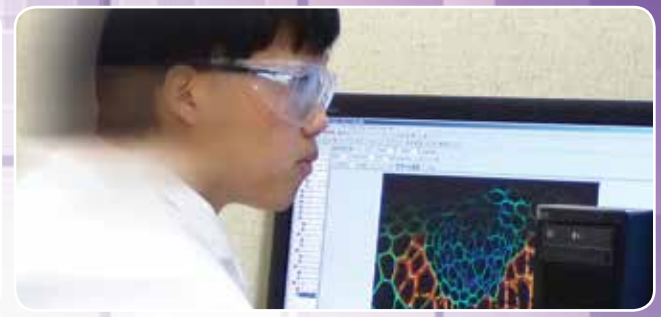
GRADUATE STUDIES | Department of Chemistry

Chemical Biology and Biomaterials



Western Science

WESTERN SCIENCE

Department of Chemistry

The Department of Chemistry at Western University offers a large and vibrant, research-intensive environment for more than 100 graduate students.

Taking a modern view of the chemical sciences, the four main research themes reflect Western's open-minded and multidisciplinary approach to research. These themes include: Chemical Biology and Biomaterials; Synthesis, Catalysis and Molecular Materials; Materials: Design, Function and Characterization; and Theory and Computation.

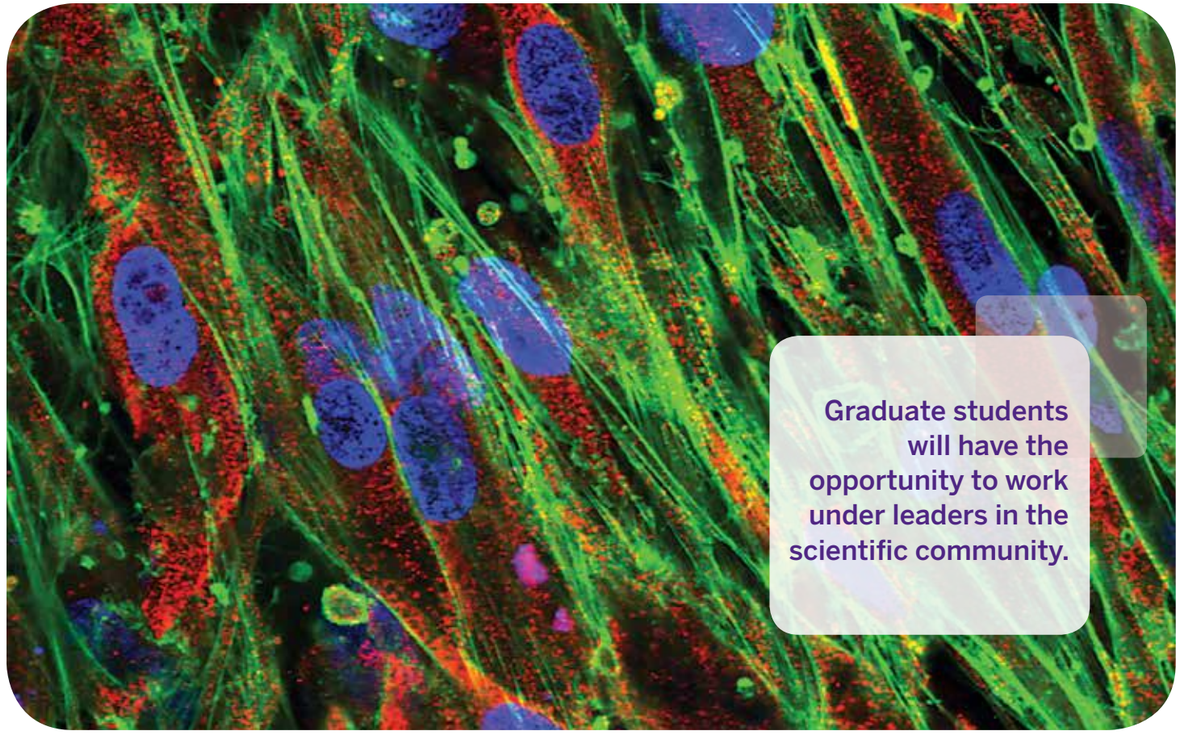
We are proud to boast over 25 NSERC-funded researchers, some of whom are Tier I and II Canada Research Chairs and Industrial Research Chairs with numerous links to academic and industrial partners, and some of the finest research facilities in Canada.

Our researchers play leading roles in organizations within Western, including: The Centre for Advanced Materials and Biomaterials Research (CAMBR), Surface Science Western, and the Western Nanofabrication Facility, and publish regularly in top tier peer-reviewed journals. Graduate students can expect their results to be disseminated globally. They may also receive opportunities to conduct applied research in collaboration with industrial partners.

Chemical Biology and Biomaterials

The "Chemical Biology and Biomaterials" research theme is at the interface between chemistry, biology and biochemistry and can be defined as the use of chemistry to advance a molecular understanding of biology and/or the harnessing of biology to advance chemistry. The development of a molecular understanding of biochemical systems requires molecular tool kits and associated instrumental developments that enable the analysis of complex processes.

These challenges bring together researchers from biochemistry, materials science and engineering, and chemistry with a focus on the elucidation of biochemical processes in a quantitative manner. Tailor-made molecules and materials make it possible to study interactions in biological processes, such as cell signalling or protein folding, and provide novel probes for molecular imaging in living cells. Microarray technologies, which enable the analysis of thousands of surface-bound molecules simultaneously, together with new single molecule techniques, have given rise to some key advances that ultimately may have applications in medical diagnostics, drug discovery and treatment of diseases.



Graduate students will have the opportunity to work under leaders in the scientific community.

The Gillies Group

Elizabeth Gillies, Associate Professor

PRIMARY RESEARCH FOCUS

The Gillies Group uses organic and polymer chemistry to develop materials for biomedical applications. We are designing new biodegradable polymers that break down by novel chemical mechanisms, triggered by stimuli such as light or changes in pH. We also aim to introduce handles to these polymers to attach drugs, contrast agents or cell signaling molecules. The polymers are then assembled into nanoparticles, nanocapsules or fibres, to be used in drug delivery, medical imaging, or tissue engineering.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our researchers work in collaboration with industry and academe including:

- LANXESS Inc. (butyl rubber functionalization)
- Paul Ragogna, Western Chemistry (phosphonium surfaces)
- Weiping Min, Western Pathology (drug delivery)
- Kibret Mequanint, Western Chemical Engineering (tissue engineering)

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

State-of-the-art synthetic labs as well as facilities for characterization of polymers and biomaterials including size exclusion chromatography, light scattering, UV-visible and fluorescence spectroscopy facilitate our research.

ACCOMPLISHMENTS AND PAST GRADUATES

Members of our group have won prestigious scholarships such as NSERC PGS and CGS awards and have gone on to obtain postdoctoral fellowships such as the Marie Curie and CNRS for studies in Europe. Many of our former students and postdoctoral fellows are also employed with companies such as LANXESS, 3M, and Accucaps.

"Proper training is an essential step in being productive in research. Dr. Gillies held weekly group meetings and smaller meetings to discuss research challenges and progress."

– Ali Nazemi, PhD

FOR MORE INFORMATION
http://publish.uwo.ca/~egillie/
or contact egillie@uwo.ca

Academic Snapshot

30
full-time faculty

100+
full-time graduate students

Over 7,500
students taught annually

2,500th BSc
by 2014

200th PhD
by 1986

475th PhD
by 2014

A Tradition of Research

Average annual research revenue
$4,000,000

FIRST
publication in 1915

100
publications by 1962

1,000
publications by 1975

2,000
publications by 1985

6,000
publications by 2012

The Hudson Group

Robert Hudson, Professor

PRIMARY RESEARCH FOCUS

Our principle research activities involve the application of organic synthesis in the field of bio-organic chemistry. We specialize in oligonucleotide analogs and our work is focused on peptide nucleic acid or PNA and nucleobase-modified DNA and RNA with special interest in fluorescent analogs. We are also engaged in the development of contrast agents for magnetic resonance imaging with collaborators at the Robarts Research Institute.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

We have our own group UPLC-ESI-MS system, UV/vis spectrophotometer, fluorimeter, HPLCs, automated synthesizers (peptide and DNA) and well-appointed synthetic labs to support our research.

STUDENT AWARDS

Mark Milne co-authored with Robert H.E. Hudson on a poster presented at the World Molecular Imaging Congress, Dublin, Ireland which received a 1st Place Poster Prize in the Probe Development Division (2012).

“As a PhD student in Hudson Group, I enjoy the great benefit of being surrounded by intelligent and dedicated chemists. The faculty and facilities provide a supportive environment for us to do frontier research and learn up-to-date techniques efficiently. Research-based study and other forms of scholarly activities inspire our creativity, develop our capability as independent researchers, and bring us personal and professional recognition, publications and other rewards.”

– Rachael (Xiaoxiao) Wang, PhD student

FOR MORE INFORMATION
http://publish.uwo.ca/~rhhudson/
or contact robert.hudson@uwo.ca

The Konermann Group

Lars Konermann, Professor and Canada Research Chair

PRIMARY RESEARCH FOCUS

Our work is at the interface of bioanalytical and biophysical chemistry. We explore the structure and function of proteins in health and disease. Most of our experiments involve the use of electrospray mass spectrometry, but we also employ a range of other spectroscopic tools, as well as computer simulations. Recent highlights from our lab include the characterization of short-lived protein folding intermediates, as well as deciphering the mechanisms of protein ligand interactions.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Our laboratory is equipped with state-of-the-art mass spectrometers with ion mobility capability. We also have various LCs, as well as lasers for covalent labelling studies.

RESEARCH AWARDS

The Konermann lab has been recognized for its excellence in research with several awards including the W.A.E. McBryde Medal, Canadian Society for Chemistry (2014); Fred Lossing Award, Canadian Society for Mass Spectrometry (2013); Ken Standing Award, ETP Symposium Inc., University of Manitoba (2013); Florence Bucke Science Prize, Western University (2011); and the Gordon Research Conference Chair (2011).

“Research in the Konermann lab is second to none. We explore many different research topics, using a wide range of techniques. Our work is published and cited in the most prominent multidisciplinary and specialized journals. One of the papers that I co-authored was downloaded more than 1,200 times in 41 countries spanning all continents in the first eight weeks after publication.”

– Siavash Vahidi, PhD student

ACCOMPLISHMENTS AND PAST GRADUATES

Students in our lab have been very successful at securing external stipends such as NSERC, PGS/CGS, and OGS and awards including the 2013 Paul de Mayo medal for best PhD thesis.

FOR MORE INFORMATION
http://publish.uwo.ca/~konerman/
or contact konerman@uwo.ca

The Luyt Group

Leonard Luyt, Associate Professor

PRIMARY RESEARCH FOCUS

Dr. Luyt’s research program spans from basic chemistry activities, looking at novel methods of incorporating metal complexes into peptide structures, through to applied research, investigating new molecular imaging agents targeting cancer. In addition to medicinal and bio-organic chemistry, the lab is involved in peptide synthesis, combinatorial library screening and the development of SPECT and PET molecular imaging agents.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Facilities available to our researchers include synthetic labs, radiochemistry labs and molecular imaging equipment. Equipment includes: automated microwave peptide synthesis, LCMS (QTOF) and automated Ga-68 radiosynthesis.

RECENT PUBLICATIONS

C.-F. Cho, G. A. Amadei, D. Breadner, L. G. Luyt, J. D. Lewis* “The Discovery of Novel Integrin Ligands from Combinatorial Libraries using a Multiplex ‘Beads on a Bead’ Approach” *Nano Lett.* **2012**, *12*, 5957–5965.

J. L. Hickey, L. G. Luyt* “Synthesis of Rhenium-centric Reverse Turn Mimics” *Chem. Eur. J.* **2012**, *18*, 12999–13007.

D. Rosita, M. A. DeWit, L. G. Luyt* “Fluorine and Rhenium Substituted Ghrelin Analogues as Potential Imaging Probes for the Growth Hormone Secretagogue Receptor” *J. Med. Chem.* **2009**, *52*, 2196–2203.

“Working in the Luyt lab has been an excellent educational experience. Dr. Luyt has an open-door policy which means that he is always willing to provide advice and motivation when required. At the same time, he allows students to retain control over the direction of their projects and encourages them towards independent thought.”

– Milan Fowkes, MSc

ACCOMPLISHMENTS AND PAST GRADUATES

Dr. Jen Hickey graduated with a PhD in 2011 and is currently Director of Chemistry for Encycle Therapeutics. Dr. Babak Behnam Azad also graduated in 2011 and is a post-doctoral fellow at Johns Hopkins University in Baltimore.

FOR MORE INFORMATION
http://publish.uwo.ca/~lluyt
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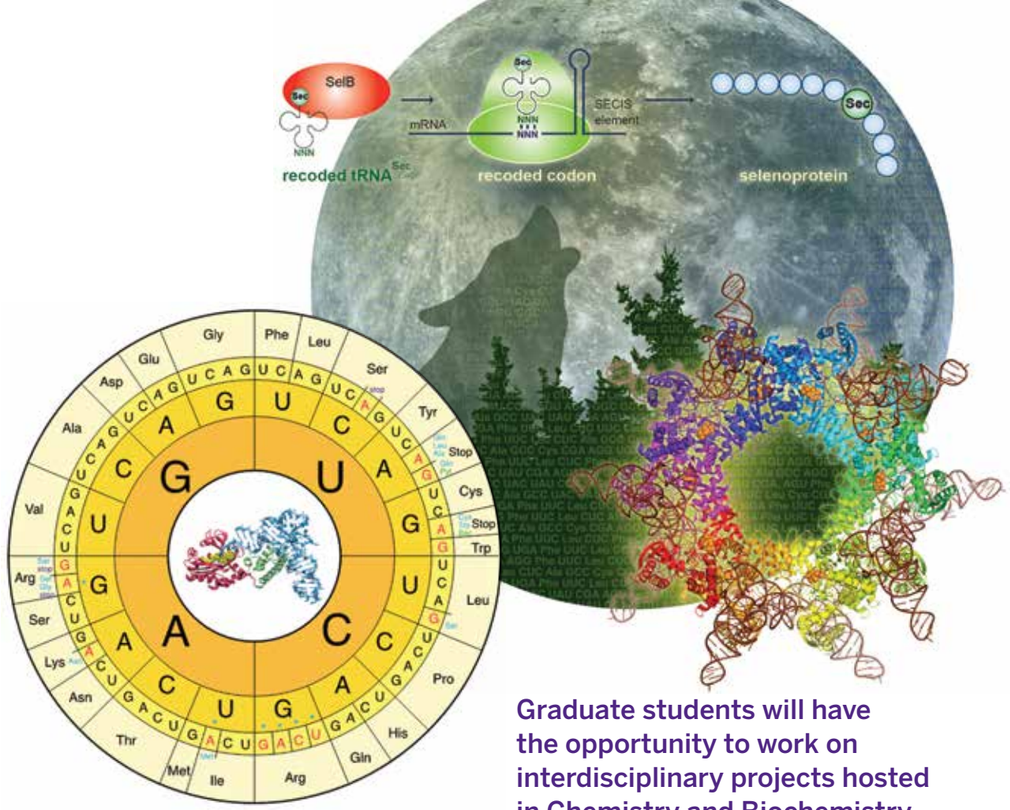

Graduate students will have the opportunity to work on interdisciplinary projects hosted in Chemistry and Biochemistry.

The O'Donoghue Laboratory

Patrick O'Donoghue, Assistant Professor of Chemistry and Biochemistry

PRIMARY RESEARCH FOCUS

The long-term objective of our laboratory is genetic code expansion: to engineer systems for protein synthesis with multiple non-canonical amino acids (ncAAs) in Escherichia coli and human cells. We are currently engineering translation systems in E. coli to site-specifically hardwire proteins with post-translational modifications, creating new biosynthetic and chemical synthetic routes to ncAAs, and designing selenocysteine-containing enzymes for industrial and medical applications.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our collaborators include: Christian Baron, Professor and Chair, Department of Biochemistry, Université de Montréal; Hiro Suga, Professor, Department of Chemistry, University of Tokyo; and Omar Orellena, Professor, Faculty of Medicine, Universidad de Chile.

RECENT PUBLICATIONS

M. J. Bröcker, J. M. L. Ho, G. M. Church, D. Söll*, P. O'Donoghue* "Recoding the Genetic Code with Selenocysteine" *Angew. Chem. Int. Ed.* **2014**, *53*, 319–323. (front cover; featured in *ChemBiochem*, 1/2014; *The Scientist*, 1/2014; *Nature Chem. Bio.*, 2/2014).

P. O'Donoghue, J. Ling, Y.-S. Wang, D. Söll* "Upgrading Protein Synthesis for Synthetic Biology" *Nature Chem. Biol.* **2013**, *9*, 594–598.

P. O'Donoghue, K. Sheppard, O. Nureki, D. Söll* "Rational Design of an Evolutionary Precursor of Glutaminyl-tRNA Synthetase" *Proc. Nat. Acad. Sci.* **2011**, *108*, 20485–20490.

K. Nozawa, P. O'Donoghue, S. Gundllapalli, Y. Araiso, R. Ishitani, T. Umehara, D. Söll*, O. Nureki* "Pyrrolysyl-tRNA Synthetase–tRNA^{Pyl} Structure Reveals the Molecular Basis of Orthogonality" *Nature* **2009**, *457*, 1163–1167.

FOR MORE INFORMATION

http://www.schulich.uwo.ca/biochem/people/bios/ODonoghue.html
or contact patrick.odonoghue@uwo.ca

The Stillman Bioinorganic Group

Martin Stillman, Professor

PRIMARY RESEARCH FOCUS

The research interests of the Stillman Group follow the general theme of using the quantitative and theoretical analysis of spectroscopic data to obtain mechanistic, functional, structural, or electronic configuration information for molecules of bioinorganic interest. All life on the planet depends on a large number of essential metals. Our research is the study of the roles of metals in biologically important systems.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our academic collaborators include: Professors Kobayashi, Tohoku University, Japan; Kohzuma, Ibaraki University, Japan; Shen, Nanjing, China; Dyson, Lausanne, Switzerland; Kille, Cardiff, Wales: Sturzenbaum, London, UK; Heinrichs, Western University; and Soldatov, Russia.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

We have access to outstanding tools and technologies including a Bruker micrOTOF2 electrospray ionization mass spectrometer; Oxford Instruments superconductings magnets for magnetic circular dichroism spectroscopy between 1 and 300 K; and a PTI nanosecond lifetime instrument.

"Our group has access to outstanding tools and technologies, keeping us at the forefront of research in our field."

– Tyler Pinter, PhD student

FOR MORE INFORMATION

www.stillmangroup.ca or on Facebook at martinstillman and stillmanbioinorganicgroup
or contact martin.stillman@uwo.ca

Yeung's Bioanalytical Chemistry Research Laboratory

Ken Yeung, Associate Professor

PRIMARY RESEARCH FOCUS

Research in the Yeung lab focuses on two analytical instruments for biological samples. Capillary Electrophoresis is utilized to perform protein sample pretreatment at sub-microliter volumes. The latest development involves the use of magnetic beads for immobilization and chemical derivatization of targeted analytes. The second interest is in the area of tissue imaging by mass spectrometry. Current work focuses on the sample cleanup and chemical derivatization that can enhance sensitivity.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Our lab is equipped with capillary electrophoresis instruments and MALDI mass spectrometers. Collaboration with researchers in medicine and dentistry provides access to samples and facilities for clinical research.

RECENT PUBLICATIONS

T. Li, C. J. Booker, K. K.-C. Yeung* "Migration Behaviour of Discontinuous Buffers in Capillary Electrophoresis during Protein Enrichment" *Analyst* **2012**, *137*, 4766–4773.

"The Yeung lab provides collaborative research opportunities between analytical chemistry and clinical sciences. In my research, mass spectrometry is applied to study protein aggregation in Alzheimer's disease. The collaboration not only diversifies my knowledge and practical skills, exposure to neurosciences allows me to acquire a unique skill set that can distinguish me from other chemists in the job market."

–Jasmine Wang, PhD student

ACCOMPLISHMENTS AND PAST GRADUATES

Many of the graduates are currently working in analytical government labs such as the National Research Council and the RCMP and private sector laboratories at Gamma-Dynacare Medical Lab and Nexreg Compliance.

FOR MORE INFORMATION

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Western Science

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