabah Ahmed[1], James Evans[1], Pauric Bannigan[1], Lie Yun Kok[1], Christine Allen[1*]
[1]*Leslie Dan Faculty of Pharmacy, University of Toronto*

There has been an increased interest in determining the therapeutic potential of the non-psychoactive cannabinoids, cannabichromene (CBC), cannabidiol (CBD), and cannabigerol (CBG). To date, limited data is available on the anticancer effects that these compounds exert and how they may affect the efficacy of existing therapeutics when administered concurrently. The purpose of this study was to investigate the cytotoxicity of non-psychoactive cannabinoids in various cancer cell lines and to determine the combined drug effect of CBD with ovarian chemotherapeutic agents, cisplatin (CDDP), and paclitaxel (PTX) in ovarian cancer (OC) cell lines. CBC, CBD, and CBG were screened for cytotoxicity as monotherapy treatments against a panel containing seven cancer cell lines. CBD was further evaluated in combination with ovarian therapeutic agents in OC cell lines at various molar ratios of CBD to either CDDP or PTX. Cytotoxicity was evaluated using the acid phosphatase assay following 72-hour treatment with either the individual cannabinoid or drug combination. To determine the combined drug effects, combination index values were calculated using the Compusyn software. All three cannabinoids exhibited dose-dependent cytotoxic effects, which resulted in micromolar IC50 values. The most potent cannabinoid was CBD, with IC50 values ranging between 14.2 ± 1.3 and 24.3 ± 3.8 µM. When CBD was further evaluated in combination with CDDP, the combined drug effect was neither cell line nor molar ratio dependent and was predominantly antagonistic at most molar ratios of CBD:CDDP. Conversely, the effects of CBD combined with PTX resulted in synergistic, additive, and antagonistic effects depending on the cell line evaluated. These results illustrate that cannabinoids have cytotoxic potential against

various cancer cell lines. Furthermore, CBD may potentiate or attenuate the effects of ovarian chemotherapeutic agents in vitro. Therefore, further investigation of combined drug effects in vivo is warranted.

Bakr Noor

Reduction-responsive MRI Contrast Switch of Clustered Superparamagnetic Iron Oxide Nanoparticles

Bakr A. A. Noor, John Oh
Department of Chemistry & Biochemistry, Concordia University

Magnetic Resonance Imaging (MRI) has become one of the most widely used anatomical tools in medicine**.** To improve the quality of diagnosis, with MRI in vivo, contrast agents have been used. Superparamagnetic iron oxide nanoparticles (SNPs) have been considered as biocompatible alternatives to clinical used Gd-based contrast agents in particular. Their contrast enhancement is size-dependent: ultrasmall SNPs with diameter <5 nm for bright imaging (T1-weighted contrast enhancement), while SNP with diameter > 10 nm and clusters for dark imaging (T2-weighted contrast enhancement). My master research aims to explore a new strategy to switch T1 & T2 contrast enhancement of SNP-based clusters via reduction-responsive degradation. The strategy centers on the stabilization of USNP colloids with poly(acrylic acid) (PAA) to form aqueous PAA/USNP colloids with single layers (Hydrodynamic diameter ≈ 16 nm). These distinct colloids are subjected to crosslinking with disulfide linkages. The formed clusters (T2-weighted contrast agent) dissociate to individual PAA/SNP colloids (T1-weighted contrast agent) upon the cleavage of disulfide bonds in the presence of cellular glutathione. The formed colloids being thiols can be oxidized to yield disulfide-crosslinked clusters. Such T1 & T2 switch upon redox reaction of disulfide can be anticipated to be a useful tool towards MRI-guided diagnosis of diseased tissues. My presentation shows our preliminary results in the synthesis of aqueous PAA/USNP colloids, cluster formation, and reduction-responsive degradation.

Anupjot Singh

Fluorescence Probing of PCL-b-PEO Polymeric Nanoparticles to understand their drug delivery properties

Anupjot Singh, Matthew G Moffitt, Cornelia Bohne
Department of Chemistry, University of Victoria

Polymer Nanoparticles have been widely demonstrated as efficient drug delivery nanocarriers to encapsulate chemotherapeutic drugs and target them actively or passively to cancer cells.[1] However, the role of molecular dynamics between drug molecules and nanoparticles on the efficiency of drug delivery is not yet efficiently understood. Thus, we use pyrene as a loading molecule that acts like hydrophobic drug molecules but has unique photophysical properties to characterize PCL-b-PEO nanoparticles. Our group expertise in two-phase microfluidic reactor synthesis of block copolymer

nanoparticles.[2] We investigate the effects of microfluidic synthesis parameters to establish their role in affecting drug delivery performance of nanoparticles. Fluorescence experiments in the steady state provide quantitative as well as qualitative information of the interaction of loaded pyrene in nanoparticle microenvironment. These studies also provide molecular scale information on drug diffusion and release.

Ref: [1] Engineered Nanoparticles for Drug Delivery in Cancer Therapy, Volume: 53, Issue: 46, Pages: 12320- 12364 [2] Microfluidic synthesis of dye-loaded polycaprolactone-block-poly(ethylene oxide) nanoparticles, Journal of Colloid and Interface Science, Volume 475, 2016, Pages 136-148

Guanqiao Wang

Measuring Diffusion Kinetics of Small Molecules in Hydrogels Using the Top Layer Method

Guanqiao Wang, Suma Susan Thomas
Department of Chemistry, University of Victoria

The diffusion of small molecules in hydrogels is studied. Two gels are investigated, a triblock polymeric gel F127 and a low molecular weight supramolecular gel. Our objective is to compare the diffusion of small molecules in these two hydrogels. We have established a reproducible method to measure diffusion kinetics of small molecules in hydrogels over cm scales, using UV-vis spectroscopy. Herein, we prepare a set volume of gel in a 10 × 10 mm quartz cuvette and add a thin layer of methylene blue solution on top. The absorbance of the sample at a fixed position is measured periodically to yield the kinetics. We have observed that the diffusion of methylene blue in NaDC is slower than in F-127 gels. This observation is not aligned with the viscosity of these gels, since NaDC hydrogels are less viscous than F-127 hydrogels. This difference in kinetics could be attributed to the difference in gel structure or the fact that NaDC monomers are charged molecules, while F-127 is a neutral polymer. We are currently investigating the cause of this observation with different dye molecules.

Biographies

Xiao Yu (Shirley) Wu, PhD, FAAPS, Killam Research Fellow
Chief Scientific Officer & Co-Founder, Nanology Labs
Professor & Director of Advanced Pharmaceutics & Drug Delivery Laboratory, Leslie Dan Faculty of Pharmacy, University of Toronto

Dr. Shirley X.Y. Wu is CEO and co-founder of Nanology Labs, a start-up pharmaceutical company that develops nanotechnology-based next generation diagnostics and therapeutics to improve cancer treatment outcomes. With two major technologies invented in the Wu lab, Nanology Labs is developing a tumor microenvironment (TME)-modulating and blood-brain barrier (BBB)-penetrating nanomedicine pipeline that is able to overcome tumor hypoxia and associated treatment resistance and enhance early detection of cancer metastases in the brain.

Dr. Wu is a professor, elected AAPS Fellow and Killam Research Fellow at the Leslie Dan Faculty of Pharmacy, University of Toronto. In her over 26-year academic career, Dr. Wu has directed an innovative research program in the area of advanced pharmaceutics and drug delivery. Her research interests include: 1) synergistic drug combination nanomedicine for treatment of multidrug resistant and metastatic cancer; 2) BBB-penetrating nanoparticles for treatment and imaging of brain tumor/metastases and CNS diseases; 3) bioreactive manganese dioxide-containing polymer-lipid nanoparticles for modulating TME and enhancing cancer therapies; 4) glucose-responsive insulin device and glucagon microneedle patch for diabetes treatment; and 5) rationale and computer-aided design of controlled release dosage forms.

François Arcand, President, Pharma *in silica*

François Arcand is president of Pharma in silica (Québec), a preclinical company devoted to a safer chemotherapy. He is an entrepreneur in life sciences (SiliCycle inc., Québec, 2013/17; ERA Biotech, Barcelona 2004/2010; Conference on Plant-made pharmaceuticals, Québec 2003, Montréal 2005; Medicago, Québec, 1997/2002) and in arts and culture (1978/1997). Co-author of « Novel Protein-Production Systems » (2004) and « Audace et ingéniosité, moteurs du développement économique et sociétal » (Institut du Québec, 2017). Appreciates sea kayak, cinema, all kinds of music and certain people. Born in Québec City in 1955; Executive MBA from John Molson School of Business, Concordia University, Montréal (1995).

Mehrdad Bokharaei, Associate Scientist, Evonik Vancouver Laboratories

Mehrdad is a Pharmaceutical Scientist with several years of experience in developing of drug delivery systems. He has been working for Evonik Vancouver Laboratories for more than two years as an associate scientist in the R&D department. His undergraduate and Master's degree were in Chemical and Biochemical Engineering and were completed in Iran and Canada. He completed his PhD in Pharmaceutical Sciences at UBC where he worked on the development of a microfluidic system for

production of monosize polymer microparticles. Before joining Evonik, he completed two years of postdoctoral fellowship at UBC and focused on the development of lipid nanoparticle formulations.

Samuel Clarke, Director of Reagents R&D, Precision NanoSystems Inc.

Dr. Samuel Clarke is an expert in the development of nanoparticles for biomedical applications and has more than 15 years' experience in the field. Samuel is the Director of Reagents R&D at Precision NanoSystems Inc. where he is responsible for the development of the nanoparticle delivery reagents and applications. Samuel previously worked for STEMCELL Technologies Inc. where he invented and commercialized magnetic nanoparticle technologies for research and cell therapy applications. Samuel studied fluorescent quantum dot nanoparticles for diagnostic applications during his post-doc at the École Normale Supérieure and PhD at McGill University.

Michael Harvey, Senior Vice President, Drug Development, Inversago Pharmaceuticals Inc.

Michael is a senior executive with 20 years of experience in drug development. His expertise in various therapeutic areas includes musculoskeletal rare diseases, oncology, as well as infectious diseases. As an experienced leader in the biotech start-up space, he successfully advanced programs throughout nonclinical and clinical development and led high performing cross-functional teams to deliver innovative therapies to patients. Over his career, he demonstrated strong abilities in strategic planning, execution in a fast-paced environment and alliance management, including pharma partner collaborations. Prior to joining Inversago, Dr. Harvey was Vice President, Drug Development and Montreal Site Head at Ipsen (formerly Clementia Pharmaceuticals Inc.). He previously assumed managing roles at Thallion Pharmaceuticals and several other biotech companies. Dr. Harvey holds a BSc in Biology and a PhD in Bioanalytical Chemistry, both from Concordia University (Montreal, Canada).

Myriam Laprise-Pelletier, Translational Researcher, Pharma *in silica*

Dr. Myriam Laprise-Pelletier is a translational researcher at Pharma in silica (Québec) since 2020. She holds a B.S. degree in Physics, and a M.S. degree and a Ph.D. in Materials Engineering from Université Laval. She did her graduate studies under the supervision of Dr. Marc-André Fortin (ULaval) on silica-based nanoparticles for MRI/PET imaging and on low-dose radioactive gold nanoparticles to treat prostate cancer. Her research focused on nanobrachytherapy performance, nanoparticle targeting and molecular imaging. One of her articles was awarded the Sylvia Fedoruk Prize from OCPM (best article in medical physics, 2018) and she was awarded the "Étudiant-chercheur étoile » from the FRQNT (2017).

Paul Moquin, Director, Scientific Affairs & New Business Development, Ceapro Inc.

Paul holds a PhD in Bioresource and Food Engineering from the University of Alberta and has been with Ceapro since 2008. At Ceapro, Dr. Moquin and his team have improved manufacturing processes, developed novel processes (e.g. PGX Technology) and ingredients. Prior to joining Ceapro, Paul was a researcher and instructor at the University of Alberta. Paul's career has focused on generating high value material from renewable materials using conventional and novel processing technologies, especially supercritical fluid processing. He is the author of a dozen peer-reviewed papers, a book chapter and over twenty presentations to international meetings, symposiums and conferences.

Amrita Nagle, Scientist, Evonik Vancouver Laboratories

Amrita has been working at Evonik Vancouver Laboratories (VAN), Canada, for more than 3.5 years and is currently serving as a scientist in the R&D department. She completed her undergraduate and Master's degree in India in pharmaceutical sciences and holds a doctorate from the National University of Singapore (NUS). She worked in Singapore as a scientist in a drug discovery company before moving to Canada. Her research career has spanned across disciplines of cell biology, drug discovery and lipid-based nanoparticle formulations.

Pooja Saxena, Medicago, Manager–R&D

Pooja is a virologist with over a decade of research experience from renowned labs across UK, USA and Canada. Pooja developed a strong background in biochemistry during her Honours degree from the University of Sussex and Ph.D. from the John Innes Centre, UK. The focus of her doctorate thesis was virus-like particles, which is the basis for several technologies that are used to develop therapeutics today. Pooja went on to pursue a post-doctoral fellowship at Indiana University in structural virology.

After her two-year post-doc, Pooja made the switch from academia to industry by accepting the role of a Research and Innovation Scientist at Medicago, a clinical-stage Canadian pharmaceutical company developing vaccines for COVID and Influenza. Currently, Pooja works at Medicago as a manager of Research Partnerships overseeing collaborative research with academic and industrial partners.