

# 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 8<sup>th</sup> 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

NSERC John C. Polanyi Award, 2023  
 Alumni Award of Excellence, University of Ottawa, 2023  
 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 8<sup>th</sup> 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)

Pacificchem 2015, Hawaii

Area convener, Inorganic Chemistry, Pacificchem 2015, Hawaii

Symposium Organizer: N-Heterocyclic Carbene Complexes of the Transition Metals,

Pacificchem 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, 97<sup>th</sup> Canadian Society for Chemistry Conference  
 Symposium Organizer: Homogeneous and Heterogeneous Catalysis in Honour of Howard Alper, 95<sup>th</sup> Canadian Society for Chemistry Conference  
 Organizing Committee member, (one of three Canadian representatives)  
 Pacificchem 2010, Hawaii  
 Area convener, Materials Chemistry, Pacificchem 2010, Hawaii  
 Area coordinator, Materials Chemistry, Pacificchem 2005, Hawaii  
 Co-organizer, Physical Organic Minisymposium, Queen's University, October 2004  
 Conference Chair, 13<sup>th</sup> 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

2023-2026	Department of Energy, co-investigator	\$6,000,000US
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
2020-2023	Semiconductor Research Corporation, PI with Ragogna, Barry	\$250,000
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 Look	\$736,000
2006-2009	NSERC strategic grant (metal sensing) Joint grant between Crudden (PI), Look 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 Look (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.

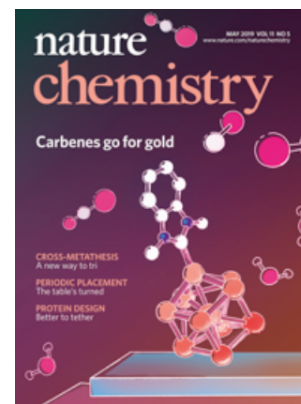
### **Japan–Germany–Canada Core–to–Core research network.**

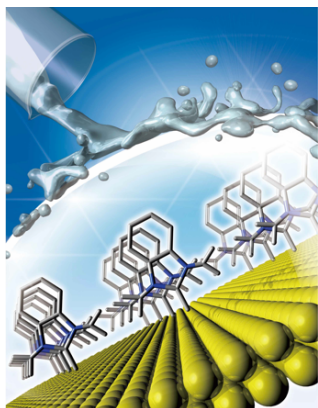
Along with my late colleague Chemistry professor Suning Wang, I participated in a trilateral Japan–Germany–Canada research network funded as a "Core-to-Core" grant from Japan. This network focused on collaborative research and student exchanges between Japan, Canada and Germany. Research areas included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



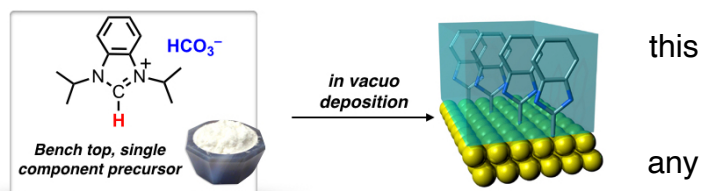


**Self-assembled NHC monolayers on gold.** In papers 130, 125 and 79, (*Nature Communications* 2021, *Chemistry a European Journal* 2020, and *Nature Chemistry* 2014), we described the first example of well-formed carbon-based monolayers on gold surfaces. Despite their widespread use in catalysis, N-heterocyclic 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.

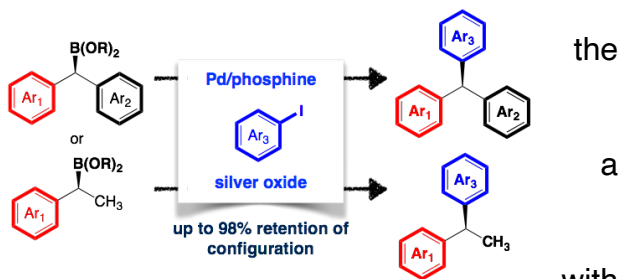
### **Bench-stable precursors for self-assembled monolayer formation.**

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 precursor, it is possible to prepare high quality films in air, without any special precautions. Films can also be deposited *in vacuo* without solvents. With these easily formed films, we also demonstrated the formation of biosensors were significantly more robust, reliable and sensitive than commercial biosensors.



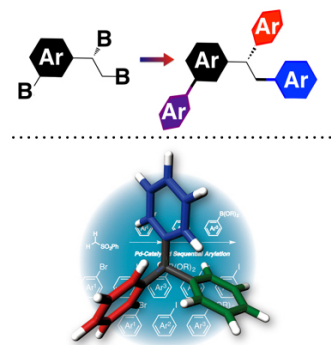
### **Stereoretentive Suzuki-Miyaura cross couplings.**

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 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 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

152. T.I. Levchenko, H. Yi, M.D. Aloisio, N.K. Dang, G. Gao, S. Sharma, C.-T. Dinh, and C.M. Crudden, "Electrocatalytic CO<sub>2</sub> Reduction with Atomically Precise Au<sub>13</sub> Nanoclusters: Effect of Ligand Shell on Catalytic Performance," **ACS Catalysis**, **2024**, *14*, 4155-4163.
151. E.L. Albright, S. Malola, S.I. Jacob, H. Yi, S. Takano, K. Mimura, T. Tsukuda, H. Häkkinen, M. Nambo, and C.M. Crudden, "Enantiopure Chiral Au<sub>13</sub> Nanoclusters Stabilized by Ditopic N-Heterocyclic Carbenes: Synthesis, Characterization, and Electrocatalytic Reduction of CO<sub>2</sub>," **Chemistry of Materials**, **2024**, *36*, 1274-1289.
150. E.L. Albright, T.I. Levchenko, V.K. Kulkarni, A.I. Sullivan, J.F. DeJesus, S. Malola, S. Takano, M. Nambo, K. Stamplecoskie, H. Häkkinen, T. Tsukuda, and C.M. Crudden, "N-Heterocyclic Carbene-Stabilized Atomically Precise Metal Nanoclusters," **Journal of the American Chemical Society**, **2024**, *146*, 5759-5780.
149. T. Zhang, S.B. Khomane, I. Singh, C.M. Crudden and P.H. McBreen, "N-heterocyclic carbene adsorption states on Pt(111) and Ru(0001)," **Phys. Chem. Chem. Phys.**, **2024**, *26*, 4083-4090.
148. D. Lee, I. Singh, A.J. Veinot, M.D. Aloisio, J.T. Lomax, P.J. Ragogna and C. Crudden, "Mesoionic Carbene-based Self-Assembled Monolayers on Gold," **Chemical Science**, **2024**, *15*, 2480-2485.
147. J. Liu, Y. Sato V.K. Kulkarni, A.I. Sullivan, W. Zhang, C.M. Crudden and J.E. Hein, "Insights into the synthesis of NHC-stabilized Au nanoclusters through real-time reaction monitoring," **Chemical Science**, **2023**, *14*, 10500-10507.
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  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.
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## Publications–Editorials/Comments

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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

8. C.M.Crudden; A.Veinot; I. Singh; S.Barry; E. Goodwin; P.Gordon; P. Ragogna; J.Lomax; P. McBreen; T.Zhang; International Patent Application No. PCT/CA2023/050541, "*Method of Selective Deposition of Small Molecules on Metal Surfaces*", filed April 21, 2023.
7. S. Barry, C.M. Crudden, E Goodwin, P. Gordon, J. Lomax, P. McBreen, P. Ragogna, I. Singh, A.J. Veinot, T. Zhang, United States Patent Application No. 18/137,538, "*Method of Selective Deposition of Small Molecules on Metal Surfaces*", filed April 21, 2023.
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, Canadian Patent 2,921,610.
2. M. Nambo and C.M. Crudden, "*Method for Producing Triarylacetonitrile*" WO2016093175A1.
1. C.M. Crudden, H.P. Looock, 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
Angus Sullivan (PhD)	Makhija Prize in Chemistry Department of Physics Prize Dean's Honour Roll Trent National Scholarship Bruce Barrett Memorial Prize NSERC Fellowship Ontario Graduate Scholarship	BSc, Trent University, ON, Canada
Viveka Kulkarni (PhD)	Dupont Canada Early Researcher Travel Award	BSc, Mount Allison University, Sackville, NS, Canada
Mark Aloisio (PhD)		BSc, University of Alberta, AB, Canada MSc, University of Alberta, AB, Canada
Aaron Erlich (PhD)		BSc, Toronto Metropolitan University
Alannah Constable (PhD)	RS. McLaughlin Fellowship	BSc, Queen's University
Sara Cheema (PhD)		MSc, Memorial University of Newfoundland
Anastasia Messina (MSc)		BSc, Queen's University
Andrew Laluk (MSc)	Ontario Graduate Scholarship	BSc, University of Manitoba
Florian Handel (MSc)		BSc, University of Stuttgart
Dana Nanan (MSc)		BSc, Western University
Dr. Tanya Levchenko (PDF)	NSERC Postdoctoral Fellowship	PhD, Western University, Canada
Dr. Zeng Rong Wong (PDF)		PhD, University of California, Berkley
Dr. Kumar Siddhant (PDF)		PhD, Ritsumeikan University, Japan
Dr. Ahmadreza Nezamzadeh		PhD, University of Saskatchewan



Ezhieh (PDF)		
Dr. Monika Snowdon (PDF)	CAS Future Leaders Award	PhD, University of Waterloo, Canada
Dr. Dianne Lee		PhD, Queen's University

### 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
Dr. Roberto Nolla-Saltiel (PDF)		PhD, University of Nottingham, UK
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

2023. 5<sup>th</sup> ICReDDD symposium (virtual talk, January); University of South California (February); University of California-Irvine (March); University of North Carolina Chapel Hill (March);

University of Rochester (May); University of Illinois Urbana-Champaign (May); Canadian Society for Chemistry (Vancouver, June); OceanNetwork Canada (Victoria, June); North American Catalysis Society (Providence, RI, June); Gordon Research Conference (Smithfield, Rhode Island, July); OMCOS21 (Vancouver, July); American Chemical Society (San Francisco, August); Kolthoff Lecture, University of Minnesota (October); XIII Colombian Symposium of Catalysis (October, virtual); University of Ottawa (October); McGill University (October); American Vacuum Society Symposium (Portland, OR, November); Samsung Science and Technology Foundation Symposium (Los Angeles, November).

**2022.** Banff Symposium on Organic Chemistry (Keynote, March, virtual); University of California Berkeley, Muetteries Lectureship (Berkeley, April); Area Selective Deposition Workshop (San Francisco, 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 (2 virtual talks); 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); 257<sup>th</sup> ACS National Meeting (Orlando, 2 invited lectures); 102<sup>nd</sup> Canadian Society for Chemistry Conference (Quebec City, three invited lectures); 258<sup>th</sup> 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; 255<sup>th</sup> ACS National Meeting (New Orleans, two invited talks), Southwestern Ontario Undergraduate Chemistry Conference, Plenary speaker (Waterloo); 25<sup>th</sup> Canadian Symposium on Catalysis, Plenary speaker/award lecture (Saskatoon); 101<sup>st</sup> 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; 43<sup>rd</sup> International Conference on Co-ordination Chemistry, keynote lecture (Sendai, Japan); American Vacuum Society, 65<sup>th</sup> 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; 100<sup>th</sup> Canadian Society for Chemistry conference (two invited talks); 12<sup>th</sup> 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; 251<sup>st</sup> ACS National Meeting (San Diego); Carleton University; 252<sup>nd</sup> ACS National Meeting (Philadelphia); IRTG Symposium, Münster, Germany; Plenary speaker, 24<sup>th</sup> Canadian Symposium on Catalysis (Ottawa); 7<sup>th</sup> annual Green Chemistry & Catalysis meeting (McGill); 15<sup>th</sup> Boron in the Americans Conference (Kingston); Mount Allison University; University of New Brunswick; Dalhousie University; Vertex Pharmaceuticals; Laval University; 4<sup>th</sup> 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); 18<sup>th</sup> Organometallic Chemistry Directed Towards Organic Synthesis (Sitges, Spain); 98<sup>th</sup> 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; 19<sup>th</sup> 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; 245<sup>th</sup> ACS National Meeting, Award symposium in honour of Melanie Sanford, New Orleans; 1<sup>st</sup> International Conference, Institute of Transformative Bio-Molecules, (Nagoya, Japan); 96<sup>th</sup> Canadian Society for Chemistry Conference, (Quebec City); 15<sup>th</sup> 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; 244<sup>th</sup> ACS National Meeting, NHC symposium, (Philadelphia); University of Minnesota; University of Iowa; 95<sup>th</sup> Canadian Society for Chemistry National Meeting (Calgary); CSC Catalysis Conference (Quebec City)
- 2011.** **Distinguished Female Lecturer, Stanford University**; California Institute of Technology; 241<sup>st</sup> ACS National Meeting, Anaheim; "Award symposium in honour of Jeffrey Bode"; 94<sup>th</sup> Canadian National Conference (Montreal); York University; Concordia University; Mount Allison

## University

- 2010.** 93<sup>rd</sup> Canadian National Conference (Toronto); University of New Brunswick (Fredericton); University of Cape Breton; Acadia University; "Catalysis and Chirality in Molecules and Materials" 23<sup>rd</sup> Jacques Cartier Center Colloquium: Catalysis Science at the Dawn of the 21<sup>st</sup> Century (Lyon, France); Pacifichem 2010 (Hawaii, three invited lectures)
- 2009.** 92<sup>nd</sup> Canadian National Conference (Hamilton); 237<sup>th</sup> 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.** 17<sup>th</sup> International Symposium on Homogeneous Catalysis (Sun City, South Africa); 16<sup>th</sup> IUPAC International Conference on Organic Synthesis (Merida, Mexico); 21<sup>st</sup> COE International Conference (Nagoya, Japan)
- 2005.** Emerging Materials Knowledge Workshop, (Sudbury) **Plenary Speaker**; 88<sup>th</sup> National Canadian Society for Chemistry conference (Saskatoon); Maritime Inorganic Discussion Weekend, (Sackville) **Plenary speaker**
- 2004.** 227<sup>th</sup> American Chemical Society annual conference, symposium on "N-Heterocyclic Carbene Chemistry"; 87<sup>th</sup> 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); 39<sup>th</sup> IUPAC conference/86<sup>th</sup> Canadian Society for Chemistry conference (Ottawa); Heterocycles Gordon Research Conference, invited speaker
- 2002.** Natural Products, Synthesis and Chirality Conference (Dalhousie) **Plenary speaker**; 85<sup>th</sup> National Canadian Society for Chemistry conference, (Vancouver); 17<sup>th</sup> National meeting, Canadian Catalysis Society, Vancouver); **Plenary speaker**; Organic Reactions and Processes Gordon Research Conference, invited speaker
- 2001.** 222<sup>nd</sup> American Chemical Society meeting, symposium on "Molecular Engineering for Phase Separable Catalysis" (San Diego)

2000. 83<sup>rd</sup> National Canadian Society for Chemistry conference (Calgary)

1999. 82<sup>nd</sup> National Canadian Society for Chemistry conference (Toronto)

## Public Outreach

- Interview with Alan Neal, CBC All in a Day, NSERC Polanyi prize.
- 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.
- Interviews with Queen's Gazette; \$16-million boost for research.
- Interviews with Queen's Gazette; Research partnership expands Queen's links with Japan.
- Interviews with Queen's Gazette; Province injects \$16 million into Queen's research.
- Interview on the Synlett best paper award 2017; Synthesis of Tetraarylmethanes by the Triflic Acid-Promoted Formal Cross-Dehydrogenative Coupling of Triarylmethanes with Arenes.
- Interview with Science Daily; Modified metals change color in the presence of particular gases.
- Interview on the Beckman Program; Beckman Scholars Program.
- Interview with Phys Org; Carbon coating: Researchers develop new process to increase strength of medical instruments.