

Pascale G. Charest

Associate Professor

Department of Molecular and Cellular Biology
Department of Chemistry and Biochemistry
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EDUCATION

- 1998 *B.Sc. Biochemistry, Université de Sherbrooke, Sherbrooke, Canada*
- 2000 *M.Sc. Biochemistry, Université de Montréal, Montréal, Canada*
Advisor: Michel Bouvier
Thesis title: *Study of the V2 vasopressin receptor palmitoylation*
Major field: Biochemistry
- 2005 *Ph.D. Biochemistry, Université de Montréal, Montréal, Canada*
Advisor: Michel Bouvier
Thesis title: *Study of G protein-coupled receptor-mediated activation of ERK1/2 MAP kinases—Role of the adaptor protein beta-arrestin*
Major field: Biochemistry and Molecular Pharmacology

EMPLOYMENT AND APPOINTMENTS

- 2000–2005 *Teaching Assistant (undergraduate biochemistry labs)*
Department of Biochemistry, Université de Montréal, Montréal, Canada
- 2003–2005 *Lecturer (medical curriculum)*
Department of Biochemistry, Université de Montréal, Montréal, Canada
- 2005–2010 *Postdoctoral Research Associate*
Division of Biological Sciences, Section of Cell and Developmental Biology, University of California-San Diego, La Jolla, CA
Advisor: Richard A. Firtel
- 2010–2012 *Assistant Project Scientist (Research Faculty)*
Division of Biological Sciences, Section of Cell and Developmental Biology, University of California-San Diego, La Jolla, CA
- 2012–2019 *Assistant Professor*
Department of Chemistry and Biochemistry, University of Arizona, Tucson, AZ
Note: *Tenure clock delayed one year for birth of a child in 2012*
- 2015–present *Faculty Member*
University of Arizona Cancer Center, Tucson, AZ
- 2015–present *Faculty Member*

Cancer Biology GIDP, University of Arizona, Tucson, AZ

2016–present *Faculty Member*

BIO5 Institute, University of Arizona, Tucson, AZ

2019–present *Associate Professor*

Department of Chemistry and Biochemistry, University of Arizona, Tucson, AZ
Department of Molecular and Cellular Biology, University of Arizona, Tucson, AZ

HONORS AND AWARDS

Undergraduate research summer fellowship, Université de Sherbrooke, Sherbrooke, Canada (1997)

Graduate research fellowship, Société Québécoise d'Hypertension Artérielle, declined (1999)

Graduate research fellowship, Canadian Hypertension Society (1999-2000)

Poster presentation award, Société Québécoise d'Hypertension Artérielle, annual scientific meeting, Montréal, Canada (2000)

Graduate research fellowship, Université de Montréal, Montréal, Canada (2000)

Graduate research fellowship, Canadian Hypertension Society. declined (2001)

Graduate research fellowship, Fonds de la Recherche en Santé du Québec (2001-2003)

Graduate research fellowship, Heart and Stroke Foundation of Canada (2001-2004)

Postdoctoral research fellowship, Fonds de la Recherche en Santé du Québec (2005-2008)

American Cancer Society Research Scholar (2015)

University of Arizona nominee for the National Camille Dreyfus Teacher-Scholar award (2017)

Department of Molecular & Cellular Biology, University of Arizona, Faculty Innovator Award (2019)

SERVICE/OUTREACH

Outreach

Local outreach

May 2012, 2013, 2014, Poster fair judge

Summer 2013, Biochemistry Club/Middle School Summer Camp presenter

Summer 2017, Mentor, Cienega High School senior exit program

Oct 2019, Meet MCB 2019 event, Tours of the Charest lab to 82 students from 6 local high schools

Oct 2019, Presentation and guided activity "Meet Dicty the amoeba", lower elementary classes, Khalsa Montessori School

State outreach

May 2015, Interview with Arizona Public Media-NPR on research funded by the American Cancer Society

May 2016, Presenter at the American Cancer Society Climb to Conquer luncheon, Phoenix, AZ

Institutional service

Departmental committees and service

2012-2016, Graduate admissions committee
Feb 2013, 2014, 2015, 2016, 2017, 2018 Annual peer review reviewer
2013-2015, Biochemistry seminar coordinator
2013-2015, CBC/CMM /MCB joint seminar committee
2013-2016, Recruitment of sponsors for departmental seminars
2013-2016, Joint Biological and Biomedical Retreat committee
2015-2016, CBC faculty search committee
2016, Working group for evaluating and recommending plan for CBC's teaching enterprise
2016, CBC graduate student awards committee, ad hoc member
2016-2018, Graduate program committee
2016-2018, Faculty advisor for the Program to Advance Women Scientists (PAWS) in Chemistry and Biochemistry
2018, CBC professional behavior working group
2018, CBC faculty search committee
2018, CBC C4 (Climate, Culture & Conduct Committee)
2017-2018, BMCB graduate program executive committee
Spring 2020, Undergraduate Biology Research Program (UBRP) selection committee
Spring 2021, Peer teaching evaluator
2012-present, Thesis & Dissertation committees (30 total, 19 currently)
2019-present, Joint Biological and Biomedical Retreat committee
2019-present, MCB undergraduate curriculum committee
2020-present, Biological Chemistry Program steering committee
2020-present, Postdoctoral researcher mentoring committee (1)

College committees and service

2013, 2014, Medical School Multiple Mini Interview (MMI) evaluator for the College of Medicine
2013-2018, College of Science Awards Committee
Spring 2020, ASEMS panel discussion

University service

Spring 2015, Grant reviewer, Cancer Center Support Grants, Pilot Project for basic/clinical partnerships to promote translational research
Fall 2016, Grant reviewer, American Cancer Society Institutional Research Grants
Spring 2017, Grant reviewer, RDI Faculty Seed Grants
Fall 2017, Grant reviewer, American Cancer Society Institutional Research Grants
Fall 2018, Grant reviewer, NCI Predoctoral to Postdoctoral Fellow Transition Award–Institutional selection of applicant
Spring 2020, Grant reviewer, RDI – Research Advancement Grant: Equipment Enhancement Fund
Summer 2020, Grant reviewer, American Cancer Society Institutional Research Grants
2020-2021, Mentor, U. Arizona Women in STEM Mentorship Program

National and International service

Memberships in professional societies

American Association for the Advancement of Science
The American Society for Biochemistry and Molecular Biology
The American Society for Cell Biology
Faculty of 1000

Service as manuscript reviewer (total number of manuscripts reviewed for each journal indicated)

BIOCELL (1), Biomolecules (6), Biotechniques (2), Cancer Biomarkers (1), Cellular Signaling (2), Cells (2), Communications Biology (2), Developmental Cell (3), Development Growth and Differentiation (1), Differentiation (2), European Journal of Cell Biology (1), FEBS Letters (2), FEMS Microbiology Reviews (1), Frontiers in Cell and Developmental Biology (3), Journal of Biological Chemistry (1), Journal of Cell Science (2), Journal of Visualized Experiments (1), mBIO (1), Microbiological Research (1), microPublication Biology (1), Molecular Biology of the Cell (10), Molecular Pharmacology (1), Molecules (1), mSphere (1), Nature Cell Biology (2), Open Biology (2), PLoS Biology (3), Proceedings of the National Academy of Science (8), Protein Science (1), Science Signaling (4), Scientific Reports (2), Small GTPases (2)

Service as external grant reviewer

Nov 2015, Natural Science and Engineering Research Council of Canada
 Mar 2017, Natural Science and Engineering Research Council of Canada
 Feb 2018, NIH Intercellular Interactions (ICI) study section
 Oct 2018, FWF Austrian Science Fund
 Feb 2021, NIH CSR Special Emphasis Panel, Fellowship: Cell Biology, Developmental Biology, and Bioengineering (F05-U)
 Jun 2021, NIH CSR Special Emphasis Panel, Fellowship: Cell Biology, Developmental Biology, and Bioengineering (F05-U)
 Jul 2021, Baylor College of Medicine

Service in international scientific meetings

Session chair, 2013 Annual International *Dictyostelium* Conference, Asheville, NC
 Organizer and meeting chair, 2016 Annual International *Dictyostelium* Conference, Tucson AZ
 Session chair, 2019 Annual International *Dictyostelium* Conference, Ann Harbor, MI
 Awards committee, 2020 Annual International *Dictyostelium* Conference, virtual
 Awards committee, 2021 Annual International *Dictyostelium* Conference, virtual

PUBLICATIONS

** Indicates publication based on work performed prior to initial faculty appointment (as graduate student, postdoctoral researcher, or assistant project scientist)*

For publications based on work done in current faculty position, authors are designated as follows:

^U, undergraduate student; ^G, graduate student; ^P, postdoctoral researcher; ^S, staff scientist; ^C, collaborator; ^{SC}, student or staff of collaborator.

Refereed journal articles (published or accepted in final form)

1. * M. Azzi, P.G. Charest, S. Angers, M. Bouvier and G. Pineyro. "βArrestin-mediated activation of MAPK by inverse agonists reveals distinct active conformations for GPCRs". *Proc. Natl. Acad. Sci. U S A* 100(20):11406-11 (2003).
Recommended by Faculty of 1000, 27 Sep 2006
2. * P.G. Charest and M. Bouvier. "Palmitoylation of the V2 vasopressin receptor carboxyl tail facilitates βarrestin recruitment leading to efficient receptor endocytosis and ERK1/2 activation". *J. Biol. Chem.* 278(42):41541-51 (2003).
3. * J. Perroy, S. Pontier, P.G. Charest, M. Aubry and M. Bouvier. "Real-time monitoring of ubiquitination in living cells by BRET". *Nat. Meth.* 1(3):203-8 (2004).

Recommended by Faculty of 1000, 7 Jan 2005

4. * P.G. Charest, S. Terrillon and M. Bouvier. "Monitoring agonist-promoted conformational changes of β -arrestin in living cells by intramolecular BRET". *EMBO rep.* 6(4): 334-40 (2005).
5. * P.G. Charest and R.A. Firtel. "Feedback signaling controls leading edge formation during chemotaxis". *Curr. Opin. Genet. Dev.* 16(4):339-47 (2006).
6. * P.G. Charest, G. Oligny-Longpré, H. Bonin, M. Azzi and M. Bouvier. "The V2 vasopressin receptor stimulates ERK1/2 activity independently of heterotrimeric G protein signalling". *Cell. Signal.* 19(1):32-41 (2007).
7. * A.T. Sasaki, C. Janetopoulos, S. Lee, P.G. Charest, K. Takeda, L.W. Sunddheimer, R. Meili, P.N. Devreotes and R.A. Firtel. "G Protein-Independent Ras/PI3K/F-Actin Circuit Regulates Basic Cell Motility". *J. Cell. Biol.* 178(2):185-91 (2007).

Recommended by Faculty of 1000, 27 Sep 2007

8. * F.F. Hamdan, M.D. Rochdi, B. Breton, D. Fessart, D.E. Michaud, P.G. Charest, S.A. Laporte and M. Bouvier. "Unraveling g protein-coupled receptor endocytosis pathways using real-time monitoring of agonist-promoted interaction between beta-arrestins and AP-2". *J. Biol. Chem.* 282(40):29089-100 (2007).
9. * P.G. Charest and R.A. Firtel. "Big roles for small GTPases in the control of directed cell movement". *Biochem. J.* 401(2):377-90 (2007).
10. * S. Zhang[#], P.G. Charest[#], and R.A. Firtel. "Spatio-temporal Regulation of Ras Activity Provides Directional Sensing". *Curr. Biol.* 18(20):1587-93 (2008). [#] Equal authorship.

Recommended by Faculty of 1000, 23 Sep 2009

11. * V. Kölsch, P.G. Charest and R.A. Firtel. "The regulation of cell motility and chemotaxis by phospholipid signaling". *J. Cell Sci.* 121(Pt 5):551-9 (2008).
12. * P.G. Charest, Z. Shen, A. Lakoduk, A.T. Sasaki, S.P. Briggs and R.A. Firtel. "A Ras signaling complex controls the RasC-TORC2 pathway and directed cell migration". *Dev. Cell.* 18:737-49 (2010).

Cover article

Highlighted in Nature Structural and Molecular Biology, 17: 678 (2010)

Recommended by Faculty of 1000, 5 Aug 2010

Press release: "UC San Diego biologists unravel mechanisms of how immune cells move". UCSD Division of Biological Sciences News, May 17, 2010

13. * P.G. Charest and R.A. Firtel. " "TORCing" neutrophil chemotaxis". *Dev. Cell* 19(6):795-6 (2010).
14. * Hecht, M.L. Skoge, P.G. Charest, E. Ben-Jacob, R.A. Firtel, W.F. Loomis, H. Levine, and W.J. Rappel. "Activated membrane patches guide chemotactic cell motility". *PLoS Comput. Biol.* 7(6):e1002044 (2011).
15. * K. Takeda, D. Shao, M. Adler, P.G. Charest, W.F. Loomis, H. Levine, A. Groisman, W.J. Rappel, and R.A. Firtel. "Incoherent feedforward control governs adaptation of activated Ras in eukaryotic chemotaxis pathway". *Sci. Signal.* 5, ra2 (2012).
16. * V. Kölsch, Z. Shen, S. Lee, K. Plak, P. Lotfi, J. Chang, P.G. Charest, J.L. Romero, T.J.

Jeon, A. Kortholt, S.P. Briggs, and R.A. Firtel. "Daydreamer, a Ras effector and GSK-3 substrate, is important for directional sensing and cell motility". *Mol. Biol. Cell.* 24(2):100-14 (2013).

17. * K. Sumita, H. Yoshino, M. Sasaki, N. Majd, E.R. Kahoud, H. Takahashi, K. Takeuchi, T. Kuroda, S. Lee, P.G. Charest, K. Takeda, J.M. Asara, R.A. Firtel, D. Anastasiou, and A.T. Sasaki. "Degradation of activated K-Ras orthologue via K-Ras specific lysine residues is required for cytokinesis". *J. Biol. Chem.* 289:3950-9 (2014).
18. A. Khanna^{SC*}, P. Lotfi^{T*}, A.J. Chavan^P, N.M. Montañó^G, P. Bolourani^{SC}, G. Weeks^C, Z. Shen^{SC}, S.P. Briggs^C, H. Pots^{SC}, P.J.M Van Haastert^C, A. Kortholt^C, and P.G. Charest. "The small GTPases Ras and Rap1 bind to and control TORC2 activity". *Sci. Rep.* 6:25823 (2016). *equal contribution.

Recommended by Faculty of 1000, 2 Jun 2016

19. AFM T. Islam^P, B.M. Stepanski^U, and P.G. Charest. "Studying chemoattractant signal transduction dynamics in *Dictyostelium* by BRET". *Methods Mol. Biol.* 1407:63-77 (2016).
20. M. Scavello^G, A.R. Petlick^G, R. Ramesh^U, V.F. Thompson^S, P. Lotfi^S, and P.G. Charest. "Protein kinase A regulates the Ras, Rap1 and TORC2 pathways in response to the chemoattractant cAMP in *Dictyostelium*". *J. Cell Sci.*, 130:1545-1558 (2017).

Featured in the front section of the journal.

21. AFM T. Islam^S, H. Yue^{SC}, M. Scavello^G, P. Haldeman^U, W.J. Rappel^C, and P.G. Charest. "The cAMP-induced G protein subunits dissociation monitored in live *Dictyostelium* cells by BRET reveals two activation rates, a positive effect of caffeine and potential role of microtubules". *Cell. Signal.*, 48:25-37 (2018).
22. AFM T. Islam^S, M. Scavello^G, P. Lotfi^S, P. Haldeman^U, D. Daniel^G, and P.G. Charest. Caffeine inhibits PI3K and mTORC2 in *Dictyostelium* and differentially affects multiple other cAMP chemoattractant signaling effectors. *Mol. Cell. Biochem.*, 457:157-168 (2019).
23. S.F. Smith, S.E. Collins, and P.G. Charest. Ras, PI3K, and mTORC2: three's a crowd? *J. Cell Sci.*, 133(19):jcs234930 (2020).

Patents

1. * M. Bouvier and P. Charest. Double brilliance beta-arrestin: A biosensor for monitoring the activity of receptors and signaling molecules, and methods of using same. Publication number CA 2,607,015 (2005). Patent number US 7,932,080 (2011).
2. * M. Bouvier, P. Charest, C. LeGouill, A. Beaudrait. Arrestin Biosensor. Publication number US 2011/0275134 (2011) and CA 2,775,278 (2012).

Dissertations and theses guided

1. A.R. Petlick. Toward Determining the role of PKA in controlling TORC2 function and chemotaxis in *Dictyostelium discoideum*. MSc thesis (2014).
2. A.M. Hanson. TORC2 mediated-chemotaxis in mammary epithelial cells. MSc thesis (2016).
3. M. Scavello. Uncovering the role of Protein Kinase A in *Dictyostelium* chemotaxis toward cyclic adenosine monophosphate. PhD dissertation (2018).

4. S.E. Collins. Role of Ras in regulating mTORC2 activity and function in breast cancer cell migration. PhD dissertation (2020).

CONFERENCES/SCHOLARLY PRESENTATIONS (LIMITED TO PERIOD IN CURRENT RANK)

Invited talks (local)

CBC/CMM/MCB Joint Retreat, Biosphere 2, Sep 2011

Drug Discovery and Developmental Therapeutics Seminar Series, College of Pharmacy, University of Arizona, Feb 2013

Arizona Imaging and Microanalysis Society annual conference, Tucson, Arizona, Mar 2013

Biological Chemistry Program Journal Club, University of Arizona, Sep 2013

Department of Immunobiology, University of Arizona, Oct 2013

Arizona Research Institute for Biomedical Imaging (ARIBI) spring workshop, Tucson, AZ, Apr 2014

Department of Basic Medical Sciences, College of Medicine, University of Arizona, Phoenix, AZ, Nov 2015

Microbiology and Immunobiology “Microlunch” seminar series, University of Arizona, Mar 2017

Collaborative Cancer Grand Rounds, University of Arizona Cancer Center, Apr 2021

Invited talks (National and International)

Biotechnology and Biological Sciences Research Council Workshop, Vanderbilt U., Nashville, TN, Mar 2012

Annual International *Dictyostelium* Conference, Asheville, NC, Aug 2013

Gordon Research Conference on Phosphorylation and G Protein-Mediated Signaling Networks, Biddeford, ME, (Poster talk), Jun 2014

Gordon Research Conference on Directed Cell Migration, Galveston, TX, (Poster talk). Jan 2015

Pennsylvania Muscle Institute, School of Medicine, University of Pennsylvania, Sept 2015

NIH/NIAID, Twinbrook campus, Rockville, MD, Sept 2015

Department of Genetics, Cell Biology and Development, University of Minnesota, Minneapolis, MN, Sep 2017

Department of Microbiology & Molecular Genetics, Oklahoma State University, Stillwater, OK, Sep 2017

Department of Biological Sciences, Hunter College, City University of New York, New York, NY, Nov 2017

Department of Biology, Texas A&M University, College Station, TX, Mar 2018

Gordon Research Conference on Phosphorylation and G Protein-Mediated Signaling Networks, Biddeford, ME, (Poster talk), Jun 2018

Department of Biomedical Sciences, New York Institute of Technology, Old Westbury, NY, Dec 2018

Department of Biology, University of Massachusetts, Amherst, MA, Feb 2019

Department of Cancer Biology, University of Toledo, Toledo, Ohio, Feb 2019

Department of Integrative Biology and Pharmacology, University of Texas Health, Houston, TX, Feb 2019

Department of Biochemistry, Microbiology, and Immunology, Wayne State University, Detroit, MI, Mar 2019

Annual International *Dictyostelium* Conference, Ann Harbor, MI, Aug 2019

Poster presentations at International Meetings (presenter underlined)

A. Khanna^{SC*}, P. Lotfi^{T*}, N.M. Montaño^G, P. Bolourani^{SC}, G. Weeks^C, Z. Shen^{SC}, S.P. Briggs^C, H. Pots^{SC}, P.J.M Van Haastert^C, A. Kortholt^{SC}, and P.G. Charest. "The small GTPases Ras and Rap1 bind to and control TORC2 activity". Gordon Research Conference on Phosphorylation and G Protein-Mediated Signaling Networks, Biddeford, ME, Jun 2014 (**selected for short talk**).

M. Scavello^G, A.R.Petlick^G, V.F. Thompson^T, P. Lotfi^T, and P.G. Charest. "PKA spatiotemporally controls chemoattractant signaling pathways and is critical for gradient sensing in *Dictyostelium*". Gordon Research Conference on Directed Cell Migration, Galveston, TX, Jan 2015 (**selected for short talk**).

A. Khanna^{SC*}, P. Lotfi^{T*}, N.M. Montaño^G, P. Bolourani^{SC}, G. Weeks^C, Z. Shen^{SC}, S.P. Briggs^C, H. Pots^{SC}, P.J.M Van Haastert^C, A. Kortholt^{SC}, and P.G. Charest. "The small GTPases Ras and Rap1 bind to and control TORC2 activity". American Society for Cell Biology Annual Meeting, San Diego, CA, December 2015.

M. Scavello^G, A.R.Petlick^G, V.F. Thompson^T, P. Lotfi^T, and P.G. Charest. "PKA spatiotemporally controls chemoattractant signaling pathways and is critical for gradient sensing in *Dictyostelium*". American Society for Cell Biology Annual Meeting, San Diego, CA, December 2015.

AFM T. Islam^P, B.M. Stepanski^U, and P.G. Charest. "Studying chemoattractant signal transduction dynamics in *Dictyostelium* by BRET". American Society for Cell Biology Annual Meeting, San Diego, CA, December 2015 (**selected for short talk**).

A. Khanna^{SC*}, P. Lotfi^{T*}, A.J. Chavan^P, N.M. Montaño^G, P. Bolourani^{SC}, G. Weeks^C, Z. Shen^{SC}, S.P. Briggs^C, H. Pots^{SC}, P.J.M Van Haastert^C, A. Kortholt^{SC}, and P.G. Charest. "The small GTPases Ras and Rap1 bind to and control TORC2 activity". Annual International *Dictyostelium* Conference, Tucson, AZ, Aug 2016.

AFM T. Islam^P, P. Haldeman^U, B.M. Stepanski^U, and P.G. Charest. "Heterotrimeric G protein activation and regulation monitored by Bioluminescence Resonance Energy Transfer (BRET)". Annual International *Dictyostelium* Conference, Tucson, AZ, Aug 2016.

M. Scavello^G, A.R. Petlick^G, R. Ramesh^U, V.F. Thompson^T, P. Lotfi^T, and P.G. Charest. "The role of PKA in *Dictyostelium* chemotaxis". Gordon Research Conference on Directed Cell Migration, Galveston, TX, Jan 2017.

AFM T. Islam^S, H. Yue^{SC}, M. Scavello^G, P. Haldeman^U, W.J. Rappel^C, and P.G. Charest. "Quantitative analyses of chemoattractant-induced heterotrimeric G protein activation kinetics in *Dictyostelium* reveal important role for high affinity pre-coupled receptors". Gordon Research Conference on Phosphorylation and G Protein-Mediated Signaling Networks, Biddeford, ME, June 2018 (**selected for short talk**).

S. Collins^G, I. Brown^U, and P.G. Charest. "Mechanistic Target of Rapamycin Complex 2 (mTORC2) Regulation in Cancer Cell Migration". Gordon Research Conference on Directed Cell Migration, Galveston, TX, Jan 2019 (**selected for short talk**).

S.F. Smith^G, E. Weiss^U, and P.G. Charest. "Investigating the Ras-mediated activation of mTORC2". Annual International *Dictyostelium* Conference, Ann Harbor, MI, Aug 2019.

J. Takashima^U, AFM T. Islam^S, M. Schultz^U, and P.G. Charest. "Investigating the cAR1:Gα2βγ interaction in *Dictyostelium* by Bioluminescence Resonance Energy Transfer". Annual International *Dictyostelium* Conference, Ann Harbor, MI, Aug 2019.

J. Takashima^U, AFM T. Islam^S, and P.G. Charest. "APEX2-Mediated Proximity Labeling in *Dictyostelium discoideum*". 2020 Beckman Symposium (Virtual), Aug 2020.

MEDIA COVERAGE

Arizona Public Media-NPR story "UA Researcher Wins \$792K Grant for Cancer Study", May 2015.
<https://www.azpm.org/s/31016-ua-researcher-wins-792k-grant-for-cancer-study/>

AWARDED GRANTS

Governmental organizations

NIH-NIGMS, R01 GM131200-01A1 <i>The role and regulation of mTORC2 in cell migration.</i> Total award: \$1,519,084 Role: PI	2019-2024
NIH-NIGMS, R01 GM131200-03S1 Administrative supplement to Support Undergraduate Summer Research <i>The role and regulation of mTORC2 in cell migration.</i> Total Award: \$7,414 Role: PI	2021
NIH-NIGMS, R01 GM131200-02S2 Administrative Supplement for Equipment Purchase <i>The role and regulation of mTORC2 in cell migration.</i> Total Award: \$73,721 Role: PI	2020

- NIH-NIGMS, 1 R01 GM131200-02S1 2020
 Administrative supplement to Support Undergraduate Summer Research
The role and regulation of mTORC2 in cell migration.
 Total Award: \$7,343
 Role: PI
- UA Department of Molecular & Cellular Biology, Faculty Innovator Award Oct 2019
Proximity proteomics to discover G protein-independent signaling pathways.
 Total award: \$5,000
 Role: PI
- Improving Health TRIF Initiative Equipment Grant Jan 2019
Total Internal Reflection Fluorescence Illumination Module Upgrade for the Spinning Disk Confocal Microscope to Enable High-Resolution Surface Imaging in the Keck Center
 Total award: \$50,000
 Role: PI
- UA Technology Research Initiative Funds, TRIF Optics/Imaging grant. Jan 2016
An environmental control system for a spinning disk confocal microscope.
 Total award: \$37,000
 Role: PI

Training grants

- NIH 1 R25 GM121228 (PI: Margaret Briebl) 2018-2023
University of Arizona Postbaccalaureate Research Education Program
 Role: Mentor
- Arnold and Mabel Beckman Foundation, Beckman Scholars Program Award (PI: Ghosh) 1999-2021
 Role: Mentor
- NIH T32 GM008659 (PI: Capaldi; Co-PI: Weinert) 1997-2020
Graduate Training in Biochemistry and Molecular Biology
 Role: Mentor
- NIH T32 GM008804 (PI: Montfort) 2003-2019
Chemistry-Biology Interface Training Program
 Role: Mentor

Private Foundations

- American Cancer Society, Research Scholar Grant. 2015-2019
Signaling mechanisms underlying the directed motility of eukaryotic cells.
 Total award: \$792,000
 Role: PI (90% of the project effort; Wouter Jan-Rappel, collaborator, 10% effort)
- University of Arizona Foundation, Faculty Seed Grant. 2014-2015
Ras proteins activate TORC2 to promote cancer cell metastasis.
 Total award: \$10,000
 Role: PI (100% of the project effort)

TEACHING ACTIVITIES**Courses taught** (contact hours and enrollment indicated)

BIOC296B	Introduction to Experimental Biochemistry (1h/week; Fall 2013, 78 students; Fall 2014, 76 students; Fall 2015, 65 students; Fall 2016, 69 students; Fall 2018, 68 students)
BIOC568	Nucleic Acids, Signaling and Metabolism (4h/week; Spring 2013, 16 students; Spring 2014, 18 students; Spring 2015, 16 students; Spring 2016, 12 students; Spring 2017, 19 students; Spring 2018, 25 students; Spring 2019, 19 students)
MED819	Medical Foundations, 4 lectures (Fall 2012, 140 students; Fall 2013, 120 students; Fall 2014, 116 students; Fall 2015, 119 students; Fall 2016, 135 students; Fall 2018, 120 student)
MCB195C	Introduction to Research in Molecular and Cellular Biology (1h/week; Fall 2019, 16 students; Spring 2020, 14 students; Fall 2020, 19 students)
MCB305H	Cell and Developmental Biology Honors (1h/week; Spring 2020, 2 students)
MCB325	The Biology of Cancer (3h/week; Fall 2020, 170 students)
MCB325H	The Biology of Cancer Honors (1h/week; Fall 2020, 8 students)
MCB695E	Science, Society and Ethics (1h/week; Spring 2020, 15 students)

Student mentored (Following and current positions indicated; * indicates authorship on peer reviewed publications)*High school students*

Ethan Weiss	KEYS intern Summer 2016, 2017	Biochemistry and MCB major, U. Arizona
Jordan Pilch	KEYS intern Summer 2017	MCB major, U. Arizona
	Cienega High School mentoring program	Spring 2018
Zoe Benson	KEYS intern Summer 2018	EEB major, U. Arizona
Natalia Bojorquez	KEYS intern Summer 2020	
Grace Harrington	KEYS intern Summer 2020	
Nikhil Mathur	KEYS intern Summer 2020	
	S.T.A.R. Labs intern	Fall 2020
Douglas Swango	KEYS intern Summer 2020	
	BASIS Senior Research Project	Spring 2021
Prithvi Yuvaraj	KEYS intern Summer 2021	
Saathvika Vegasina	KEYS intern Summer 2021	
Makaela Valencia	KEYS intern Summer 2021	
Saathvik Chandupatia	KEYS intern Summer 2021	

Undergraduate students

Branden Stepanski*	2012-2014 (BSc)	MS University of Utah, Forensic scientist
Joseph Cada	2013-2015 (BSc)	Law School, Arizona State University, Judicial Law Clerk at United States District Court for the District of Arizona
Matthew O'Mara	2014-2017 (BSc)	Clinical Research Coordinator at Bay Area Retina Associates
Pearce Haldeman*	2015-2017 (BSc)	Research specialist, Caltech; UCSD School of Medicine, class of 2023
Ramya Ramesh*	2014-2018 (BSc)	UA Medical School, class of 2022
McKenna Schultz*	2017-2019 (BSc)	MS, Science of Health Care Delivery, ASU
Isabella Brown	2018-2020 (BSc)	Graduate School, UT Southwestern
Ethan Weiss	2017-2021 (BSc)	

Jamison Takashima	2018-2021 (BSc)	Graduate School, California Institute of Technology
Avani Kumar	2018-present	
Nitant Soni	2019-present	
Stephen Dilley	2019-present	
Isabella Feldmann	2019-present	
Shon Alimukhamedov	2020-present	
Isabelle Mundo	2020-present	
Meccah Jarrah	2021-present	

Graduate students

Alexandra Petlick*	2012-2014 (Chemistry MSc)	Lubricants Technology Researcher, ExxonMobil
Nieves Montano*	2012-2014 (Biochemistry MSc)	Teacher, Paulo Freire Freedom School
Amanda Hanson	2014-2016 (Biochemistry MSc)	Instructor, Brightmont Academy
Dustin Daniel*	2014-2016 (Applied Biosci. MSc)	MBA Arizona State U. Associate Software Engineer at Daniel Development Group
Maggie Scavello*	2014-2018 (2015-2017 BCP T32 fellow, Biochemistry PhD)	Scientist, Janssen Inc.
Shannon Collins*	2016-2020 (2016-2018 BCP T32 fellow, Biochemistry PhD)	Finishing MD part of MD/PhD degree, class of 2022
Stephen Smith*	2017-present (2017-2019 BCP T32 fellow, Biochemistry)	
Agata Orlinski	2017-present (Biochemistry)	
Alyssa Werner	2018-present (2019-2021 BCP T32 fellow, Biochemistry)	
Genesis Cahigas	2018-present (Biochemistry)	
Mollie Wiegand	2020-present (2020-2022 BCB T32 fellow, Molecular and Cellular Biology)	
Helena Woroniecka	2021-present (2021-2022 BCP T32 fellow, Biochemistry)	

Postdoctoral researchers

AFM Tariqul Islam*	2013-2016	Research Scientist in Charest lab
Anita Chavan*	2015-2017	Post-doctoral researcher, Worcester Polytechnic Institute

Contributions to Instructional Innovations and Collaborations

Teaching workshops attended

Fall 2013	AAU-STEM Education Project: Teaching Talks (3) AAU-STEM Faculty Learning Community, participant
Spring 2014	AAU-STEM Education Project: Teaching Talks (4) AAU-STEM Faculty Learning Community, participant
Summer 2020	U. Arizona See and Do Online Workshops (D2L, Panopto, and Zoom teaching tools)

Development of course materials

2013-2014	Development of new curriculum for BIOC568, with inclusion of active learning exercises
2014	Developed in-class active learning and assessment exercises for MED819
2014	Developed new course objectives and material for BIOC296B
2014-present	Continued development of new course material for BIOC568
2018	Developed new course material and notes for new lecture in MED819
2018	Developed new format, material, in-class active learning and assessment exercises for BIOC296B

2019-2020	Development of material, in-class active learning and assessment exercises for MCB195C
2020	Development of online platform for remote learning in MCB325/325H