

# Christopher J. Douglas

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## PROFESSIONAL EXPERIENCE

2014–present Associate Professor of Chemistry, UMN – Twin Cities  
2007–2014 Assistant Professor of Chemistry, UMN – Twin Cities  
2005–2007 NIH-NRSA Postdoctoral Fellow  
Caltech, Advisor: Professor Robert H. Grubbs

## EDUCATION

2005 Ph.D. in Chemistry, University of California at Irvine  
Advisor: Professor Larry E. Overman  
"Evaluation of Ferrocenyloxazoline Palladacyclic Catalysts for the  
Asymmetric Allylic Imidate Rearrangement and Studies toward an  
Enantioselective Synthesis of Sarain A."  
1999 B. S. in Chemistry, University of Minnesota at the Twin Cities  
Advisor: Professor Richard P. Hsung

## HONORS AND AWARDS

### *Independent Career*

2017 George W. Taylor Distinguished Teaching Award (UMN)  
2014 George W. Taylor Career Development Award (UMN)  
2012 NSF CAREER Award  
2011 DuPont Young Investigator  
2010–2011 Outstanding Professor Award, College of Science & Engineering (UMN)  
(Selected by Undergraduates at the University of Minnesota)  
2010 Cottrell Scholar, Research Corporation for Science Advancement  
2010 Thieme Synthesis/Synlett Journal Award  
2009–2011 3M Nontenured Faculty Grant Award

### *Prior to Independent Career*

2005–2007 Ruth L. Kirschstein National Research Service Award  
2002–2004 ARCS Foundation Graduate Fellow  
2001 Bristol-Myers Squibb Graduate Fellow  
2001 NSF Pre-doctoral Honorable Mention  
1999 Graduate with High Distinction, GPA 3.893/4.000,  
UMN– Twin Cities  
1999 Merck Award  
1998 NSF-REU Fellow, Sponsored by Pharmacia-Upjohn  
1995–1999 Badger Mining Co. Scholar

## SYNERGISTIC ACTIVITIES

- 2013–present Mentor and Facilitator for the Cottrell Scholar Collaborative – New Faculty workshop in Chemistry. Held in Washington DC at the ACS headquarters for 40-50 new chemistry faculty annually in late summer. Workshop focuses on teaching, integrating teaching and research, student mentoring, managing a research lab, and effective time management. <http://chem.wayne.edu/feigggroup/CSCNFW/>
- 2010–present Mentor for the Mentorship Program for Aspiring Chemistry Teachers (MPACT) for organic chemistry.
- 2010 Participant at Process Oriented Guided Inquiry Learning (POGIL) training conferences (Great Lakes Regional 3-day conference, and UMN 1-day conference).
- 2010–2014 Collaborator for developing high efficient organic solar cells with the Departments of Chemistry and Chemical Engineering & Materials Sciences.
- 2009–2014 Organizer for Exploring Careers in Engineering & Physical Science (ECEPS) Day for Twin Cities high school students <http://www.chem.umn.edu/groups/douglas/outreach.html>
- 2007–present Synthetic organic chemistry weekly super-group meetings “synthesis lunch” with organic chemistry groups at Minnesota
- 2007–2014 Collaborator with UMN’s NSF-sponsored Materials Research Science and Engineering Center (MRSEC), Organic Optoelectronic Interfaces group (IRG2). <http://www.mrsec.umn.edu/index.php>

## TEACHING

Organic Synthesis (CHEM 4321/8321)	Fall 2007–9, 2014 (4 times)
Physical Organic Chemistry (CHEM 8352/4352)	Spring 2011, 2014, 2018 (3 times)
Organic Chemistry I (CHEM 2301)	Fall 2010–12, Spring 2009 (7 times)
Organic Chemistry II (CHEM 2302)	Spring 2016, 2018 (2 times)
Honors Organic Chemistry II (CHEM 2322H)	Spring 2014–16 (3 times)

## PUBLICATIONS

**Independent Career:** \* indicates corresponding author, ‡ indicates undergraduate co-author, † indicates equal contribution

(45) Serratore, N. A.; Anderson, C. B.; Frost, G. B.; Hoang, G. T.; Underwood, S. J.; Gemmel, P. M.; ‡ Hardy, M. A.; ‡ Douglas, C. J.\* “Overcoming Electronic Control in Arene Acylation using Iridium-Catalyzed Bond Functionalization” *submitted*.

(44) Pan, Z.; † Wang, S.; † Brethorst, J. T.; Douglas, C. J.\* “Palladium and Lewis Acid-Catalyzed Intramolecular Aminocyanation of Alkenes: Scope, Mechanism, and Stereoselective Alkene Difunctionalizations” *J. Am. Chem. Soc.* accepted, DOI: 10.1021/jacs8b01330.

- (43) Savikhin, V.; Jagadamma L.; Purvis, L.; Robertson I.; Oosterhout, S.; Douglas, C. J.; Samuel, I. D. W.; Toney, M.\* “Morphological, Chemical, and Electronic Changes of the Conjugated Polymer PTB7 with High Temperature Annealing” *iScience* accepted.
- (42) Purvis, L. J.; Gu, X.; Ghosh, S.; Zhang, Z.; Cramer, C. J.;\* Douglas, C. J.\* “Synthesis and Characterization of Electron Deficient Asymmetrically Substituted Diarylindenotetracenes” *J. Org. Chem.* ASAP, DOI: 10.1021/acs.joc.7b02756
- (41) Bera, K.; Douglas, C. J.; Frontiera, R. R.\* “Femtosecond Raman Microscopy Reveals Structural Dynamics Leading to Triplet Separation in Rubrene Singlet Fission” *J. Phys. Chem. Lett.* **2017**, *8*, 5929. DOI: 10.1021/acs.jpcclett.7b02769
- (40) Wu, Y.; Ren, X.; McGarry, K. A.; Bruzek, M. J.; Douglas, C. J.; Frisbie, C. D.\* “Scanning Kelvin Probe Microscopy Reveals Planar Defects Are Sources of Electronic Disorder in Organic Semiconductor Crystals” *Adv. Electron. Mater.* **2017**, *3*, 1700117. DOI: 10.1002/aelm.201700117
- (39) Bertram, J. H. Mulliner, K. M.; Shi, K.; Plunkett, M. H.; Nixon, P.; Serratore, N. A.; Douglas, C. J.; Aihara, H.; Barney, B. M.\* “Characterization of Five Fatty Aldehyde Dehydrogenase Enzymes From *Marinobacter* and *Acinetobacter*: Structural Insights into the Aldehyde Binding Pocket” *Appl. Environ. Microbiol.* **2017**, e00018-17. DOI: 10.1128/aem.00018-17
- (38) Benduhn, J.;\* Tvingstedt, K.; Piersimoni, F.; Ullbrich, S.; Fan, Y.; Tropiano, M.; McGarry, K. A.; Douglas, C. J.; Zeika, O.; Riede, M.; Marder, S.; Neher, D.; Spoltore, D.; Vandewal, K.\* “Intrinsic Non-Radiative Voltage Losses in Fullerene-Based Organic Solar Cells” *Nat. Energy.* **2017**, *2*, 17053. DOI: 10.1038/nenergy.2017.53
- (37) Ren, X.;\* Bruzek, M. J.; Hanifi, D. A.; Schulzetenberg, A.; Wu, Y.; Kim, C. H.; Zhang, Z.; Johns, J. E.; Salleo, A.; Fratini, S.; Troisi, A.; Douglas, C. J.; Frisbie, C. D.\* “Negative Isotope Effect on Field-Effect Hole Transport in Fully Substituted <sup>13</sup>C-Rubrene” *Adv. Electron. Mater.* **2017**, *3*, 1700018. DOI: 10.1002/aelm.201700018
- (36) Frost, G. B.; Serratore, N. A.; Ogilvie, J. M.; Douglas, C. J.\* “Mechanistic Model for Enantioselective Intramolecular Alkene Cyanoamidation via Palladium-Catalyzed C–CN Bond Activation” *J. Org. Chem.* **2017**, *82*, 3721–3726. DOI: 10.1021/acs.joc.7b00196
- (35) Hoang, G. T.;† Walsh, D. J.;‡† McGarry, K. A.; Anderson, C. B.; Douglas, C. J.\* “Development And Mechanistic Study of Quinoline-Directed Acyl C–O Bond Activation and Alkene Oxyacylation Reactions” *J. Org. Chem.* **2017**, *82*, 2972–2983. DOI: 10.1021/acs.joc.6b03011
- (34) Ogden, W. A.;‡ Ghosh, S.; Bruzek, M. J.; McGarry, K. A.; Balhorn, L.;‡ Young, V. G. Jr.; Purvis, L. J.; Wegwerth, S. E.; Zhang, Z.; Serratore, N. A.; Cramer, C. J.;\* Gagliardi, L.;\* Douglas, C. J.\* “Partial Fluorination as a Strategy for Crystal Engineering of Rubrene Derivatives” *Cryst. Growth & Des.* **2017**, *17*, 643–658. DOI: 10.1021/acs.cgd.6b01497
- (33) Dreis, A. M.; Otte, S. C.; Eastwood, M. S.; Alonzi, E. R.;‡ Brethorst, J. T.; Douglas, C. J.\* “Diastereoselective Intramolecular Cyanoamidation with Alkenes” *Eur. J. Org. Chem.* **2017**, 45–48. DOI: 10.1002/ejoc.201601283

- (32) Zhang, Z.; Ogden, W. A.;<sup>‡</sup> Young, V. G. Jr.; Douglas, C. J.\* “Synthesis, Electrochemical Properties, and Crystal Packing of Perfluororubrene” *Chem. Commun.* **2016**, 52, 8127–8130. DOI: 10.1039/C6CC03259A
- (31) Jiang, X.; Pan, Z.; Douglas, C. J.\* “Cyclization of an Alkene-Bearing Cyclopentanone: the Role of Rhodium and Brønsted Acid” *Tetrahedron Lett.* **2015**, 56, 5324–5327.
- (30) Hoang, G. T.; Pan, Z.; Brethorst, J. A.; Douglas, C. J.\* “Intramolecular Oxyacylation of Alkenes using a Hydroxyl Directing Group” *J. Org. Chem.* **2014**, 79, 11383–11394.
- (29) Rondla, N. R.; Ogilvie, J. M.; Pan, Z.; Douglas, C. J.\* “Palladium Catalyzed Intramolecular Acylcyanation of Alkenes Using  $\alpha$ -Iminonitriles” *Chem. Commun.* **2014**, 50, 8974–8977.
- (28) Pan, Z.; Pound, S. M.; Rondla, N. R.; Douglas, C. J.\* “Intramolecular Aminocyanation of Alkenes by N–CN Bond Cleavage” *Angew. Chem., Int. Ed.* **2014**, 53, 5170–5174.
- (27) Dreis, A. M.; Douglas, C. J.\* “Carbon-Carbon Bond Activation with 8-Acylquinolines” *Top. Curr. Chem.* **2014**, 346, 85–110.
- (26) Xie, W.;\* Prabhumirashi, P. L.; Nakayama, Y.; McGarry, K. A.; Geier, M. L.; Uragami, Y.; Mase, K.; Douglas, C. J.; Ishii, H.; Hersam, M. C.; Frisbie, C. D.\* “Utilizing Carbon Nanotube Electrodes to Improve Charge Injection and Transport in Bis(trifluoromethyl)-dimethyl-rubrene (fm-rubrene) Ambipolar Single Crystal Transistors” *ACS Nano* **2013**, 11, 10245–10256.
- (25) Mullenbach, T. K.; McGarry, K. A.; Luhman, W. A.; Douglas, C. J.;\* Holmes, R. J.\* “Connecting Molecular Structure and Exciton Diffusion Length in Rubrene Derivatives” *Adv. Mater.* **2013**, 25, 3689–3693.
- (24) McGarry, K. A.; Xie, W.; Sutton, C.; Risko, C.; Wu, Y.; Young, V. G. Jr.; Brédas, J.-L.;\* Frisbie, C. D.;\* Douglas, C. J.\* “Rubrene-Based Single-Crystal Organic Semiconductors: Synthesis, Electronic Structure, and Charge-Transport Properties” *Chem. Mater.* **2013**, 25, 2254–2263.
- (23) Xie, W.; McGarry, K. A.; Liu, F.; Wu, Y.; Ruden, P. P.;\* Douglas, C. J.;\* Frisbie, C. D.\* “High-Mobility transistors Based on Single Crystals of Isotopically Substituted Rubrene- $d_{28}$ ” *J. Phys. Chem. C* **2013**, 117, 11522–11529.
- (22) Beletskiy, E. V.; Sudheer, Ch.; Douglas, C. J.\* “Cooperative Catalysis Approach to Intramolecular Hydroacylation” *J. Org. Chem.* **2012**, 77, 5884–5893. *Selected by the editors as a Feature Article.*
- (21) Gu, X.; Luhman, W. A.; Yagodkin, E.; Holmes, R. J.;\* Douglas, C. J.\* “Diarylindenotetracenes via a Selective Cross-Coupling/C-H Functionalization: Electron Donors for Organic Photovoltaic Cells” *Org. Lett.* **2012**, 14, 1390–1393.
- (20) Yagodkin, E.; McGarry, K. A.; Douglas, C. J.\* “Preparation of 6,11-Dihydroxy-5,12-Tetracenedione” *Org. Prep. Proc. Int.* **2011**, 43, 360–363.
- (19) Rondla, N. R.; Levi, S. M.;<sup>‡</sup> Ryss, J. M.;<sup>‡</sup> Vanden Berg, R. A.; Douglas, C. J.\* “Palladium-Catalyzed C–CN Activation and Intramolecular Cyanoesterification of Alkynes” *Org. Lett.* **2011**, 13, 1940–1943.
- (18) Hoang, G. T.; Reddy, V. J.; Nguyen, H. H. K.;<sup>‡</sup> Douglas, C. J.\* “Insertion of an Alkene into an Ester: An Intramolecular Oxyacylation Reaction of Alkenes via Acyl C–O Bond Activation”

*Angew. Chem. Int. Ed.* **2011**, *50*, 1882–1884. Selected by the Editorial Board as a 'Hot Paper' and highlighted by *Nachrichten aus der Chemie*.

(17) Yagodkin, E.; Douglas, C. J.\* "Low Temperature Kumada-Corriu Cross-Coupling of Polychlorinated Acene Derivatives and a Synthesis of Sterically Demanding Acenes" *Tetrahedron Lett.* **2010**, *51*, 3037–3040.

(16) Yagodkin, E.; Xia, Y.; Kalihari, V.; Frisbie, C. D.†; Douglas, C. J.\* "Synthesis, Solid State Properties, and Semiconductor Measurements of 5,6,11,12-Tetrachlorotetracene." *J. Phys. Chem. C.* **2009**, *113*, 16544–16548.

(15) Wentzel, M. T.; Reddy, V. J.; Hyster, T. K.‡; Douglas, C. J.\* "Chemoselectivity in Catalytic C–C and C–H Bond Activation: Controlling Intermolecular Carboacylation and Hydroarylation of Alkenes." *Angew. Chem. Int. Ed.* **2009**, *48*, 6121–6123.

(14) Dreis, A. M.; Douglas, C. J.\* "Catalytic Carbon–Carbon Sigma Bond Activation: An Intramolecular Carbo-Acylation Reaction with Acylquinolines" *J. Am. Chem. Soc.* **2009**, *131*, 412–413.

### **Supervised Career:**

(13) Stewart, I. C.; Douglas, C. J.; Grubbs, R. H.\* "Increased Efficiency in Cross-Metathesis Reactions of Sterically-Hindered Olefins" *Org. Lett.* **2008**, *10*, 441–444. *Second-most accessed paper from Org. Lett. between January – March 2005*

(12) Becker, M. H.; Chua, P.; Downham, R.; Douglas, C. J.; Garg, N. K.; Hiebert, S.; Jaroch, S.; Matsuoka, R. T.; Middleton, J. A.; Ng, F. W.; Overman, L. E.\* "Total Synthesis of (–)-Sarain A" *J. Am. Chem. Soc.* **2007**, *129*, 11987–12002. *Most downloaded from J. Am. Chem. Soc. between July – September 2007*

(11) Douglas, C. J.; Heibert, S.; Overman, L. E.\* "Toward an Enantioselective Total Synthesis of Sarain A: Construction of an Advanced Intermediate and Rearrangement of the Sarain A Core Under Mild Conditions" *Org. Lett.* **2005**, *7*, 933–936.

(10) Anderson, C. E.; Donde, Y.; Douglas, C. J.; Overman, L. E.\* "Asymmetric Allylic Imidate Rearrangement. Evaluation and Synthesis of Novel Ferrocenyloxazoline Palladacyclic Catalysts and Imidate Motifs" *J. Org. Chem.* **2005**, *70*, 648–657.

(9) Douglas, C. J.; Overman, L. E.\* "Catalytic Asymmetric Synthesis of All-Carbon Quaternary Stereocenters" *Proc. Nat. Acad. Sci. USA* **2004**, *101*, 5363–5367.

(8) Fredrick, M. O.; Mulder, J. A.; Tracey, M. R.; Hsung, R. P.\*; Huang, J.; Kurtz, K. C. M.; Shen, L.; and Douglas, C. J. "A Copper-Catalyzed C–N Bond Formation Involving sp-Hybridized Carbons. A Direct Entry to Chiral Ynamides via *N*-Alkynylation of Amides" *J. Am. Chem. Soc.* **2003**, *125*, 2368–2369.

(7) Shen, H. C.; Wang, J. S.; Cole, K. P.; McLaughlin, M. J.; Morgan, C. D.; Douglas, C. J.; Hsung, R. P.\*; Coverdale, H. A.; Gerasuto, A. I.; Hahn, J. M.; Liu, J.; Sklenicka, H. M.; Wei, L. L.; Zehnder, L. R.; Zifcsak, C. A. "A Formal [3+3] Cycloaddition Reaction. Improved Reactivity Using alpha, beta-Unsaturated Iminium Salts and Evidence for Reversibility of 6-pi-Electron Electrocyclic Ring Closure of 1-Oxatrienes" *J. Org. Chem.* **2003**, *68*, 1729–1735.

(6) Wei, L. L.; Mulder, J. A.; Xiong, H.; Zifcsak, C. A.; Douglas, C. J.; Hsung, R. P.\* "Efficient Preparations of Novel Ynamides and Allenamides" *Tetrahedron*, **2001**, *57*, 459–466.

- (5) Hsung, R. P.;\* Shen, H. C.; Douglas, C. J.; Morgan, C. D.; Degen, S. J.; Yao, L. J. "Sequential 1,2-Addition–Electrocyclic Ring Closures Involving Acyclic *a*, *b*-Unsaturated Iminiums: A Formal [3+3] Cycloaddition Strategy to Unique Pyranyl Spirocycles" *J. Org. Chem.* **1999**, *64*, 690–691.
- (4) Hsung, R. P.;\* Wei, L.; Sklenicka, H. M.; Douglas, C. J.; McLaughlin, M. J.; Mulder, J. A.; Yao, L. J. "Formal Cycloaddition Reaction of Vinylogous Amides with *a*, *b*-Unsaturated Iminiums. A Strategy for Construction Piperidinyl Heterocycles" *Org. Lett.* **1999**, *1*, 509–512.
- (3) Hsung, R. P.;\* Zifcsak, C. A.; Wei, L.; Douglas, C. J.; Xiong, H.; Mulder, J. A. "Hetero [2+2] Cycloaddition Reaction of 10-Alkynyl-9(10*H*)-acridones with Aldehydes. Stereoselective synthesis of Trisubstituted Alkenes and 1,3-Dienes" *Org. Lett.* **1999**, *1*, 1237–1240.
- (2) Wei, L.; Xiong, H.; Douglas, C. J.; Hsung, R. P.\* "Inverse Demand [4+2] Cycloaddition Reactions of Allenamides: Reactivity Scopes of An Electron Deficient Variant of Allenamines" *Tetrahedron Lett.* **1999**, *40*, 6903–6907.
- (1) Douglas, C. J.; Sklenicka, H. M.; Shen, H. C.; Mathias, D. S.; Degen, S. J.; Golding, G. M.; Morgan, C. D.; Shih, R. A.; Mueller, K. L.; Seurer, L. M.; Johnson, E. W.; Hsung, R. P.\* "Synthesis and UV Studies of a Small Library of 6-Aryl-4-hydroxy-2-pyrones. A Relevant Structural Feature for the Inhibitory Property of Arisugacin Against Acetylcholinesterase" *Tetrahedron* **1999**, *55*, 13683–13696.