Cathleen M. Crudden

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Current Positions

Queen's University, Chemistry
AV Douglas Distinguished University Professor
Tier 1 Canada Research Chair
Scientific Director, C2MCI
Research Professor, Nagoya University ITbM
Editor-in-Chief, ACS Catalysis

Research Highlights

$24M New Frontiers in Research Fund
$9M CFI Innovation Fund
$1.6M CREATE grant (NSERC)
$1M Department of National Defense
Highest national NSERC Discovery grants in all scientific areas, 2016 and 2020
Total Research Funding >**$54M, $45M as PI**

Service to the Community

Founder and Scientific Director–Carbon to Metal Coatings Institute (C2MCI)
President, Canadian Society for Chemistry
Chair, Chemical Institute of Canada
Chair, Fellowship committee, RSC–Mathematical and Physical Sciences
Director, Catalysis and Materials Divisions, CSC Board of Directors
Chair and Founder, NSERC Chemistry Liaison Group

Major Awards

Fellowship, Royal Society of Canada
Fellowship, Chemical Institute of Canada
Fellowship, Royal Society of Chemistry UK
Killam Research Fellow
Cope Award–American Chemical Society
Montreal Medal, Alfred Bader Award, Lemieux award and others (CSC)
Queen's National Scholar
Premier's Research Excellence Award

Education

BSc, University of Toronto
MSc, University of Toronto, Mark Lautens
PhD, University of Ottawa, Howard Alper
Visiting Researcher, Osaka University, Japan, Shinji Murai
NSERC Postdoctoral Fellow–University of Illinois Urbana-Champaign, Scott Denmark

Research Areas/Interests

Catalysis, synthetic organic chemistry, chirality, pharmaceutically relevant synthesis

Nanomaterials, nanoclusters

Materials chemistry, self-assembled monolayers, organic films, sensing, corrosion prevention, atomic layer deposition

Publications

144 peer reviewed publications
Journals include Nature Chemistry, Nature Communications, Journal of the American Chemical Society, ACS Catalysis and others
One publication chosen as top paper of the year (Synlett)
One publication awarded 8th place in Canada's Top Ten Hot Papers in Science (Essential Science Indicators)
25 papers cited >100 times

Past Employment/Visiting Professorships

2021	Chair, Chemical Institute of Canada
2020	Vice-Chair, Chemical Institute of Canada
2018	Visiting Professor, Université Claude Bernard Lyon 1, France
2013	Past President, Canadian Society for Chemistry
2012	President, Canadian Society for Chemistry
2012	Visiting Professor, Global Centers of Excellence, Kyoto, Japan
2011	Vice-President, Canadian Society for Chemistry
2007	Visiting Research Professor, Universitat Roviri i Virgili, Tarragona, Spain
2006	Visiting Research Professor, Nagoya University, Group of Ryoji Noyori
2002–2009	Associate Professor, Queen's University
2002–2007	Queen's National Scholar, 5 year research chair (non-renewable)
2001–2002	University Research Professor, University of New Brunswick
2000	Associate Professor (tenured), University of New Brunswick
1996–2000	Assistant Professor, University of New Brunswick

Honours and Awards

Alfred Bader Award, Chemical Society of Canada, 2022
Most Inspiring Teacher, Queen's Chemistry, 2021
Fellow, Royal Society of Canada, 2020
Arthur C. Cope Scholar, American Chemical Society, 2019
Montreal Medal, Chemical Institute of Canada, 2019
International Precious Metals Institute Carol Tyler award (US), 2018
Catalysis Award, Canadian Catalysis Society, 2018
Top paper of 2017 award, Synlett
Queen's Excellence in Research Award, 2017
Canada Research Chair (Tier 1), 2017-2027
Fellow, Royal Society of Chemistry UK, 2016
R.U. Lemieux Award for Organic Chemistry, CSC 2017
Killam Research Fellow, 2015-2016
Fellow, Chemical Institute of Canada, 2014
Clara Benson Award, Canadian Society for Chemistry, 2011
Catalysis Lectureship Award, Canadian Catalysis Society, 2011
NSERC Accelerator Awardee, 2010 *(one of eight in Chemistry in Canada)*
Global Centers of Excellence Visiting Professorship, Kyoto, Japan, 2008
Merck and Company Academic Development Award, 2008
Visiting Professorship, Catalan Government, 2007
Awarded 8th place in Canada's Top Ten Hot Papers in Science (*Essential Science Indicators),* 2006
Research Center for Materials Science Visiting Professorship, Nagoya Japan, 2006
Johnson and Johnson Focused Giving Award, 2006
Premier's Research Excellence Award, February 2003
Chancellor's Research Award, January 2003
Queen's National Scholar Award, January 2001
Granted early promotion and tenure, July 2000

University of New Brunswick Merit Award, June 1999
Ichikizaki Travel award for Young Chemists, April 1999 and November 1997
IUPAC Travel Award, December 1998
Research and Innovation Award, December 1997
NSERC Post-doctoral Fellowship, 1995-1996
Ontario Graduate Scholarship, 1993-1994
Bio-Mega / Boehringer Ingelheim Graduate Research Scholarship, 1993
NSERC Post-graduate Fellowship, 1991-1993
George Wright Cumulative Examination Award, 1990
University of Toronto Open Fellowship, 1990-1991 and 1989-1990
David McLaren Scholarship, and Ivan Szak Scholarship, 1988
Canadian Society for Chemistry Award for Academic Excellence, 1988
University of Toronto entrance scholarship, 1985

Lectureships

2022, Earl L. Muetterties Lectureship, University of California, Berkeley, US
2022, Klemm Lecturer, University of Oregon, US
2022, Chem Cell Press Lecturer, University of California, Los Angeles, California US
2021, ScotChem Lectureship (Scotland, UK) (postponed to 2023)
2020, Merck-Karl Pfiser Visiting Lecturer in Organic Chemistry, Massachusetts Institute of Technology (United States)
2017, Swiss Chemical Society Lectureship (Switzerland)
2014, Organic Reactions Lectureship, University of Illinois at Urbana-Champaign (US)
2014, Inaugural Aldrich Lectureship, University of Michigan (US)
2014, Keith Fagnou Memorial Lectureship, Ottawa University (Can)
2011, Catalysis Lectureship, Canadian Catalysis Society (Can)

Editorial, Board and Panel Positions

International Journals

- Editor-in-chief, ACS Catalysis, 2021–present
- Senior Editor, Bulletin of the Chemical Society of Japan
- Editorial Board, Organic Syntheses, 2019–2022
- Scientific Advisory Board, ChemRxiv, 2019–present
- Editorial Advisory Board, Angewandte Chemie International Edition, 2019–2020 (resigned)
- Editorial Advisory Board, ACS Central Science, 2018–present
- Editorial Advisory Board, Chem, 2018–present
- Editorial Advisory Board, Synthesis/Synlett 2013–present
- Editorial Advisory Board, Chemical Record (Japan), 2010–present
- Editorial Advisory Board, Chemical and Engineering News, 2014–2022
- Editorial Advisory Board, Organometallics, 2015–2018

National Journals

- Editorial Advisory Board, Canadian Journal of Chemistry, 2004-2009
- Editorial Board, Canadian Chemical News 1999-2010
- Columnist, “Chemical Shifts”, bi-monthly article in Canadian Chemical News on Canadian

chemical research

National and International Granting Agency Work

- Alfred P. Sloan Research Fellowship Selection Committee, 2022-present
- Editorial Advisory Board, RIKEN, Japanese national labs, 2019–present
- NSERC Partnerships Grants program Evaluation Committee, 2019
- Reviewer, EPSRC graduate training centers (UK), 2018
- Member, Review panel, DFG Centers of Excellence Program (Germany) 2017–2018
- Member, Review panel, AAAS review of grants for Saudi Arabia (US), 2018
- Chair, National NSERC–Chemistry Liaison Committee, 2017–2022
- Chair, Strategic Grants Panel, Competitive Manufacturing, NSERC, 2009, 2007
- Member, Strategic Grants Panel, NSERC, 2006–2009

National and International Chemical Societies

- Chair, Chemical Institute of Canada, 2021-2022
- Vice–Chair, Chemical Institute of Canada, 2020-2021
- Past President, Canadian Society for Chemistry, 2013
- President, Canadian Society for Chemistry, 2012
- Vice–President, Canadian Society for Chemistry, 2011
- Vice–President, Inorganic Division, Canadian Society for Chemistry, 2011
- Director, Catalysis and Materials Divisions, CSC Board of Directors, 2002-2005
- Director, Catalysis and Materials Divisions, CSC Board of Directors, 1999-2002
- Member, Executive Committee, Fluorine Division, American Chemical Society 2002-2005
- Fellow, Chemical Institute of Canada
- Fellow, Royal Society of Chemistry UK
- Member, American Chemical Society and Chemical Society of Japan

National and International Reviews

- Reviewer, Centers of Excellence, Germany
- Reviewer, Doctoral awards, Austria
- Reviewer, Faculty Candidates, Chemistry Department, University of Oulu, Finland, 2018
- Reviewer for tenure cases/promotions at Princeton University, University of Illinois at Urbana-Champaign, University of Michigan, University of Tokyo, University of Edinburgh, Manchester University, University of Saskatchewan, University of Alberta, University of British Columbia, Dalhousie University, University of the Fraser Valley and others

Organization of Conferences and Symposia

Co-chair, Gordon Research Conference, Atomically Precise Nanochemistry, 2022
Vice-chair, Boron Americas, June 2016, Kingston
Organizing Committee member, (one of two Canadian representatives)
Pacifichem 2015, Hawaii
Area convener, Inorganic Chemistry, Pacifichem 2015, Hawaii
Symposium Organizer: N-Heterocyclic Carbene Complexes of the Transition Metals, Pacifichem 2015, Hawaii
Vice-Chair, International Symposium on Homogeneous Catalysis, 2014, Ottawa

Chair, Canada-Japan MEXT workshop, 2014, Ottawa
Symposium Organizer: N-Heterocyclic and Mesoionic Carbenes in Catalysis, 97th Canadian Society for Chemistry Conference
Symposium Organizer: Homogeneous and Heterogeneous Catalysis in Honour of Howard Alper, 95th Canadian Society for Chemistry Conference
Organizing Committee member, (one of three Canadian representatives)
Pacifichem 2010, Hawaii
Area convener, Materials Chemistry, Pacifichem 2010, Hawaii
Area coordinator, Materials Chemistry, Pacifichem 2005, Hawaii
Co-organizer, Physical Organic Minisymposium, Queen's University, October 2004
Conference Chair, 13th Quebec-Ontario Minisymposium in Organic and Bio-organic Chemistry, Queen's University, November 2002
Symposium organizer: "Fluorine Chemistry" at the 84th National Canadian Society for Chemistry conference, Montreal, Que., May 2001
Section organizer: "Homogeneous Catalysis" at the North American Catalysis Society Meeting, Toronto, Ontario, June 2001
Symposium organizer: "Solids and Separation Science in Synthesis" at the 83rd National Canadian Society for Chemistry conference, Calgary, Ab., June 2000

Major Grants and Awards in Support of Research

2021–2027	New Frontiers Research Fund (Transformative), PI *(one of 7 funded in Canada)*	$24,000,000
2021-2026	NSERC Discovery Grant (operating)	$605,000
2021	NSERC RTI (equipment grant)	$141,000
2020	Innovation for Defense Excellence and Security (Public Works)	$850,000
2020–2021	New Frontiers Research Fund (Exploration), PI with J. Hein	$250,000
2020	NSERC RTI (equipment grant)	$47,000
2019	Idea to Innovation (NSERC)	$125,000
2019	Innovation for Defense Excellence and Security (Public Works)	$160,000
2018-2020	Petroleum Research Fund	$120,000
2017-2020	Japan Society for Promotion of Science (operating funds)	$225,000
2016–2020	NSERC Discovery Grant (operating) *(highest nationally in 2016)*	$625,000
2015	CFI Innovation Fund/MRI-ORF (Crudden (PI) with 9 others)	$8,823,520
2015–2016	Killam Research Fellowship	$140,000
2014-2016	Japan Society for Promotion of Science Kakenhi (Grants-in-aid for Scientific Research) operating funds	$180,000
2014-2016	NSERC strategic grant, Crudden, (P.I.), Kraatz, Kennepohl, Horton, J.H. and Albrecht, M. (international collaborator)	$560,000
2014-2016	NSERC strategic grant, Mauzeroll, (P.I.), Crudden, and Horton	$470,000
2013-2015	NSERC strategic grant, Stephan, D. (P.I.) and Crudden	$472,000
2013	NSERC RTI (equipment grant)	$122,000
2013-2014	American Chemical Society Petroleum Research Fund	$100,000
2012-2014	NSERC strategic grant, Crudden (PI) and Westcott (Mt A)	$270,000
2012-2014	NSERC strategic grant, Cunningham (PI) and Crudden	$320,000

2010-2016	NSERC CREATE grant (chiral materials), Crudden (PI) and 9 others	$1,600,000
2010-2015	NSERC Discovery grant (operating)	$450,000
2010-2013	NSERC Discovery Accelerator Supplement	$120,000
2010-2012	NSERC strategic grant (metal free reductions), Crudden (PI) and D. Stephan (Toronto)	$465,000
2010	NSERC RTI (equipment grant)	$117,000
2009-2011	NSERC strategic grant (chiral materials) Joint grant between Crudden (PI), Lemieux and Oleschuk	$600,000
2008-2009	NSERC strategic grant (hydrogen storage)	$200,000
2008	CFI leaders opportunity fund (chiral materials) Joint grant between Lemieux (PI), Crudden and Loock	$736,000
2006-2009	NSERC strategic grant (metal sensing) Joint grant between Crudden (PI), Loock and Brown	$450,000
2007	NSERC RTI (equipment grant)	$120,000
2006-2008	Merck Frosst Unrestricted Research Grant	$75,000
2006-2008	Johnson and Johnson Focused giving grant	$120,000
2006-2010	NSERC operating grant	$300,000
2006	NSERC equipment grant	$45,000
2006-2007	NSERC CRD grant (asymmetric synthesis)	$44,000
2005-2006	NSERC CRD grant (fibre optics) Joint grant between Loock (PI), Crudden and Brown	$204,000
2005-2007	NSERC strategic grant (chiral materials) Joint grant between Crudden (PI), Lemieux and Sayari	$375,000
2004-2005	Merck Frosst Unrestricted Research Grant	$50,000
2003	Premier's Research Excellence Award	$100,000
2003	Chancellor's Research Award	$50,000
2003	Merck and Company, Unrestricted Research Grant	$40,000
2002	Canada Foundation for Innovation/Ontario Innovation Trust (Infrastructure) Joint grant with 7 others, Snieckus PI	$7,455,800
2001-2006	NSERC (Operating)	$262,500
2001-2002	NSERC (Collaborative Research and Development)	$60,000
2001	NSERC (Infrastructure) Joint grant with 6 others, Crudden PI	$294,000
2001-2002	Pharmaceutical Consortium, Combi Chem grant	$100,000
1999-2001	NSERC (Operating)	$130,000
1999-2001	NSERC (Collaborative Research and Development)	$69,000
1998	CFI New Opportunities Grant	$112,766
1998-2002	Merck and Company, Unrestricted Research Grant	$92,000
1998	Research Corporation, Research and Innovation Award	$47,000
1997-1998	NSERC (Operating)	$70,000

Leadership Experience

Scientific Director, Carbon to Metal Coating Institute (C2MCI), (2021-present)

The C2MCI is a nascent institute at Queen's University based around a $24M research grant to myself as PI, and a team of 18 other researchers. The research funded by this grant will support upwards of 75 students and postdoctoral fellows across multiple universities and countries. Research is focused on the use of N-heterocyclic carbenes to protect metal surfaces at the macro, micro and nano scales, with applications in corrosion resistance, semiconductor manufacturing and nanomedicine.

Chair, Chemical Institute of Canada (2021)

The Chemical Institute of Canada is the umbrella organization for the Canadian Society for Chemistry (CSC), the Canadian Society for Chemical Engineering (CSChE) and the Canadian Society for Chemical Technologists (CSCT). During my term, I oversaw the hiring of our new Executive Director, and the merging of the CSCT into the CSC. I also set the stage for a new organization structure for the Awards portfolio and the merging of CSC and CSChE annual conferences.

President, Canadian Society for Chemistry (2012-2013)

In 2011, I was asked to stand as President Elect of the Canadian Society for Chemistry, and was elected without contest, serving as Vice-President, President and Past-President for the subsequent three years. During my tenure as President, I made significant changes in finance, administration, and transparency at the Canadian Society for Chemistry. I spearheaded the creation of a science advocacy group, which prepared and submitted a brief to the House of Commons standing committee on finance in preparation for the yearly budgeting process.

My presidency also coincided with a change in the regulations surrounding by-laws of not for profit societies like the Canadian Society for Chemistry, and thus I oversaw the creation and approval of new by-laws. This requirement gave us the opportunity to redefine our relationships with other societies and our financial structure. Thus, in concert with the board of directors, we made relatively significant changes to CSC structure.

Other initiatives I led included increased focus on communications using electronic media and increased internationalization of the CSC. As part of improving the international focus of the CSC, I worked closely with the American Chemical Society (ACS) to enable Canada's participation in the new corporation of Pacifichem (see below). I also worked closely with the presidents of the British, German and Japanese chemical societies during my tenure, focusing on the issues of women in science and other issues facing chemistry societies world-wide.

National Chemistry–NSERC Liaison Committee: Chair and Founder (2017–2021)

Following my work as President of the CSC, I was asked to found and run a national level organization with the aim to improve the ability of the chemistry community to have productive conversations with the Natural Sciences and Engineering Research Council of Canada (NSERC). I worked with NSERC to set up a committee comprised of key NSERC staff and researchers across the country representing all disciplines of chemistry and all career stages.

This group has contributed to the discussion of science funding in Canada through engaging with the Minister of Science, the Science Advisor to the Prime Minister and various high level officials at NSERC including the President. These engagements have included the preparation of a white paper on the evolution of funding in Canada, providing feedback on the development of a new industry-led funding program, advocating for improved funding of students and equipment,

presentations at Science Policy forums and regular informal interactions with the various parts of the funding ecosystem in Canada. I continue to chair this group of 15 of the top researchers in Canada.

Organizing Committee Member Pacifichem 2010 and 2015

Pacifichem, the largest chemistry conference in the world, is organized jointly by the three founding societies: Canadian Society for Chemistry, the Chemical Society of Japan and the American Chemical Society. These three societies take turns as chief organizer, with Canada organizing the 2010 conference. I was part of the three person Canadian delegation in charge of the 2010 conference, which was highly successful. Myself and one other team member then stayed on the organizing committee to assist with the 2015 conference. In addition to the three societies, the organizing committee also has representatives from South Korea, China, Australia and New Zealand.

Principal Investigator NSERC-CREATE grant 2010-2016 (10 PIs)

From 2010–2016, I led a team of 10 PIs after successfully obtaining a CREATE grant to support students and postdoctoral fellows from chemistry, physics and chemical engineering working in the area of chiral materials at Queen's. In addition to funding research directly, this grant is intended to improve the soft skills aspects of graduate education.

Our grant was highly focused on international exchange and interactions with international researchers. All PhD students enrolled in this program were given funding to spend 3-4 months carrying out research abroad. In addition, international experts in chiral materials travel to Queen's for invited fellowships, and to give a course on their specialty to CREATE students. This program has allowed me to invite 17 international faculty from *Japan, France, Switzerland, the US, Finland, Scotland, Sweden, and the Netherlands*. Students involved in the program traveled to these countries and more as part of their research exchanges.

Overall this CREATE grant provided significant international content to the program at Queen's, and has created important opportunities for Queen's students to find postdoctoral positions, and for Queen's faculty to enter into national and international collaborations. At least eight collaborations have been initiated directly from this program.

Principal Investigator, CFI Innovation Fund grant 2015

In 2014, I was asked to lead a CFI grant supporting materials and surface science research at Queen's. This grant was funded at $8.8M and has dramatically improved the ability of researchers in Chemistry, Chemical Engineering and Physics to carry out research in surface science. Seven other Queen's faculty, and researchers from the University of Toronto and from University College Dublin were key collaborators on this research project. In addition to bringing much needed infrastructure to Queen's, this grant has been highly successful at cementing collaborative relationships between Queen's and the University of Toronto and our collaborator in Dublin. Two PhD students have carried out research exchanges with our Irish collaborator, and connections with the University of Toronto have also been strengthened.

International principal investigator at the Institute for Transformative bio-Molecules, Nagoya, Japan. (2013–present)

This institute is one of only seven "World Premier Research Institutes" in Japan, modeled on German Max Planck Institutes. The purpose of these WPI institutes is to bring top foreign researchers to Japan and to improve the internationalization of research and universities in Japan. The focus of

the Nagoya Institute for Transformative Bio-Molecules is to bring synthetic chemists together with plant and animal biologist to have an impact on global food issues including the development of novel biofuels, improving drought resistance in plants, and controlling/understanding seasonal reproduction.

I was invited to be a part of this institute because of my expertise in the preparation of chiral organic compounds, my proven track record of working in highly multidisciplinary environments, and my strong connections with Japan. The institute is comprised of eight Japanese PIs, two international biologists and two international chemists, myself and Dr. Jeff Bode from ETH Zurich. The institute funds 2-3 postdoctoral fellows, and an assistant professor in my lab, who are using our chemistry to prepare synthetic thyroid hormones. In collaboration with biologist Takashi Yoshimura, we are aiming to understand how small molecules affect seasonal breeding in bird species. My group is also working on developing metal nanoparticles with stable organic overlayers for bio-imaging, in vivo diagnostics and eventually, targeted chemotherapy.

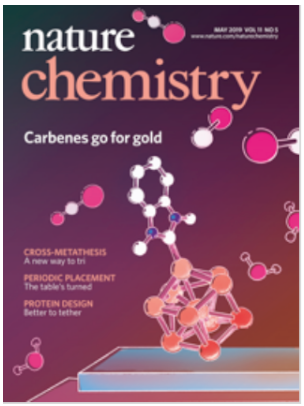
My significant connections to Japan have resulted in many Japanese exchange students coming to Canada to study at Queen's. Since arriving at Queen's, I have hosted 14 exchange students from Japan, in addition to students from Brazil, Sweden, and Spain. These students worked on various projects in my group, from catalysis to pharmaceutical synthesis to nanoscience.

Japan–Germany–Canada Core–to–Core research network.

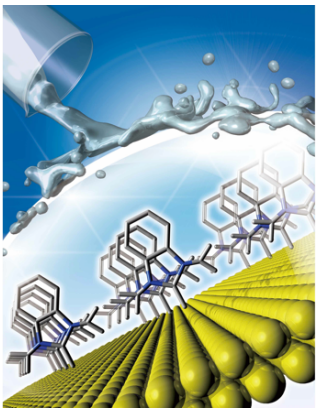
Along with my late colleague Chemistry professor Suning Wang, I participated in a trilateral Japan–Germany–Canada research network funded as a "Core-to-Core" grant from Japan. This network focused on collaborative research and student exchanges between Japan, Canada and Germany. Research areas included catalysis, main group chemistry, and materials research.

Research Interests

N-Heterocyclic carbene (NHC)-stabilized clusters.



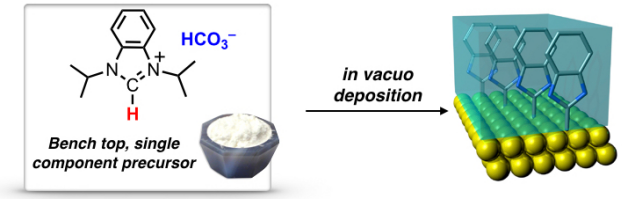
In papers 121 and 116 (***Nature Chemistry* 2019** and ***Jacs* 2019**), we describe the first examples of metallic nanoclusters protected by NHC ligands. Nanoclusters are a unique class of nanomaterial in that they are materials with size-dependent properties, but unlike related nanoparticles, they are atomically precise single molecules, while nanoparticles are conglomerates of similar-sized species. Nanoclusters are typically prepared with thiol ligands as surface ligands, with some examples of phosphines. Neither of these ligands is perfect: thiol-based ligands exclusively protect clusters by surrounding them with a shell of oxidized Au species, and phosphines are weakly bound, limiting the stability of the resulting nanoclusters. NHCs are the best of both worlds, they keep the Au core in a metallic state, but bind with very strong bonds. These clusters have unique properties including the highest photoluminescence quantum yield ever recorded for nanoclusters.



Self-assembled NHC monolayers on gold. In papers 130, 125 and 79, (***Nature Communications* 2021, *Chemistry a European Journal* 2020,** and ***Nature Chemistry* 2014**), we described the first example of well-formed carbon-based monolayers on gold surfaces. Despite their widespread use in catalysis, N-heterocyclic carbenes (NHCs) have seen few applications in materials chemistry. In molecular transition metal complexes, they are known by their abilities to form strong metal–carbon bonds, making NHC complexes more resistant to heat and oxidation than typical complexes. With the assumption that these properties would translate to materials, we attempted the synthesis of self-assembled monolayers on gold and found that sterically unencumbered carbenes form monolayers that are significantly more stable than the state-of-the-art sulfur-based films. The NHC films are stable to high temperature, refluxing solvent, boiling acid, base and oxidation with dilute hydrogen peroxide. The work was called "game changing" and "the new gold standard" by international experts, and highlighted in chemistry and physics news magazines including ***Chemical and Engineering News*** (US), ***Physics Today*** (UK), ***Chemistry World*** (UK), ***Canadian Chemical News*** (CDN) and others.

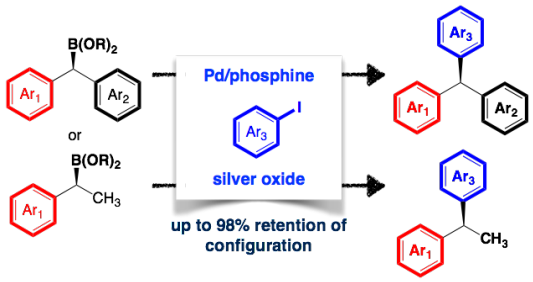
Bench-stable precursors for self-assembled monolayer formation.

In publication 94, (***Nature Communications* 2016**), the synthesis of a single component bench-stable precursor for use in the preparation of NHC films on metals was described. While our previous publication required inert atmosphere techniques and highly reactive chemicals, with this precursor, it is possible to prepare high quality films in air, without any special precautions. Films can also be deposited *in vacuo* without any solvents. With these easily formed films, we also demonstrated the formation of biosensors that were significantly more robust, reliable and sensitive than commercial biosensors.



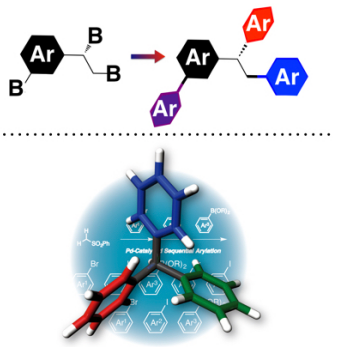
Stereoretentive Suzuki-Miyaura cross couplings.

Our group has reported a substantial development in the Suzuki-Miyaura reaction (***Jacs 2009 and 2014, and ACIE 2014**, papers 80, 78 and 48*). This reaction is the number one reaction used in industry for the preparation of carbon-carbon bonds. Prior to our reports, the Suzuki-Miyaura reaction could only be used to make bonds with no stereochemistry, which is a huge limitation since a significant number of pharmaceutical compounds are chiral. We have reported the first example of this reaction performed with chiral organoboron partners, proceeding with retention of chirality. Prior to this report, all coupling reactions of these systems failed or proceeded with loss of stereochemistry/chirality. The work has been used by other labs in the synthesis of two pharmaceutical agents, and has been highlighted in ***Chemical and Engineering News***, and ***Synfacts***, among others.



Iterative Suzuki-Miyaura cross coupling of multiply borylated molecules.

In our second ***2016 Nature Communications paper*** (paper 89), we reported the first example of iterative reaction of multiply functionalized organoboron compounds without any protecting group requirements. In addition, chiral compounds could be employed without loss of chirality. This discovery is currently under use in the automated robotic synthesis of organic molecules. This type of synthesis is employed in many other fields such as for the synthesis of genes and peptides, but has not been employed in the synthesis of small molecules in collaboration with the Burke group at UIUC.



Peer Reviewed Publications

144. Y. Choi, C.S. Park, H.V. Tran, C.H. Li, C.M. Crudden, T.R. Lee* "Functionalized *N*-Heterocyclic Carbene Monolayers on Gold for Surface-Initiated Polymerizations," **2022, *ACS Applied Materials & Interfaces,*** *14*, 44969-44980.
143. T. Zhang, S.B. Khomane, I. Singh, C.M. Crudden, P.H. McBreen* "Functionalization of Metal-Supported Graphene by an *N*-Heterocyclic Carbene," **2022**, ***Journal of Physical Chemistry C,*** *126*, 14430-14440.
142. M. Nambo*, K. Ghosh, J.C.H. Yim, Y. Tahara, N. Inai, T. Yanai, C.M. Crudden*. "Desulfonylative Coupling of Alkylsulfones with *gem*-Difluoroalkenes by Visible-Light Photoredox Catalysis" **2022**, ***ACS Catalysis,*** *12*, 9526-9532.
141. C.M. Crudden*, "Gender Equity in Funding" **2022**, ***Nature Reviews Chemistry***, 6, 233-234.
140. V.K. Kulkarni, B. Nourmohammadi Khiarak, S.Takano, S. Malola, E.L. Albright, T.I. Levchenko, M.D. Aloisio, C.-T. Dinh*, T. Tsukuda*, H. Häkkinen*, C.M. Crudden*, "NHC-Stabilized Hydrido Au_{24} Nanoclusters: Synthesis, Structure, and Electrocatalytic Reduction of CO_2," **2022**, ***Journal of the American Chemical Society****, 144*, 9000-9006.
139. R.W.Y Man, H. Yi, S. Malola, S. Takano, T. Tsukuda*, H. Häkkinen*, M. Nambo*, C.M. Crudden*, " Synthesis and Characterization of Enantiopure Chiral Bis NHC-Stabilized Edge-Shared Au_{10} Nanocluster with Unique Prolate Shape" **2022**, ***Journal of the American Chemical Society****, 144,* 2056-2061.
138. P. Lummis, K. Osten, T. Levchenko, M. Hazer, S. Malola, B. Owens-Baird, A. Veinot, E. Albright, G. Schatte, S. Takano, K. Kovnir, K. Stamplecoskie*, T. Tsukuda*, H. Häkkinen*, M. Nambo*, and C.M. Crudden*, "NHC-Stabilized Au_{10} Nanoclusters and their Conversion to Au_{25} Nanoclusters," **2022**, ***Journal of the American Chemical Society Au****, 2,* 875-885.
137. M. Nambo*, Y. Maekawa, C. M. Crudden*, “Desulfonylative Transformations of Sulfones by Transition Metal Catalysis, Photocatalysis and Organocatalysis,” **2022**, ***ACS Catalysis****, 12*, 3013-3032.
136. E. Angove, F. Grillo, H. A. Früchtl, A. J. Veinot, I. Singh, J. H. Horton, C. M. Crudden, and C. J. Baddeley*, “Highly Ordered N-Heterocyclic Carbene Monolayers on Cu(111),” **2022**, ***Journal of Physical Chemistry Letters****, 13*, 2051-2056.
135. M. Nambo, C. M. Crudden, “Transition Metal-Catalyzed Cross-Couplings of Benzylic Sulfone Derivatives” **2021, *Chemical Record,*** *21,* 3978-3988.
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46. K. McEleney, C.M. Crudden and J. H Horton* "X-ray photoelectron spectroscopy and the Auger parameter as tools for characterization of silica-supported Pd catalysts for the Suzuki-Miyaura Reaction," ***Journal of Physical Chemistry C***, **2009**, *113*, 1901-1907.
45. S.L. MacQuarrie, M.P. Thompson, A. Blanc, N.J. Mosey, R.P. Lemieux*, and C.M. Crudden* "Chiral Mesoporous Materials Based on Axial Chirality," ***Journal of the American Chemical Society***, **2008**, *130*, 14099-14101.

Highlighted in Nature Chemistry

44. J. Barnes, S. Brown, C.M. Crudden, M. Dreher, K. Plett, H.P. Loock* "Chemical Sensor Based on Functionalized PDMS Coatings on Long-Period Fiber Gratings," ***The Analyst***, **2008**, *133*, 1541-1549.

Cover Article, Hot Article

43. J. Praetorius, C.M. Crudden* "*N*-Heterocyclic Carbene Complexes of Rhodium: Structure, Stability and Reactivity," ***Dalton Transactions***, **2008**, *0,* 4079-4094.

Cover Article

42. J. Barnes, R.S. Brown, J. Cipot-Wechsler, C.M. Crudden, J. Du, H.P. Loock*, K. Plett "Long-period Gratings in Chemical Sensing" ***Proceedings, SPIE***, **2008**, *7099*, 70992C1.
41. J.M. Praetorius, D.P. Allen, R. Wang, J.D. Webb, F. Grein, P. Kennepohl*, C.M. Crudden* "*N*-heterocyclic Carbene Complexes of Rh: Reaction with Dioxygen without Oxidation," ***Journal of the American Chemical Society***, **2008**, *130*, 3724-3725.
40. S. MacQuarrie, J. Barnes, K. McEleney, J.H. Horton, H.P. Loock, C.M. Crudden* "Catalysis with Pd Foil: Investigations into the Effect of Catalysis on Surface Structure by XPS and SEM," ***Angewandte Chemie International Edition***, **2008**, *47*, 3279-3282.

****Cover Article***

39. B. Nohair, S. MacQuarrie, C.M. Crudden, S. Kaliaguine* "Functionalized SBA-16 and KiT-6 as supports for different palladium complexes (Pd(0) and Pd(II)): Synthesis and catalytic activity for the Suzuki-Miyaura coupling reaction," ***Journal of Physical Chemistry C***, **2008**, *112*, 6065-6072.
38. D.R. Edwards*, P. Montoya-Pelaez, C.M. Crudden* "Experimental Investigation into the Mechanism of the Corey-Chaykovsky Epoxidation of Benzaldehyde with Dimethylsulfonium Benzylide," ***Organic Letters,*** **2007**, *9*, 5481-5484.
37. D.R. Edwards, Y.B. Hleba, C.M. Crudden*, "Regioselectivity of the Rhodium Catalyzed Hydroboration of Vinyl Arenes: Electronic Twists and Mechanistic Shifts," ***Angewandte Chemie International Edition***, **2007**, *46*, 7799-7802.
36. J.D. Webb, S. MacQuarrie, K. McEleney and C. M. Crudden* "Mesoporous silica-supported Pd catalysts: An investigation into structure, activity and leaching," ***Journal of Catalysis,*** **2007**, *252*, 97-109.
35. D.R. Edwards*, J. Du, C.M. Crudden*, "Experimental Demonstration of Base-Catalyzed Interconversion of Isomeric Betaine Intermediates in the Corey-Chaykovsky Epoxidation," ***Organic Letters***, **2007**, *9*, 2397-2400.

34. J.M. Praetorius, M.W. Kotyk, J.D. Webb, R. Wang and C.M. Crudden*, "Rhodium *N*-Heterocyclic Carbene Carboxylato Complexes: Synthesis, Structure Determination and Catalytic Activity in the Hydroformylation of Alkenes," ***Organometallics*, 2007**, *26*, 1057-1061.
33. C.M. Crudden*, K. McEleney, S.L. MacQuarrie, A. Blanc, M. Sateesh, J.D. Webb, "Modified mesoporous materials as metal scavengers and catalyst supports," ***Pure and Applied Chemistry,* 2007**, *79*, 247-260.
32. P.J. Montoya-Pelaez, Y.-S. Uh, C. Lata, M.P. Thompson, R.P. Lemieux and C.M. Crudden* "The synthesis and resolution of 2,2', 4,4', 6,6'-substitued chiral biphenyl derivatives for application in the preparation of chiral materials," ***Journal of Organic Chemistry*, 2006**, *71*, 5921-5929.
31. K. McEleney, D.P. Allen, A.E. Holliday and C.M. Crudden* "Functionalized mesoporous silicates for the removal of ruthenium from reaction mixtures," ***Organic Letters*, 2006**, *8*, 2663-2666.

    ****ACS noteworthy paper***

    ****Highlighted in Synfacts***

30. F. Grien*, A.C. Chen, D.R. Edwards, C.M. Crudden* "Theoretical and Experimental Studies on the Baeyer-Villiger Oxidation of Ketones," ***Journal of Organic Chemistry* 2006**, *71*, 861-872.
29. C.M. Crudden*, M. Sateesh, R. Lewis, "Mercaptopropyl-modified mesoporous silica: An efficient scavenger for Pd resulting in a reusable, non-leaching catalyst for coupling reactions," ***Journal of the American Chemical Society,* 2005**, *127*, 10045-10050.

    ****Highlighted, Chemical and Engineering News***

28. D. P. Allen, C.M. Crudden*, L.A. Calhoun, R. Wang, A. Decken "Rhodium *N*-heterocyclic carbene complexes: Synthesis, structure, phosphine exchange and catalytic activity," ***Journal of Organometallic Chemistry,* 2005**, *690*, 5736-5746.

    ****Invited manuscript,** *special issue on N-heterocyclic carbenes*

27. A.C. Chen, D.P. Allen, C.M. Crudden*, A. Decken, "Synthesis, structure determination and hydroformylation activity of *N*-heterocyclic carbene complexes of rhodium," ***Canadian Journal of Chemistry, Special issue dedicated to Howard Alper*, 2005**, *87*, 943-975.
26. D.R. Edwards, C.M. Crudden*, K. Yam, "One-Pot Carbon Monoxide Free Hydroformylation of Internal Olefins to Terminal Aldehydes," ***Advanced Synthesis and Catalysis*, 2005**, *347*, 50-54.
25. C.M. Crudden*, Y.B. Hleba, A.C. Chen, "Regio and Enantiocontrol in the Room Temperature Hydroboration of Vinyl Arenes," ***Journal of the American Chemical Society*, 2004**, *126*, 9200-9201.
24. D. Allen, C.M. Crudden*, L.A. Calhoun, R. Wang, "Irreversible cleavage of a carbene-rhodium bond in Rh *N*-heterocyclic carbene complexes: Implications for catalysis," ***Journal of Organometallic Chemistry,* 2004**, *689*, 3203-3209.
23. C.M. Crudden* and D. Allen, "Stability and Reactivity of *N*-Heterocyclic Carbene Complexes" ***Coordination Chemistry Reviews, invited review* 2004**, *248*, 2247-2273.

    ****Top downloaded article for CCR***

    ****Eight most cited article in Canada in 2006 – essential science indicators***

22. L. Ren, A.C. Chen, A. Decken and C.M. Crudden* "Chiral Bidentate *N*-Heterocyclic Carbene Complexes of Rh and Pd," ***Canadian Journal of Chemistry*, 2004**, *84*, 1781-1787.
21. C.M. Crudden* and D.R. Edwards, "Catalytic Asymmetric Hydroboration: Recent Advances and Applications in Carbon-Carbon Bond Forming Reactions," ***European Journal of Organic***

Chemistry, **2003**, *2003,* 4695-4712.

20. M. Fairgrieve, C.M. Crudden*, "Asymmetric Hydroboration-Homologation: Towards the Synthesis of Gliflumide," In *Catalysis of Organic Reactions*, D.G. Morrell, Ed., Marcel Dekker, **2003**, *40*, 509.
19. L. Ren and C.M. Crudden* "Directing abilities of alcohol-derived functional groups in the hydroformylation of olefins," ***Journal of Organic Chemistry,*** **2002**, *67*, 1746-1750.
18. I. Motorina and C.M. Crudden, "Asymmetric Dihydroxylation of Olefins Using Cinchona Alkaloids on Highly Ordered Inorganic Supports," ***Organic Letters,*** **2001**, *3*, 2325-2328.

17. C.M. Crudden*, D. Allen, M. Mikoluk and J. Sun, "Rhodium Bis Phosphine Catalysts on Mesoporous Silica Supports: New Efficient Catalysts for the Hydrogenation of Alkenes", ***Chemical Communications***, **2001**, *0,* 1154-1155.
16. C.M. Crudden*, A.C. Chen and L.A. Calhoun, "A Demonstration of the Primary Stereoelectronic Effect in the Baeyer-Villiger Oxidation of □-Fluoro Cyclohexanones," ***Angewandte Chemie International Edition***, **2000**, *39*, 2851-2855.

****Cover Article, VIP paper, Highlighted in Chemtracts***

15. A.C. Chen, L. Ren, A. Decken and C.M. Crudden* "Rhodium carbene complexes: Highly selective catalysts for the hydroformylation of styrene derivatives," ***Organometallics***, **2000**, *19*, 3459-3461.
14. L. Ren and C.M. Crudden*, "Homologations of boronate esters: The first observation of sequential insertions," ***Chemical Communications***, **2000**, *0,* 721-722.
13. A.C. Chen, L. Ren and C.M. Crudden*, "Catalytic Asymmetric Hydrocarboxylation and Hydrohydroxymethylation. A Two Step Approach to the Enantioselective Functionalization of Vinyl Arenes," ***Journal of Organic Chemistry***, **1999**, *64*, 9704-9710.
12. A.C. Chen, L. Ren and C.M. Crudden*, "Catalytic Asymmetric Carbon-Carbon Bond Forming Reactions. 1. Preparation of Optically Enriched 2-Aryl Propionic Acids by a Catalytic Asymmetric Hydroboration/Homologation Sequence," ***Chemical Communications***, **1999**, 611-612.
11. S.E. Denmark*, Z. Wu, C.M. Crudden and H. Matsuhashi, "Catalytic Epoxidation of Alkenes with Oxone. 2. Fluoroketones," ***Journal of Organic Chemistry***, **1997**, *62*, 8288-8289.
10. C.M. Crudden and H. Alper*, "Insertion of Carbon Monoxide into Allylic Carbon-Sulfur Bonds Catalyzed by Palladium and Ruthenium Complexes," ***Journal of Organic Chemistry***, **1995**, *60*, 5579-5587.
9. M. Lautens, W. Tam., J.C. Lautens, L.G. Edwards, C.M. Crudden and A.C. Smith, "Cobalt-Catalyzed [2 + 2 + 2] (Homo-Diels-Alder) and [2 + 2+ 4] Cycloadditions of Bicyclo[2.2.1]hepta-2,5-dienes," ***Journal of the American Chemical Society***, **1995**, *117*, 6863-6879.
8. H. Alper*, C.M. Crudden and K. Khumtaveeporn, "Unprecedented Iridium Catalyzed Group Transfer Reactions of 1, 3-Thiazanes," ***Journal of the Chemical Society, Chemical Communications***, **1995**, 1199-1200.
7. M. Lautens*, C.H. Zhang, J.B. Goh, C.M. Crudden and M.J.A. Johnson, "Exploring the Reactivity of Alkenes Bearing Silicon and/or Tin in the Hydroxyl–Directed Hydrogenation. A Diastereoselective Synthesis of Heterobimetallic Compounds," ***Journal of Organic Chemistry***, **1994**, *59*, 6208-6222.
6. C.M. Crudden and H. Alper*, "The Regioselective Hydroformylation of Vinylsilanes. A Remarkable Difference in the Selectivity and Reactivity of Co, Rh and Ir Catalysts," ***Journal of***

Organic Chemistry, **1994**, *59*, 3901-3907.

5. M. Lautens*, A.S. Abd-El-Aziz and C.M. Crudden, “Synthesis and Characterization of the Ring-Opened Copolymers of Deltacyclene, 5-Siloxydeltacyclene and Norbornene,” ***Journal of Polymer Science, Part A: Polymer Chemistry***, **1993**, *31*, 569.
4. M. Lautens*, C.H. Zhang, and C.M. Crudden, “The Hydroxyl-Directed Hydrogenation of Vinyl Stannanes and Silanes: A Highly Diastereoselective Route to ß-Stannyl and ß-Silyl Alcohols,” ***Angewandte Chemie International Edition,*** **1992**, *31*, 232-234.
3. M. Lautens*, C.M. Crudden, A.S. Abd-El-Aziz and T. Wada, “Preparation and Ring-Opening Metathesis Polymerization of 5-Siloxydeltacyclene and Deltacyclene Using the Schrock Molybdenum Alkylidene Catalyst,” ***Macromolecules***, **1991**, *24*, 1425-1427.
2. M. Lautens* and C.M. Crudden, “Ring Opening Reactions of Deltacyclene Epoxides,” ***Tetrahedron Letters***, **1989**, *30*, 4803-4806.
1. M. Lautens* and C.M. Crudden, “Scope of the Cobalt-Catalyzed [2+2+2] Homo-Diels-Alder Reaction,” ***Organometallics***, **1989**, *8*, 2733-2735.

Publications–Editorials/Comments

4. S. Bordiga, S. Chang, J. Chen, C. Crudden, A. Dey, P. Fornasiero, T.B. Gunnoe, C.W. Jones, S. Linic, D. Ma, F. Maseras, T. Ooi, B.R. Cuenya, P. Sautet, S.L. Scott, V. Stamenkovic, Y. Wang, T.P. Yoon, H. Zhao, “Excellence versus Diversity? Not an Either/Or Choice” **2020**, ***ACS Catalysis,*** *10*, 7310-7311.
3. C.M. Crudden, “ACS Catalysis Appoints Four New Editors, Including the First Editors from Industry” **2021**, ***ACS Catalysis,*** *11*, 10694-10694.
2. C.M. Crudden, “Charting the Next Phase of ACS Catalysis” **2021**, ***ACS Catalysis,*** *11*, 6153-6154.
1. T. Ooi, C. Crudden, “2021 Nobel Laureates Recognized in Organocatalysis” **2021**, ***ACS Catalysis,*** *11*, 15234-15234.

Intellectual Property

6. C.M. Crudden, J Hugh Horton, M.R.R. Narouz, J.D. Padmos “Methods of forming carbene-functionalized composite materials” US Patent 11008291`.
5. C.M. Crudden, J.H. Horton, M.R.R. Narouz, P. Unsworth, Z. Li, A. Nazemi, J.D. Padmos, P. Eisenberger, M.T. Zamora, M. W. A. MacLean "*Methods of Forming Carbene-Functionalized Composite Materials*" US provisional Patent 2015-051-06US.
4. C.M. Crudden, J.H. Horton, M.R. Narouz, B. Mariampillai, A. Al-Rashed, "*Etching Metal Using N-Heterocyclic Carbene-Functionalized Material*", US provisional patent 2016-017-03US.
3. C.M. Crudden, J.H. Horton, O.V. Zenkina, I.I. Ebralidze, C.A. Smith "*Carbene-Functionalized Composite Materials*" US Patent 2015-051-02US.
2. M. Nambo and C.M. Crudden, "*Method for Producing Triarylacetonitrile*" WO2016093175A1.
1. C.M. Crudden, H.P. Loock, J. Du, S. Dickson, L. Benhabib, R.S. Brown “*Optical Sensor using functional composite materials*”, US Patent 7,776,611 B2, Canada 2,632,524.

Books/Book Chapters/Special Issues

- C. Smith and C.M. Crudden*, “Self–assembled monolayers from carbon-based ligands on metal surfaces.” In, Molecular Technology, H. Yamamoto, Ed., Wiley, **2018**.
- B.W. Glasspoole, E.C. Keske and C.M. Crudden*, "Stereospecific and Stereoselective Suzuki-Miyaura Cross-Coupling Reactions." In, New Trends in Cross Coupling: Theory and Applications, T. Colacot, Ed., Royal Society for Chemistry, **2014.**
- C.M. Crudden* and J.M. Praetorius “Synthesis, Activation and Decomposition of *N*-Heterocyclic Carbene-Containing Complexes.” In, N-Heterocyclic Carbenes: From Laboratory Curiosities to Efficient Synthetic Tools, S. Diez-Gonzalez, Ed., Royal Society for Chemistry Series in Catalysis, **2009.**
- *Nanostructured Active Sites in Catalysis*, S.L. Scott, C. Jones, C.M. Crudden, Editors, Kluwer Academic Press, **2002**.
- C.M. Crudden*, D.P. Allen, I. Motorina, M. Fairgrieve “Late Transition Metal Complexes Immobilized on Structured Surfaces as Catalysts for Hydrogenation and Oxidation Reactions.” In, *Nanostructured Active Sites in Catalysis*, S.L. Scott, C. Jones, C.M. Crudden, Eds., Kluwer Academic Press, **2002**, 113-156.
- Issue 6-7, Canadian Journal of Chemistry, **2005**, Organized by C.M. Crudden in honour of Howard Alper

Training and Mentoring

Current group: CANADA

HQP	Scholarships and Awards	Academic History
Emily Albright (PhD)	Karel Wiesner Postgraduate Scholarship William and Lois Paine Founder's Scholarship	BSc, University of New Brunswick, NB, Canada MSc, University of New Brunswick, NB, Canada
Dianne Lee (PhD)	QGA Fellowship (Queen's)	BSc, Dalhousie University, NS, Canada
Angus Sullivan (PhD)	Makhija Prize in Chemistry Department of Physics Prize Dean's Honour Roll Trent National Scholarship Bruce Barrett Memorial Prize NSERC Fellowship	BSc, Trent University, ON, Canada
Viveka Kulkarni (PhD)		BSc, Mount Allison University, Sackville, NS, Canada
Mark Aloisio (PhD)		BSc, University of Alberta, AB, Canada MSc, University of Alberta, AB, Canada
Aaron Erlich (MSc)		BSc, Toronto Metropolitan University
Alannah Constable (MSc)		BSc, Queen’s University
Anastasia Messina (MSc)		BSc, Queen’s University
Andrew Laluk (MSc)		BSc, University of Manitoba

Florian Handel (MSc)		BSc, University of Stuttgart
Dana Nanan (MSc)		BSc, Western University
Jana Alpin (MSc)		BSc, University of Stuttgart
Stefanie Schiele (MSc)		BSc, University of Stuttgart
Dr. Tanya Levchenko (PDF)	*NSERC Postdoctoral Fellowship*	PhD, Western University, Canada
Dr. Roberto Nolla-Saltiel (PDF)		PhD, University of Nottingham, UK
Dr. Kumar Siddhant (PDF)		PhD, Ritsumeikan University, Japan
Dr. Ahmadreza Nezamzadeh Ezhieh	(PDF)	PhD, University of Saskatchewan
Dr. Monika Snowdon (PDF)		PhD, University of Waterloo, Canada

Current group: JAPAN

HQP	Scholarships and Awards	Country/School of origin
Dr. Joseph DeJesus (PDF)		PhD, University of Tennessee, USA
Dr. Samuel Jacobs (PDF)		University of California, Santa Barbara, USA
Ryusei Ookura (MSc)		BSc, Okayama University
Yasuyo Tezuka (technician)		BSc, Shizuoka University
Motoo Otsuka (technician)		MSc, Shinshu University

Accomplishments of Selected Former Group Members

- *Alex Veinot, PhD,* Vanier and Banting Scholar, incoming faculty member Dalhousie U
- *Ali Nazemi, PhD,* Assistant Professor, Université du Québec à Montréal (Canada)
- *Mina Narouz, PhD,* NSERC Postdoctoral fellowship, Mitacs JSPS fellowship
- *Eric Keske, PhD,* Assistant Professor, Trent University, Peterborough, Ontario. Selected as one of 45 Reaxys Prize finalists world-wide NSERC Postdoctoral fellowship at U Edinburgh (Scotland)
- *Tomohiro Seki, PhD*, Takeda Pharmaceuticals, Yokohama (Japan)
- *Steven Dickson, PhD,* Research Project Lead, Imperial Oil (Canada)
- *Jonathan Webb, PhD,* Research Project Lead, Imperial Oil (Canada)
- *Jenny Du, PhD,* Director, Apeel Sciences, California (USA)
- *Jeremy Praetorius*, *PhD,* Research Scientist, Chevron Oil, Oklahoma (USA)
- *Daryl Allen*, *PhD,* Product Development Manager, Materia, California (USA)
- *Ren Li, PhD,* Senior Research Investigator, Array BioPharma, Boulder, Colorado (USA)
- *Austin Chen, PhD,* Scientist Inception Sciences, California (USA)
- *Olena Zenkina, Former PDF,* Assistant Professor, University of Ontario Institute of Technology (Canada)
- *Stephanie MacQuarrie, Former PDF,* Professor, University of Cape Breton (Canada)
- *Kazunori Hirabayashi*, *Former PDF,* Professor, Tokyo Metropolitan University (Japan)

- *Daniel Canseco-Gonzalez, Former PDF*, Research Scientist, BASF (Mexico)
- *Daisuke Imao, Former PDF,* Research Scientist, Evonik (Japan)
- *Kazuhiko Semba*, *Exchange PhD,* Assistant Professor, Kyoto University (Japan)
- *Yoichi Hoshimoto*, *Exchange PhD,* Assistant Professor, Osaka University (Japan)
- *Takuji Kawamoko, Exchange PhD,* Assistant Professor, Yamaguchi University (Japan)

Invited Lectures

2022. Banff Symposium on Organic Chemistry (Keynote, March, virtual); University of California Berkeley, Muetteries Lectureship (Berkeley, April); Area Selective Deposition Workshop (San Fransisco, April); Canadian Society for Chemistry (Edmonton, June); Swedish Chemical Society Annual meeting (Plenary, Linkoping, June); Astra Zeneca UK (Manchester, Sept); Gregynog Organic Synthesis Workshop, plenary (Wales, Sept); Columbia University (New York, Sept.); Division of Organic Chemistry Virtual lectureship (October, Virtual); University of California Los Angeles, Cell Press Lectureship (Los Angeles, November); University of Oregon, Clemm Lecturer (Eugene, Oregon, November).

2021. Imperial College London (virtual talk); University of Tennessee- Knoxville (April, virtual seminar); York University-UK (January, virtual talk); McMaster University (2virtual talk); University of Manitoba (March, virtual seminar); NYU (April, virtual seminar); Indiana U tour (April, virtual); Commonwealth Chemistry Congress (May, virtual); ChemCon 2021, UNB (May, virtual); *ESOC* Virtual Mini Symposium *(*July, Plenary lecture); Innovation, Science, and Economic Development Canada (ISED) roundtable discussion on Leadership, Diversity, and Women in Science (July, virtual). All other invitations for 2021 were postponed due to COVID-19.

2020. Merck-Karl Pfiser Visiting Lecturer in Organic Chemistry, Massachusetts Institute of Technology. All other invitations for 2020 postponed or cancelled due to COVID-19.

2019. Core to Core symposium (Plenary, Nagoya University); University of British Columbia; Simon Fraser University; Université Claude Bernard Lyon 1, France; ERATO Molecular Science Symposium (Nagoya University); 257th ACS National Meeting (Orlando, 2 invited lectures); 102nd Canadian Society for Chemistry Conference (Quebec City, three invited lectures); 258th ACS National Meeting (San Diego); Inorganic Discussion Weekend (Plenary speaker, Oshawa); Japan–US Science forum, Harvard; University of New Brunswick; St. Mary's University; Dalhousie University; Rutgers University; Chemical Science Symposium on Organic Materials, London, England

2018. Western University (student selected seminar); Münster University Core-to-Core symposium; 255th ACS National Meeting (New Orleans, two invited talks), Southwestern Ontario Undergraduate Chemistry Conference, Plenary speaker (Waterloo); 25th Canadian Symposium on Catalysis, Plenary speaker/award lecture (Saskatoon); 101st Canadian Society for Chemistry annual conference (Edmonton, two invited talks); Gilead Sciences Inc. (Edmonton); International Precious Metals Institute annual conference, Plenary speaker/award lecture (San Antonio); Boron in the Americas XVI (Boston); Stereochemistry Gordon Research Conference Newport Rhode Island; 43rd International Conference on Co-ordination Chemistry, keynote lecture (Sendai, Japan); American Vacuum Society, 65th international symposium, Long Beach

California; International Kyoto Conference on Organic Chemistry (Kyoto, Japan).

2017. Simon Fraser University; University of British Columbia; University of Victoria; University of Calgary; Laval University; 100th Canadian Society for Chemistry conference (two invited talks); 12th International Conference for Heteroatom Chemistry (Vancouver); International Symposium on Monolayer Protected Clusters (Monte Verita); University of Zurich; University of Basel; University of Fribourg; University of Bern; University of Geneva; ETH Zurich.

2016. University of Alberta; University of Toronto; 251st ACS National Meeting (San Diego); Carleton University; 252nd ACS National Meeting (Philadelphia); IRTG Symposium, Münster, Germany; Plenary speaker, 24th Canadian Symposium on Catalysis (Ottawa); 7th annual Green Chemistry & Catalysis meeting (McGill); 15th Boron in the Americans Conference (Kingston); Mount Allison University; University of New Brunswick; Dalhousie University; Vertex Pharmaceuticals; Laval University; 4th International Symposium on New Frontiers in Materials Science, Hokkaido; International Symposium on Catalysis and Fine Chemicals, Taiwan; ITbM International Symposium, Nagoya.

2015. Two Gordon Research Conferences (Organic Reactions and Processes and Inorganic Reaction Mechanisms, latter as discussion leader); American Vacuum Society meeting (California); Pacifichem 2015 (Honolulu, two invited talks); 18th Organometallic Chemistry Directed Towards Organic Synthesis (Sitges, Spain); 98th Canadian Society for Chemistry conference (two invited talks); International Symposium on Monolayer Protected (Tokyo); Joint IBS-KAIST/ITbM Symposium (Seoul)

2014. Oxford University; International Symposium on Homogeneous Catalysis, **Plenary Lecturer**, **Tateshina Conference** (Japanese Gordon Conference), **Aldrich Endowed Lecture**, University of Michigan; 19th International Symposium on Homogeneous Catalysis, Ottawa; Bristol University; **Fagnou Lecturer**, Ottawa University; Edinburgh University; University of Illinois at Urbana Champaign, **Organic Reactions Lecturer**; Queen's Nanoscience Symposium, **Plenary Lecturer**

2013. Princeton University; **Beckman Scholars Symposium**, California; Chemical Society of Japan Annual Meeting, Canada-Japan Symposium, Ritsukumen, Japan; 245th ACS National Meeting, Award symposium in honour of Melanie Sanford, New Orleans; 1st International Conference, Institute of Transformative Bio-Molecules, (Nagoya, Japan); 96th Canadian Society for Chemistry Conference, (Quebec City); 15th Asian Chemistry Congress, Singapore; Kyoto University, Katsura Campus; University College Dublin; Toyota Research Labs, Nagoya; Nagoya University, Kyoto University.

2012. Toyota Research Labs, Nagoya; Nagoya University; Kyoto University; Institute for Chemical Research; Kyoto University Uji Campus; Osaka University; Dalhousie University; 244th ACS National Meeting, NHC symposium, (Philadelphia); University of Minnesota; University of Iowa; 95th Canadian Society for Chemistry National Meeting (Calgary); CSC Catalysis Conference (Quebec City)

2011. Distinguished Female Lecturer, Stanford University; California Institute of Technology; 241st ACS National Meeting, Anaheim; "Award symposium in honour of Jeffrey Bode"; 94th

Canadian National Conference (Montreal); York University; Concordia University; Mount Allison University

2010. 93rd Canadian National Conference (Toronto); University of New Brunswick (Fredericton); University of Cape Breton; Acadia University; "Catalysis and Chirality in Molecules and Materials" 23rd Jacques Cartier Center Colloquium: Catalysis Science at the Dawn of the 21st Century (Lyon, France); Pacifichem 2010 (Hawaii, three invited lectures)

2009. 92nd Canadian National Conference (Hamilton); 237th American Chemical Society annual conference, "Organoboron Chemistry" symposium; BASF Boron Conference; Organic Reactions and Processes; Gordon Research Conference, discussion group leader

2008. Summer Organic Chemistry Conference, Memorial University of Newfoundland, **Plenary lecturer;** Junior Nanotechnology Network, McGill University, **Plenary Lecturer**; Organic Reactions and Processes, Gordon Research Conference, invited speaker

2007. Global Center of Excellence Lecturer, Waseda University, **Plenary Lecturer**; Physical Organic Gordon Research Conference, invited speaker

2006. 17th International Symposium on Homogeneous Catalysis (Sun City, South Africa); 16th IUPAC International Conference on Organic Synthesis (Merida, Mexico); 21st COE International Conference (Nagoya, Japan)

2005. Emerging Materials Knowledge Workshop, (Sudbury) **Plenary Speaker**; 88th National Canadian Society for Chemistry conference (Saskatoon); Maritime Inorganic Discussion Weekend, (Sackville) **Plenary speaker**

2004. 227th American Chemical Society annual conference, symposium on "*N*-Heterocyclic Carbene Chemistry"; 87th National Canadian Society for Chemistry conference (London); NSF workshop for Synthetic Organic Chemistry, invited speaker (one of 15 invitees; Stereochemistry Gordon Research Conference, invited speaker; Organic Reactions and Processes, Gordon Research Conference, invited speaker; Facilitated Chemical Synthesis, Gordon Research Conference, invited speaker

2003. Quebec-Ontario Minisymposium on Organic/Bioorganic Chemistry (Montreal); 39th IUPAC conference/86th Canadian Society for Chemistry conference (Ottawa); Heterocycles Gordon Research Conference, invited speaker

2002. Natural Products, Synthesis and Chirality Conference (Dalhousie) **Plenary speaker**; 85th National Canadian Society for Chemistry conference, (Vancouver); 17th National meeting, Canadian Catalysis Society, Vancouver); **Plenary speaker**; Organic Reactions and Processes Gordon Research Conference, invited speaker

2001. 222nd American Chemical Society meeting, symposium on "Molecular Engineering for Phase Separable Catalysis" (San Diego)

2000. 83rd National Canadian Society for Chemistry conference (Calgary)

1999. 82nd National Canadian Society for Chemistry conference (Toronto)

Public Outreach

- Interview with Kit Chapman, Chemistry World; In situ with Cathleen Crudden.
- Interview with Mark Peplow, Nature Reviews Chemistry.
- Interview with Vivien Gandolfi, Queen's Chemistry Department Student Council.
- Element of surprise radio series; Iridium, Palladium, Caesium, and Osmium.
- Interviews with Alan Neal, CBC All in a Day; Cathleen Crudden's team at Queen's gets $24 million.
- Interview with Ben Charland; What on Earth is Going on?
- Interviews with Chemistry World; Earth-abundant metal catalyst activation made simple.
- Interviews with Chemistry World; Carbene monolayer technology on a roll.
- Interviews with Chemistry World; Canada's research council is open for business.
- Interviews with Chemistry World; Carbenes beat thiols for robust monolayers.
- Interviews with Chemical & Engineering News; Machine Automates Assembly Of Small Molecules.
- Interviews with Chemical & Engineering News; Foreign students postdocs US worry about the future.
- Interviews with Chemical & Engineering News; Boron chemistry branches.
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