BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
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NAME: Kyle R. Barrie

eRA COMMONS USER NAME: KRBARRIE

POSITION TITLE: Graduate (PhD) Student

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
The College of New Jersey, Ewing, NJ	BS	05/2018	Physics, Chemistry
University of Pennsylvania, Philadelphia, PA	PhD	05/2025	Biochemistry and Molecular Biophysics

A. Personal Statement

I aim to continue my personal drive to elucidate a structural-functional understanding of the cytoskeleton throughout my scientific career and hope to foster the growth of new scientists along the way. To this end, I have engaged in a wide variety of research and mentorship activities during my relatively short time in an academic environment. My undergraduate research was diverse; I worked in a Physics lab studying neuronal networks, a Chemistry lab studying Intrinsically Disordered Proteins, and an Oncology lab studying novel methods for cancer treatment. Each of these experiences helped to sharpen my scientific interest and revealed a passion for structural biology that would guide me in my search for graduate programs. After spending two years as an analytical chemist for a pharmaceutical company to broaden my professional skills and provide financial stability, I enrolled as a graduate student in Biochemistry and Molecular Biophysics at the University of Pennsylvania to continue pursuing my passion. I immediately rotated in the lab of Dr. Roberto Dominguez, where I gained significant interest in the actin cytoskeleton and the unique combination of structural and biochemical approaches of the lab. Following my subsequent rotations, I joined the Dominguez Lab for my thesis work, focusing on mechanisms of actin filament regulation at the leading edge of migrating cells and have already begun authoring a manuscript. As a first-generation student lacking familial collegiate experience, I recognize the inherent difficulty of pursuing a career in science and have made it my personal mission to guide others along the way as best I can. Throughout my tenure as an undergraduate, I served as a senior tutor of mathematics and science and helped > 50 students understand difficult concepts across a wide array of courses. In addition to my normal hours at the tutoring center, I encouraged each of my tutees to reach out to me whenever they were challenged with difficult problems or needed advice on careers to pursue. I am happy to say that I significantly influenced many of these students to pursue STEM majors, and some of them have even gone on to pursue graduate degrees in their respective fields. Additionally, as the senior student researcher in each of my undergraduate labs, I gained hands-on experience with mentoring incoming peers on all aspects of independent research so that they experienced a smooth transition and were more inclined to continue pursuing research opportunities. This general spirit of unbiased assistance continues to permeate, as I trained many new chemists during my time in the pharmaceutical industry and help my peers and collogues in my thesis lab on short notice. I will ensure that this trend continues throughout my academic career, as I already have plans to mentor incoming undergraduate students and volunteer to teach science at local public schools across the Philadelphia area. Additional training at NCCAT will help me gain skills and knowledge necessary to continue pursuing each of these avenues; I will learn high-level cryo-EM analysis that will assist in pursuing my research passions, and this cryo-EM knowledge will be used to train other peers that are less familiar with the technique.

B. Positions and Honors

Positions and Employment

2014 – 2018: Science and Mathematics Tutor at The College of New Jersey
2015 – 2018: Undergraduate Researcher at The College of New Jersey
2017: Summer Research fellow at Johns Hopkins University
2017 – 2018: Housing Assistant at The College of New Jersey
2018 – 2020: Analytical Development Chemist at Hovione LLC

Professional Memberships

2017-: Member, Phi Kappa Phi National Honor Society
2017-: Member, Biophysical Society
2017-: Member, Sigma Pi Sigma Physics Honor Society
2017-: Member, Gamma Sigma Epsilon Chemistry Honor Society

Honors

2018: Fink-Moses-Preggar Award for highest graduating Physics GPA
2018: Dr. Jerry Goodkin Award for outstanding achievement in physical chemistry

C. Contributions to Science

Undergraduate Research: In the lab of Dr. Tuan Nguyen, I constructed an *in-vitro* model to investigate the network-like properties of neuronal firing following mild brain injury. We isolated cortical rat neurons on flexible membranes and monitored their capacity for bursts of activity before and after membrane stretching. This work led to a summer research experience that culminated with a poster presentation to faculty and peers. Shortly after, I joined the lab of Dr. Michelle Bunagan and worked to elucidate changes in the secondary structure of Late Embryogenesis Abundant (LEA) proteins under different conditions. We developed a system for trapping consensus-sequence LEA peptides within reverse micelles and used circular dichroism spectropolarimetry to monitor their secondary structure with various concentrations of water. This work revealed a preferred shift toward helical conformations under conditions of minimal hydration, and we presented our findings at ACS and Biophysical Society annual meetings. In addition to work at my undergraduate institution, I served as a summer research fellow in the Institute for NanoBiotechnology (INBT) at Johns Hopkins University. My work at INBT was carried out in the lab of Dr. Robert Ivkov and focused on the characterization of magnetic nanoparticles used for targeted hyperthermia to treat digestive cancers.

Graduate Research: In the lab of Dr. Roberto Dominguez, I conduct research aimed at revealing the structural-functional mechanisms by which cytoskeletal effectors regulate actin filament (F-actin) dynamics. During my rotation with Dr. Dominguez, I purified different isoforms of tropomyosin using a novel human expression system and conducted biophysical experiments to assess the affinity of each isoform with F-actin in a concentration-dependent manner, leading to a co-authored publication. My thesis project centers around CARMIL, a membrane-localized regulator of F-actin organization. I have already developed a method to purify CARMIL constructs from human cells and determined the first cryo-EM structure of a CARMIL dimer. This structure reveals many new details about the mechanism of CARMIL dimerization and membrane localization, which will be reported to the scientific community in a manuscript that is currently being prepared.

Peer-reviewed publications:

1. Carman PJ, **Barrie KR**, Dominguez R. (2021). Novel human cell expression method reveals the role and prevalence of posttranslational modification in nonmuscle tropomyosins. *J. Biol Chem.*
2. **Barrie KR**, Carman PJ, Boczkowska M, Dominguez R. (2022). Mechanism of CARMIL dimerization and membrane localization. *In preparation*.

D. Additional Information: Research Support and/or Scholastic Performance

YEAR	COURSE TITLE	GRADE
	THE COLLEGE OF NEW JERSEY – CUMULATIVE GPA: 3.89	
2014	Organic Chemistry I	B+
2014	Calculus B	A-

YEAR	COURSE TITLE	GRADE
2014	First Seminar: World Views	A
2014	General Physics I	A
2015	Organic Chemistry II	B+
2015	Topics: Asia/Eurasia/Middle East	A
2015	General Physics II	A
2015	Basic Spanish Sequence II	A-
2015	Themes in Biology	A-
2015	Analytical Chemistry	A
2015	Mathematical Physics	A
2015	Modern Physics	A
2016	Gendering the Harlem Renaissance	A
2016	Quantum Chemistry	A
2016	Biochemistry	B+
2016	Biomedical Physics	A
2016	Independent Research I	A
2016	Forensic Chemistry	A
2016	Chemical Thermodynamics	A
2016	Independent Research II	A
2016	Electromagnetic Theory I	A
2017	Independent Research II	A
2017	Classical Mechanics	A
2017	Condensed Matter	A-
2017	Advanced Experimental Physics	A-
2017	Inorganic Structure and Bonding	A
2017	Independent Research II	A
2017	Computer Science I for Science/Engineering	A
2017	Creative Design	A
2018	Physics of Clouds and Climate	A
2018	Differential Equations	A
2018	Independent Research II	A
2018	Biophysical Methods	A
	UNIVERSITY OF PENNSYLVANIA – CUMULATIVE GPA: 4.0	
2020	Cell Biology	A
2020	Macromolecular Biophysics	A
2020	Macromolecular Crystallography	A
2020	Lab Rotation	A+
2021	Structural and Mechanistic Biochemistry	A
2021	Data Analysis and Scientific Inference	A
2021	Cryo-EM	A
2021	Lab Rotation	A
2021	Human Physiology	A
2021	Cancer Biology	A
2021	Pre-Dissertation Lab	A

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
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NAME: Dominguez, Roberto

eRA COMMONS USER NAME (credential, e.g., agency login): Dominguez

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date	FIELD OF STUDY
Faculty of Physics, Odessa Mechnikov National University, former USSR	B.S., M.S.	09/1982 – 06/1987	Theoretical Physics and Mathematics
Pasteur Institute & University of Paris-Sud, France	Ph.D.	07/1993 – 03/1996	Protein Crystallography and Biochemistry
Rosenstiel Center, Brandeis University, MA	PostDoctoral Fellow	03/1996 – 02/1998	Structural Biology of Molecular Motors

A. Personal Statement

The Dominguez lab has had a long-standing interest in studying proteins that control actin cytoskeleton and membrane dynamics, and the signaling pathways that regulate their activities. Cytoskeletal proteins control a myriad of functions, including cell locomotion, organelle transport, and muscle contraction, and their dysfunction leads to human diseases, such as cancer, musculoskeletal and neurodegenerative disorders. A major focus of the lab, and this grant in particular, has always been the study of proteins that control muscle contraction, including myosin motors, actin and regulatory proteins such as a-actinin and utrophin.

My interest in the cytoskeleton began during my postdoctoral years with Carolyn Cohen at Brandeis, where I determined the first structure of myosin (smooth muscle myosin II) at the beginning of the power stroke. While my interest on myosin motors continues to this day, the main focus of my lab since its start in 1998 at the BBRI (Boston) has been the actin cytoskeleton. In 2006, the lab moved to the University of Pennsylvania (Department of Physiology). Here, I am also a member of the Pennsylvania Muscle Institute (PMI), a world-class institution dedicated to the study of the cytoskeleton. At UPenn we have collaborations with several labs, including Michael Ostap, Erika Holzbaur, Tatyana Svitkina, Hansell Stedman, and Robert Heuckeroth (CHOP).

Our work aims to correlate structure and function by using a broad range of complementary approaches. Structural biology, including x-ray crystallography and cryo-EM, are major tools in the lab. These methods yield atomic-level information about cytoskeletal proteins and their complexes. We use a host of other approaches, including cell and molecular biology, bioinformatics, biophysical and biochemical methods (ITC, MALS, FRET, TIRF, SAXS) to correlate the structural findings with the physiological activities of cytoskeletal proteins.

A key component of our mission is to train the next generation of scientists and educators. The Dominguez lab has trained over 40 postdocs and students. The lab was initially located at the BBRI (Boston), a non-teaching institution, where trainees were primarily postdoctoral fellows. After the move to UPenn the lab became heavily invested in graduate and undergraduate training. Among previous lab trainees, 9 are now professors (or equivalent) in five different countries USA (Silvia Jansen and David Kast), Belgium (Frederic Kerff and Mohammed Terrak), France (Francois Ferron), South Korea (Sung Haeng Lee, Suk Namgoong and InGyun Lee), and UAE (Saif Alqassim), and several are pursuing successful careers in the pharmaceutical industry (Ludovic Otterbein, David Chereau, Adam Zwolak, Bengi Turegun and Austin Zimmet). Current lab trainees include 7 students: Peter Carman, Rachel Ceron, Fred Fregoso, Elana Baltrusaitis, Kyle Barrie, Nicholas Palmer, and Andy Nguyen.

Ongoing and recently completed projects that I would like to highlight include:

Ongoing:

R01 GM073791
Dominguez R (PI)
03/01/2019 – 02/28/2023
Structural Basis of Actin Cytoskeleton Dynamics

RM1 GM136511
Ostap EM, Holzbaur E, Lakadamyali M, Dominguez R (MPI)
05/01/2020 – 04/30/2025
Integrative Mechanisms of Organelle Dynamics from the Atomic-to-Cellular Level

R01 DK128282
Heuckeroth RO (PI), Dominguez, R (Co-Investigator)
09/28/2021 – 08/31/2026
Biochemical and cellular mechanisms linking actin mutations to visceral myopathy

No-cost extension:

R01 MH087950
Dominguez R (PI)
06/01/2016 – 05/31/2022, **NCE**
BAR Proteins Linking Membrane and Cytoskeleton Dynamics

Four recent citations:

1. Rebowski G, Boczkowska M, Drazic A, Ree R, Goris M, Arnesen T, **Dominguez R**. Mechanism of actin N-terminal acetylation. ***Sci Adv*** (2020) **6**(15), DOI: 10.1126/sciadv.aay8793. PMC7141826
2. Zimmet A, Van Eeuwen T, Boczkowska M, Rebowski G, Murakami K, **Dominguez R**. Cryo-EM Structure of NPF-Bound Human Arp2/3 Complex and Activation Mechanism. ***Sci Adv*** (2020) **6**(23), DOI: 10.1126/sciadv.aaz7651. PMC7274804
3. Baker RW, Reimer JM, Carman PJ, Turegun B, Arakawa T, **Dominguez R**, Leschziner AE. Structural insights into assembly and function of the RSC chromatin remodeling complex. ***Nature Struct Mol Biol*** (2021) **28**, DOI: 10.1038/s41594-020-00528-8. PMC7855068
4. Fregoso FE, van Eeuwen T, Simanov G, Rebowski G, Boczkowska M, Zimmet A, Gautreau AM, **Dominguez R**. Molecular mechanism of Arp2/3 complex inhibition by Arpin. ***Nat Commun*** (2022) DOI: 10.1038/s41467-022-28112-2.

B. Positions, Scientific Appointments, and Honors

Scientific Appointments

2010-present	Professor of Physiology, U. of Pennsylvania, Perelman School of Medicine, Philadelphia, PA
2006-2010	Associate Professor, U. of Pennsylvania, Perelman School of Medicine, Philadelphia, PA
2001-2006	Principal Scientist (Associate Prof), Boston Biomedical Research Institute, Watertown, MA
1998-2001	Scientist (Assistant Prof), Boston Biomedical Research Institute, Watertown, MA
1996-1998	Postdoctoral Fellow, Rosenstiel Center, Brandeis U, MA (mentor: Dr. C Cohen)
1993-1996	PhD Student, Pasteur Institute & Paris-Sud University, Paris, France (mentor: Dr. PM Alzari)
1992-1993	Pre-doctoral Trainee, EMBL, Heidelberg, Germany (mentor: Dr. D Suck)
1989-1991	Pre-doctoral Trainee, University of Liége, Belgium (mento: Dr. O Dideberg)
1987-1989	Scientist, Center for Genetic Engineering and Biotechnology, Havana, Cuba

Positions and Memberships

2021-2022	Member POWER Cluster Hire Committee, Perelman School of Medicine
2021-2022	Chair Physiology Faculty Search Committee
2021-present	Chair Admissions Committee, Biochemistry & Molecular Biophysics Graduate Group
2020	MSFC, RM1 Study Section, ad-hoc reviewer
2019-present	Member, Scientific Advisory Board of TroBio Therapeutics Ltd (Australia)
2018-present	Member, Faculty Mentoring Committee, Dr. Shae Padrick (Drexel U. College of Medicine)
2017-present	Member, Biomedical Research Core Facilities Committee, Perelman School of Medicine
2014-present	Member, Bridge Funding Advisory Committee, Perelman School of Medicine

2016 NIGMS Council Meeting, ad-hoc reviewer
2015-present Member, Editorial Board of the Journal of Muscle Research and Cell Motility
2009-present Associate Editor, Cytoskeleton
2008-2014 Member, Editorial Board of Biophysical Journal
2006-2010 Member, NIH Study Section, MSFC
2006- Member, American Society for Cell Biology
1998- Member, Biophysical Society

Honors

2019 Appointed William Maul Measey Presidential Professor of Physiology
2010 Wenner-Gren Foundation Distinguished Lecturer (FEBS/EMBO meeting, Sweden)
2002-2005 Established Investigator of the American Heart Association
1999-2001 American Heart Association, Grant-in-Aid Junior Investigator
1998-2001 Basil O'Connor Scholar of the March of Dimes
1992-1992 Fellow of the German Academic Exchange Service (DAAD)
1989-1991 Fellow of the Societé Française de Belgique

C. Contributions to Science

1. *Myosin structure-function*: As a postdoctoral fellow in Dr. Carolyn Cohen's lab at Brandeis University I determined structures of smooth muscle myosin with bound ADP•Pi and ATP analogs. These structures provided the first direct visualization of the pre-power stroke state, and conclusively demonstrated the swinging lever-arm hypothesis that is now featured in textbooks. As an independent investigator at BBRI, my lab continued the work on myosin motors, including revealing the unusual structural properties of the long lever arm of myosin V. More recently, in collaboration with the Ostap lab at Penn, we have determined structures of myosin-I. These highly cited studies have had a deep impact in the field. Numerous groups have used our structures to design myosin mutations, position fluorescent probes, analyze EM maps, and test dynamic models of the myosin ATPase cycle.

a. **Dominguez R**, Freyzon Y, Trybus KM, Cohen C. Crystal structure of a vertebrate smooth muscle myosin motor domain and its complex with the essential light chain: visualization of the pre-power stroke state. ***Cell*** (1998) **94**:559-571.

b. Terrak M, Rebowski G, Lu RC, Grabarek Z, **Dominguez R**. Structure of the light chain-binding domain of myosin V. ***PNAS*** (2005) **102**:12718-12723. PMC1200277

c. Shuman H, Greenberg MJ, Zwolak A, Lin T, Sindelar CV, **Dominguez R**, Ostap EM. A vertebrate myosin-I structure reveals unique insights into myosin mechanochemical tuning. ***PNAS*** (2014) **111**:2116-2121. PMC3926069

d. Mentes A, Huehn A, Liu X, Zwolak A, **Dominguez R**, Shuman H, Ostap EM, Sindelar CV. High-resolution cryo-EM structures of actin-bound myosin states reveal the mechanism of myosin force sensing. ***PNAS*** (2018) **115**:1292-1297. PMC5819444

2. *Structural biology of actin and actin-binding proteins*: As an independent investigator at BBRI, the main focus of my lab became the actin cytoskeleton. At the time, the structure of actin had only been determined in complexes with three actin-binding proteins (DNase I, gelsolin and profilin). These proteins inhibit nucleotide hydrolysis, which had impeded visualization of the ADP state in actin. Because actin is the most abundant protein in mammalian cells, and a crucial player in myriad of cellular functions, this was a considerable limitation. We solved the problem by covalently modifying actin at Cys-374 with the fluorescent dye TMR, allowing for the first crystallization of monomeric actin in both the ADP and ATP states. These structures showed for the first time the changes that take place in the actin monomer upon nucleotide hydrolysis and γ-phosphate release. Numerous studies in the field have found inspiration in this original work that has been widely cited. Through the years, our lab has been at the forefront of actin structural biology, determining several ground-braking structures, including those of ternary complexes of actin with gelsolin and Tropomodulin and with profilin and actin's N-terminal acetyl transferase NAA80. We have also studied countless actin-binding proteins (Ena/VASP, CARMIL, etc.), proteins involved in pathogen infection that highjack the actin cytoskeleton (toxofilin, Sca2, VopL), and dynein-dynactin activating adaptors (BICD2, HOOK, CRACR2a, TRAK). Our work is characterized by its attention to protein function and its multidisciplinary nature, spanning from cell to structural biology and making extensive use

of biophysical approaches.

- **a.** Otterbein LR, Graceffa P, **Dominguez R**. The crystal structure of uncomplexed actin in the ADP state. ***Science*** (2001) **293**:616-618
- **b.** Zwolak A, Yang C, Feeser EA, Ostap EM, Svitkina T, **Dominguez R**. CARMIL leading edge localization depends on a non-canonical PH domain and dimerization. ***Nat Commun*** (2013) **4**:2523. DOI:10.1038/ncomms3523.PMC3796438
- **c.** Lee IG, Olenick MA, Boczkowska M, Franzini-Armstrong C, Holzbaur EL, **Dominguez R**. A Conserved Interaction of the Dynein Light Intermediate Chain with Dynein-Dynactin Effectors Necessary for Processivity. ***Nat Commun*** (2018) **9**:986. PMC5841405
- **d.** Rebowski G, Boczkowska M, Drazic A, Ree R, Goris M, Arnesen T, **Dominguez R**. Mechanism of actin N-terminal acetylation. ***Sci Adv*** (2020) **6**(15), DOI: 10.1126/sciadv.aay8793. PMC7141826

3. *Study of the muscle cytoskeleton*. In addition to our myosin work (see above), our laboratory has had a long-standing interest in understanding the mechanisms that regulate muscle contraction. One example is the regulation of smooth muscle contraction by phosphorylation/dephosphorylation of the myosin regulatory light chain (RLC). Dephosphorylation, which results in muscle relaxation, is catalyzed by the myosin phosphatase, composed of three subunits: the catalytic subunit PP1, the regulatory subunit MYPT1, and a small subunit of unknown function (M20). Contrary to protein kinases that tend to be specialized, PP1 is ubiquitous, and its activity is regulated through a combinatorial mechanism whereby PP1 forms complexes with a myriad of regulatory subunits (>200) that control its specificity and activity in time and space. Our structure of PP1-MYPT1 was the first structure ever determined of a PP1-regulatory subunit complex. The protein phosphatase field has relied on this structure for inspiration to understand the role of regulatory subunits in PP1 function. Several pharmaceutical companies also use this structure to design PP1 inhibitors to treat diseases such as cancer. We have also studied other muscle regulatory components, including tropomodulin, tropomyosin, leiomodin, α-actinin and utrophin.

- **a.** Terrak M, Kerff F, Langsetmo K, Tao T, **Dominguez R**. Structural Basis of Protein Phosphatase 1 Regulation. ***Nature*** (2004) **429**:780-784.
- **b.** Rao JN, Rivera-Santiago R, Li XE, Lehman W, **Dominguez R**. Structural analysis of smooth muscle tropomyosin a and b isoforms. ***J Biol Chem*** (2012) **287**:3165-3174. PMC3270971
- **c.** Rao JN, Madasu Y, **Dominguez R**. Mechanism of actin filament pointed-end capping by tropomodulin. ***Science*** (2014) **345**:463-467. PMC4367809
- **d.** Kumari R, Jiu Y, Carman PJ, Tojkander S, Kogan K, Varjosalo M, Gunning P, **Dominguez R**, Lappalainen P. Tropomodulins control the balance between protrusive and contractile structures by stabilizing actin-tropomyosin filaments. ***Curr Biol*** (2020) **30**:767-778. PMC7065974

4. *Actin filament nucleation*. For the last 15 years, our laboratory has been at the forefront of the study of actin nucleators, with a specific focus on molecular mechanisms. Processes such as cell motility, intracellular trafficking, and the movement of several pathogens require rapid bursts of actin polymerization/depolymerization. Because the formation of new filaments is kinetically unfavorable, cells use actin filament nucleators to control the *de novo* formation of actin filaments in time and space. Our contributions in this area include the discovery of Leiomodin, a muscle cell-specific nucleator, characterization of the molecular mechanism of Arp2/3 complex activation by members of the WASP family of NPFs, and dissection of the structure and function of the most common actin-binding domain in nucleation, the WH2 domain. Recently, we have also determined crucial structures of Arp2/3 complex with N-WASP family nucleation-promoting factors bound.

- **a.** Chereau D, Kerff F, Graceffa P, Grabarek Z, Langsetmo K, **Dominguez R**. Actin-bound structures of Wiskott-Aldrich syndrome protein (WASP)-homology domain 2 and the implications for filament assembly. ***PNAS*** (2005) **102**:16644-16649
- **b.** Chereau D, Boczkowska M, Skwarek-Maruszewska, A, Fujiwara I, Rebowski G, Hayes DB, Lappalainen P, Pollard TD, **Dominguez R**. Leiomodin is an actin filament nucleator in muscle cells. ***Science*** (2008) **320**:239-243
- **c.** Boczkowska M, Rebowski G, Kast DJ, **Dominguez R**. Structural analysis of the transitional state of Arp2/3 complex activation by two actin-bound WCAs. ***Nature Commun*** (2014) **5**:3308. doi: 10.1038/ncomms4308. PMC4364448

d. Zimmet A, Van Eeuwen T, Boczkowska M, Rebowski G, Murakami K, **Dominguez R**. Cryo-EM Structure of NPF-Bound Human Arp2/3 Complex and Activation Mechanism. ***Science Advances*** (2020) **6**(23), DOI: 10.1126/sciadv.aaz7651. PMC7274804

5. *BAR domain proteins*. The study of BAR domain proteins that coordinate actin cytoskeleton and membrane dynamics under the control of signaling cascades is one area in which our lab has had a considerable impact during the last 10 years, and our focus on this area is expanding. We have studied the structures of several BAR domain proteins, including Missing-in-Metastasis (MIM), PinkBAR, IRSp53, and PICK1 as well as the mechanism by which they are regulated *in vitro* and in cells.

a. Pykäläinen A, Boczkowska M, Zhao H, Saarikangas J, Rebowski G, Jansen M, Hakala J, Koskela E, Peränen J, Vihinen H, Jokitalo E, Salminen M, Ikonen E, **Dominguez R***, Lappalainen P*. Pinkbar is an epithelial-specific BAR domain protein that generates planar membrane structures. ***Nature Struct Mol Biol*** (2011) **18**:902-907. PMC3910087

b. Kast DJ, Yang C, Disanza A, Boczkowska M, Madasu Y, Scita G, Svitkina T and **Dominguez R**. Mechanism of IRSp53 inhibition and combinatorial activation by Cdc42 and downstream effectors. ***Nature Struct Mol Biol*** (2014) **21**:413-422. PMC4091835

c. Kast DJ, **Dominguez R**. Mechanism of IRSp53 inhibition by 14-3-3. ***Nature Commun*** (2019) **10**:483. PMC6351565

d. Kast DJ, **Dominguez R**. IRSp53 Coordinates AMPK and 14-3-3 Signaling to Regulate Filopodia Dynamics and Directed Cell Migration. ***Mol Biol Cell*** (2019) **30**:1285–1297. PMC6724608

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/myncbi/roberto.dominguez.1/bibliography/public/

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Fred E. Fregoso

eRA COMMONS USER NAME (credential, e.g., agency login): FFREGOSO

POSITION TITLE: Graduate Student

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
California State University Northridge, Northridge, CA	BS	05/2016	Biochemistry
California State University Northridge, Northridge, CA	MS	05/2019	Biochemistry
University of Pennsylvania, Philadelphia, PA	PhD	05/2025	Biochemistry, Biophysics

A. Personal Statement

My research project concentrates on regulatory mechanisms of cytoskeleton remodeling and how defects in these systems contribute to human disease. I hope to continue this line of scientific investigation in parallel with training and mentoring the future generation of scientists. In pursuit of this goal, I have taken a fully active role in both research projects and teaching opportunities. I became involved in research during the last year of my undergraduate studies, where I joined the laboratory of Dr. Paula Fischhaber to study DNA repair mechanisms using a molecular biology and fluorescence microscopy techniques. This work led to multiple presentations at conferences, some resulting in awards, and a publication that investigates the requirement of DNA repair proteins in a pathway often subverted in cancers. As a graduate student during this time, I mentored undergraduates in my research lab, and as a course instructor in teaching labs. Taking advanced biochemistry courses assisted in strengthening my scientific knowledge base that effectively allowed me to better teach difficult concepts to students. Spending two years in this environment revealed my latent passion towards teaching and mentorship. As a Ph.D. student, I joined the laboratory of Dr. Roberto Dominguez where I study proteins that regulate the actin cytoskeleton. I have so far co-authored a review on the regulation of branched actin networks and have a 1st author publication under review describing a novel inhibitory mechanism of the Arp2/3 complex. Despite a career as a scientist not existing in my family's history, and through many iterations of trial-and-errors, I continue to trailblaze for future generations. Mentorship from my PIs has informed me on the career of an independent academic research investigator, where I will use this role to inspire future trainees and influence the field of cytoskeleton research. The F31 award will propel this work to produce high-impact publications and allow for professional development opportunities at scientific meetings, with the University of Pennsylvania existing as the prime location for me to hone the skills necessary to achieve my goal.

Peer-Reviewed Articles:

1. Odango RJ, Camberos, JP, **Fregoso FE**, and Fischhaber PL (2021). SAW1 is Increasingly Required to Recruit Rad10 as SSA Flap-Length Increases from 20-50 Bases in Single-Strand Annealing in S. cerevisiae. *Biochem. Biophys. Rep.*
2. Gautreau AM, **Fregoso FE**, Simanov G, and Dominguez R (2021). Nucleation, Stabilization, and Disassembly of Branched Actin Networks. *Trends Cell Biol*.
3. **Fregoso FE**, Eeuwen TV, Simanov G, Rebowski G, Boczkowska G, Zimmet A, Gautreau AM and Dominguez R (2022). Mechanism of Arp2/3 complex inhibition by Arpin. *Nat. Commun.*

B. Positions, Scientific Appointments and Honors

Positions and Employment

2015-2016 Undergraduate Researcher, Paula Fischaber Lab, CSUN, Northridge, CA
2016-2019 MS Graduate Researcher, Paula Fischaber Lab, CSUN, Northridge, CA
2017-2019 Chemistry Teaching Assistant
2018-2019 MS Graduate Student Mentor, CSUN BUILD PODER, Northridge, CA
2019- Ph.D. Student, Roberto Dominguez Lab, Univ. Pennsylvania, Philadelphia, PA
2020-2021 Executive Board, Univ. Pennsylvania PennINSPIRE, Philadelphia, PA
2020- Executive Board, Univ. Pennsylvania SACNAS, Philadelphia, PA
2021- Department of Physiology DEI Committee, Univ. Pennsylvania, Philadelphia, PA
2021- Volunteer, Univ. Pennsylvania Project BioEYES, Philadelphia, PA
2021- Mentor, Univ. Pennsylvania FERBS Program, Philadelphia, PA

Professional Memberships

2017- Member, American Society of Biochem. & Mol. Biology
2020- Member, Society for Advancement of Chicanos/Hispanics and Native Americans in Science

Honors

2017 CSUPERB Student Travel Grant
2018 College of Science and Mathematics Graduate Fellowship for Outstanding Research Promise
2019 CSUPERB Don Eden Graduate Student Research Competition Winner
2019 Nathan O. Freedman Memorial Award for Outstanding Graduate Student
2019 Graduating with Distinction (Honors)
2022-2023 NIH T32 Structural Biology and Molecular Biophysics training grant, Univ. Pennsylvania

C. Contributions to Science

1. **Undergraduate/Graduate (MS) Research:** Failure to repair covalent modifications to DNA (DNA damage) by the biologic repair pathways results in genetic mutations and cancer, particularly skin cancer. In Dr. Paula Fischhaber's Lab, I studied the recruitment of an DNA endonuclease to a repair intermediate as a function of both the presence of an uncharacterized protein Saw1 and structural state of the repair intermediate. We used confocal fluorescence microscopy to monitor colocalization of proteins to DNA damage sites, and quantitative PCR measure repair product formation which provides insights into efficiency of repair. By studying the requirements of faithful repair, we can gain a clearer picture on the complex crosstalk that exists amongst the expansive family of DNA repair pathways which can inform on therapeutics. This is work is now published and allowed for numerous poster and oral presentations are conferences and symposiums.

Poster Presentations

   a. Camberos, JP, **Fregoso FE**, Odango RJ, Iannolo BR, and Fischhaber PL (2016). Elucidation of Saw1 and Rad1-10 Recruitment to the Induced Double Strand Break Site as a function of Non-homologous Sequence Length. CSUPERB annual meeting, Anaheim, CA
   b. **Fregoso FE** and Fischhaber PL (2017). Necessity of Saw1 for Recruitment of Rad1-Rad10 to Single-Strand Annealing Substrates Containing Twenty-Nucleotide Flaps. Keystone meeting, Santa Fe, NM
   c. **Fregoso FE** and Fischhaber PL (2017). Development of a Specialized Yeast Strain to Monitor Recruitment Patterns of Saw1 Mediated Rad1-Rad10 Recruitment to DNA Damage Sites through Single-Strand Annealing. ASBMB meeting, Chicago, IL
   d. **Fregoso FE**, Camberos, JP, Odango RJ, and Fischhaber PL (2018). The Necessity of Saw1 in Recruiting Rad1-Rad10 to Single-Strand Annealing Sites Increases as a Function of Increasing DNA Flap Length in S. cerevisiae. CSUPERB annual meeting, Santa Clara, CA
   e. **Fregoso FE**, Camberos, JP, Odango RJ, and Fischhaber PL (2018). The necessity of Saw1 in recruiting Rad1-Rad10 to single-strand annealing sites increases as a function of increasing DNA flap length in S. cerevisiae. CSUN cancer symposia, Northridge, CA

f. **Fregoso FE**, Odango RJ, Camberos, JP, and Fischhaber PL (2019). The effects of varying DNA flap length from 20 to 50 deoxynucleotides on the mechanism of single-strand annealing in Saccharomyces cerevisiae. CSUPERB annual meeting, Anaheim, CA

Oral Presentations

g. **Fregoso FE** and Fischhaber PL (2018). The absence of Saw1 attenuates single-strand annealing DNA repair in S. cerevisiae as a function of increasing 3′ non-homologous tail lengths.. CSUN creative works annual symposium, Northridge, CA

h. **Fregoso FE** and Fischhaber PL (2018). Saw1 is required to localize Rad1-Rad10 to single-strand annealing DNA repair sites and allow for efficient repair as a function of increasing 3′ flap length in S. cerevisiae. CSU student research competition, Sacramento, CA

i. **Fregoso FE**, Odango RJ, Camberos, JP, and Fischhaber PL (2019). The effects of varying DNA flap length from 20 to 50 deoxynucleotides on the mechanism of single-strand annealing in Saccharomyces cerevisiae. CSUPERB annual meeting, Anaheim, CA

j. **Fregoso FE** and Fischhaber PL (2019). The absence of Saw1 attenuates single-strand annealing DNA repair in S. cerevisiae as a function of increasing 3′ non-homologous tail lengths. CSUN creative works annual symposium, Northridge, CA

2. **Graduate (PhD) Research Thesis Lab**: The actin cytoskeleton underpins key cellular processes that require precise regulation to maintain proper functions. In Dr. Dominguez's lab I am a coauthor of a review where we survey our current understanding of Arp2/3 complex for its role in assembly and disassembly of actin network cortex from a protein structure point of view. I am now studying inhibition of Arp2/3 complex, a regulatory mechanism important for its potential in reducing cancer cell invasion both *in vitro* and in cells through an ongoing collaboration with Dr. Alexis Gautreau's lab (École Polytechnique). This collaboration has resulted in a 1st author paper currently under review in *Nature Communications*, where we probe the molecular mechanism of Arp2/3 complex by Arpin through structural, biochemical/biophysical, and *in vivo* assays. I look forward continuing to present this work at conferences and symposiums, while progressing my thesis work by studying the biochemical and structural properties that underpin functional differences of the oldest proposed inhibitor, the family of human Coronins, towards the regulation of Arp2/3 complex.

Poster Presentations

a. **Fregoso FE**, Eeuwen TV, Simanov G, Rebowski G, Boczkowska G, Zimmet A, Gautreau AM and Dominguez R (2021). Mechanism of Arp2/3 complex inhibition by Arpin. Penn Biophysics, Biochemistry Department Retreat, Philadelphia, PA

Oral Presentations

b. **Fregoso FE**, Eeuwen TV, and Dominguez R (2021). Mechanisms of Arp2/3 complex inhibition by Arpin. Penn annual structural biology symposium, Philadelphia, PA

D. Scholastic Performance

YEAR	COURSE TITLE	GRADE
CALIFORNIA STATE UNIVERSITY NORTHRIDGE (BS) – COMULATIVE GPA: 3.21		
2011	Principles of Chemistry	D
2011	Approved University Writing	C-
2011	College Algebra	D
2011	College Algebra Lab	CR
2011	Freshman Seminar	D
2012	Intro. to Art Process	A
2012	Intro. to Art Process Lab	A
2012	Intro. to Literature	B+
2012	World History since the 1500s	B
2012	Critical Reasoning	A
2012	Biological Principles I	A-
2012	Biological Principles I Lab	A

YEAR	COURSE TITLE	GRADE
2012	Calculus I	B
2012	Calculus I Lab	CR
2012	American Political Institutes	B
2013	Biological Principles II	A
2013	Biological Principles II Lab	A
2013	General Chemistry I	C
2013	General Chemistry I Lab	C+
2013	Calculus II	D
2013	Principles of Chemistry	D+
2013	General Chemistry II	B
2013	General Chemistry II Lab	B
2013	Cell Biology	C+
2013	Organic Chemistry I	A-
2013	Organic Chemistry I Lab	C
2013	Fundamentals of Public Speaking	F
2013	Fundamentals of Public Speaking Lab	F
2013	Mechanics I	F
2013	Mechanics I Lab	F
2014	Organic Chemistry II	A-
2014	Organic Chemistry II Lab	B-
2014	Organic Chemistry II Recitation	A-
2014	Fundamentals of Public Speaking	A
2014	Fundamentals of Public Speaking Lab	A
2014	Mechanics I	A
2014	Mechanics I Lab	A
2014	Calculus II	A
2014	Physical Chemistry I	A-
2014	Chemical Analysis I	C-
2014	Chemical Analysis I Lab	C+
2014	Electricity and Magnetism	B-
2014	Electricity and Magnetism Lab	A-
2015	Art History of the World	A
2015	Genetics	B+
2015	Physical Chemistry II	C+
2015	Inorganic Chemistry	B+
2015	Directed Research	A
2015	Biotechnology	A
2015	Chemical Analysis II	A
2015	Chemical Analysis II Lab	A-
2015	Biochemistry I	A
2015	Biochemistry II Lab	A
2015	Directed Research	A
2016	Biochemistry II	A
2016	Biochemistry II Lab	A
2016	Topics in Biochemistry	A-
2016	DNA Protein Interactions	A-
2016	History of Afro-American Writing	A
2016	American History from 1865 to Present	B

CALIFORNIA STATE UNIVERSITY NORTHRIDGE (MS) – COMULATIVE GPA: 3.95

YEAR	COURSE TITLE	GRADE
2016	Recombinant DNA Techniques	A
2016	Recombinant DNA Techniques Lab	A
2016	Chemistry TA Workshop	CR
2016	Receptor Biochemistry	A
2017	Advanced Analytical Chemistry	A
2017	Structure Based Drug Design	A
2017	Literature Seminar	A
2017	Advanced Inorganic Chemistry	A
2017	Bio-organic Chemistry	A-
2018	Directed Graduate Research A	A
2018	Directed Graduate Research C	A
2018	Thesis Seminar	B+
2018	Directed Graduate Research A	A
2018	Directed Graduate Research B	A
2018	Thesis Project A	A
2018	Thesis Project B	A
	UNIVERSITY OF PENNSYLVANIA	
2019	Cell Biology	A
2019	Macromolecular Biophysics	A
2019	Lab Rotation	A+
2019	Human Physiology	A
2020	Molecular Basis of Disease I	A
2020	Structural and Mechanistic Biochemistry	A-
2020	Data Analysis and Scientific Inference	B+
2020	Cryo-Electron Microscopy	A
2020	Lab Rotation	A
2020	Macromolecular Crystallography	B+
2020	Pre-Dissertation Lab	A+
2021	Candidacy Exam Course	A
2021	Pre-Dissertation Lab	A

Cal. State Univ. Northridge used CR (credit) and NC (no credit) system for supplemental labs and workshops, where CR is a Pass and NC is a Fail.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Peter J. Carman

eRA COMMONS USER NAME: CARMANP

POSITION TITLE: Graduate (PhD) Student

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Rutgers University, New Brunswick, NJ	BS	05/2017	Biotechnology
University of Pennsylvania, Philadelphia, PA	PhD	05/2023	Biochemistry, Biophysics

A. Personal Statement

My research focuses on the regulation of the actin cytoskeleton and how disruption contributes to human diseases. In the long term, I hope to continue this understanding while also teaching and mentoring scientists in a research setting. To aid in my training, I have engaged in various research projects and teaching experiences. During my undergraduate studies, I conducted research in the laboratory of Dr. Peter Kahn investigating the thermodynamics of amyloid fibril formation. This work resulted in a senior thesis and multiple poster presentations. Being the most senior undergraduate in a lab composed solely of undergraduates provided me with experience in lab management and mentoring. I also began taking pedagogy courses and teaching as a microbiology TA while at Rutgers. In graduate school I rotated with Dr. Jim Shorter where I continued studying misfolded proteins, co-authoring a paper using Hsp104 to disaggregate disease related substrates. I then joined the lab of Dr. Roberto Dominguez where I study actin cytoskeleton-regulating proteins. I have published a 1st author review on BAR domain proteins interacting with the actin cytoskeleton and have co-authored four research publications in collaboration with the Lappalainen (U. Helsinki, Finland), Leschziner (UCSF), Holzbaur (U. Penn) and Baylies (MSKCC) labs. I have developed a new system for the expression and purification of tropomyosin isoforms which for the first time allows characterization of the physiologically relevant form of these isoforms. For my thesis project, I have used this system to study the isoform-specific impact of tropomyosin regulation on actin networks as it pertains to human muscle myopathies. I have published two 1st author papers regarding this expression and its use. Growing up with my father being a professor/PI I have knowledge of the advantages and drawbacks of being a PI, and I plan to whole-heartedly pursue a career as a research scientist where I can positively influence the cytoskeleton field and other trainees. Support from NCCAT will allow me to complete the proposed work and develop as a communicator at scientific meetings, while the University of Pennsylvania is a fantastic place to further my mentoring and collaborative working skills to ensure I succeed in the next step of my science career.

Selected peer-reviewed articles:

1. **Carman PJ** and Dominguez R. (2018). BAR domain proteins-a linkage between cellular membranes, signaling pathways, and the actin cytoskeleton. *Biophysical Rev.*
2. Kumari R, Jiu Y, **Carman PJ**, Tojkander S, Kogan K, Varjosalo M, Gunning PW, Dominguez R, Lappalainen P. (2020). Tropomodulins control the balance between protrusive and contractile structures by stabilizing actin-tropomyosin filaments. *Curr Biol*.
3. Cason SE, **Carman PJ**, Van Duyne C, Goldsmith J, Dominguez R, Holzbaur ELF. (2021). Sequential dynein effectors regulate axonal autophagosome motility in a maturation-dependent pathway. *Journal of Cell Biology.*
4. **Carman PJ**, Barrie K, Dominguez R. (2021). Novel human cell expression method reveals the role and prevalence of posttranslational modification in nonmuscle tropomyosins. *J. Biol Chem.*

B. Positions and Honors

Positions and Employment

2014-2017 Undergraduate Researcher, Rutgers University
2015-2017 Aresty Research Fellow, Rutgers University
2017- Graduate Student, Roberto Dominguez Lab, Department of Physiology, Univ. Pennsylvania
2017- Instructor/Mentor, Upward Bound Math & Science, Philadelphia, PA
2020- Official, Campus Recreation Intramurals, Univ. Pennsylvania

Professional Memberships

2014- Member, American Society of Biochem. & Mol. Biology
2015- 2017 Alpha Zeta Honors Fraternity, Rutgers University
2017- Member, American Society for Cell Biology

Honors

2011 Eagle Scout, Boy Scouts of America
2013-2016 Amelia L Ruggles Scholarship
2015 Academic Excellence Award
2016-2017 Rutgers Scarlet Scholarship
2017 School of Environ. & Biol. Sciences Scholarship
2018 A. Josua Wand 1st place poster prize in Biophysics, Biochemistry Department Retreat
2019-2021 NIH T32 Pennsylvania Muscle Institute training grant, Univ. Pennsylvania

C. Contributions to Science

1. **Undergraduate Research:** Formation of protein amyloids is associated with various human diseases and involves complex thermodynamic processes. In Dr. Peter Kahn's lab I studied the volume change upon polymerization of soluble insulin into amyloid fibrils. We used a novel, custom glass-blown apparatus to measure exact volume changes upon polymerization and calculated water expelled upon polymerization to estimate thermodynamic properties of the reaction. By studying these basic values, we can gain understanding of the mechanism of fibril formation and attempt to design inhibitors.
    a. **Carman, PJ** and Kahn, PC. (2015). Examining Charge Burial in Globular Proteins. Aresty Undergraduate Research Symposium, Livingston Student Center, Piscataway, NJ
    b. **Carman, PJ** and Kahn, PC. (2016). Investigating the Thermodynamics of Insulin Amyloid. George H. Cook Honors Committee, New Brunswick, NJ
    c. **Carman, PJ** and Kahn, PC. (2017). Thermodynamics of Insulin Amyloid Formation by Capillary Dilatometry Volume Change. ASBMB annual meeting, Chicago, IL

2. **Graduate Research Rotation**: Protein disaggregases/chaperones are capable of disassembling amyloid fibrils and re-folding proteins into their native state. As a potential therapeutic solution to neurodegenerative disease, I evolved the chaperone Hsp104 through rational mutagenesis to unfold disease-associated protein fibrils. I identified various mutant Hsp104 proteins capable of rescuing disease toxicity caused by alpha-synuclein, TDP-43 and FUS. This research has been published, and is a promising mechanism to target in neurodegenerative diseases.
    a. Tariq, A., J. Lin, M.E. Jackrel, C.D. Hesketh, **Carman PJ**, K.L. Mack, R. Weitzman, C. Gambogi, O.A. Hernandez Murillo, E.A. Sweeny, E. Gurpinar, A.L. Yokom, S.N. Gates, K. Yee, S. Sudesh, J. Stillman, A.N. Rizo, D.R. Southworth, and J. Shorter. (2019). Mining disaggregase sequence space to safely counter TDP-43, FUS, and alpha-synuclein proteotoxicity. *Cell Rep.* 28(8):2080–2095.

3. **Graduate Research Thesis Lab**: The actin cytoskeleton contributes to cell processes that must be tightly regulated to ensure proper function. In Dr. Dominguez's lab I've written a 1st author review where I place BAR domain proteins which sense membrane curvature in the context of their regulation of the actin cytoskeleton. I've also studied the actin-binding proteins tropomyosin and tropomodulin, and how they stabilize actin stress fibers in U2OS cells (collaboration with the Lappalainen lab). In a collaboration with the Leschziner lab we solved the structure of the actin-related-protein-containing

nucleosome remodeler RSC. I also collaborated with the Holzbaur lab to understand regulation of autophagosome trafficking by dynein-dynactin effectors, and the Baylies lab to study *Drosophila* tropomodulins and their role in muscle development. I look forward to continuing my thesis work studying the interaction of tropomyosin isoforms with specific tropomodulin & leiomodin isoforms and how they regulate cell processes in the context of human muscle diseases.

a. **Carman PJ** and Dominguez R. (2018). BAR domain proteins-a linkage between cellular membranes, signaling pathways, and the actin cytoskeleton. *Biophysical Rev.*
b. Kumari R, Jiu Y, **Carman PJ**, Tojkander S, Kogan K, Varjosalo M, Gunning PW, Dominguez R, Lappalainen P. (2020). Tropomodulins control the balance between protrusive and contractile structures by stabilizing actin-tropomyosin filaments. *Curr Biol*.
c. Baker R, Reimer J, **Carman PJ**, Arakawa T, Dominguez R, Leschziner A. (2021). Structural insights into assembly and function of the RSC chromatin remodeling complex. *Nature Struct Mol Biol*.
d. Cason SE, **Carman PJ**, Van Duyne C, Goldsmith J, Dominguez R, Holzbaur ELF. (2021). Sequential dynein effectors regulate axonal autophagosome motility in a maturation-dependent pathway. *Journal of Cell Biology.*
e. **Carman PJ**, Barrie K, Dominguez R. (2021). Novel human cell expression method reveals the role and prevalence of posttranslational modification in nonmuscle tropomyosins. *J. Biol Chem.*
f. **Carman PJ**, Dominguez R. (2022). Novel protein production method combining native Expression in human cells with an intein-based affinity purification and self-cleavable tag. *bio-Protocol.*
g. Zapitar**-**Morales C, **Carman PJ**, Dominguez R, Baylies M. (2022). *Drosophila* tropomodulin controls the length and organization of muscle sarcomeres. *In preparation.*
h. Barrie KR, **Carman PJ**, Boczkowska M, Dominguez R. (2022) Mechanism of CARMIL dimerization and membrane localization. *In preparation.*
i. Ceron R, Boczkowska M, Rebowski G, **Carman PJ**, Dominguez R. (2022). Method to express and purify actin isoforms from human cells. *In preparation*

D. Additional Information: Research Support and/or Scholastic Performance

YEAR	COURSE TITLE	GRADE
	RUTGERS UNIVERSITY – CUMULATIVE GPA: 3.90	
2013	General Chemistry I	A
2013	Exposition and Argument	B
2013	Ecology, People & the Environment	A
2013	Introduction to Human Ecology	A
2013	Readings in Biology	A
2014	General Chemistry II	A
2014	General Psychology	A
2014	Chemistry Laboratory	A
2014	Statistics for Research	A
2014	Issues in Biotechnology	A
2014	Honors Seminar I	A
2014	Organic Chemistry	C
2014	Intro. to Computer Science	A
2014	Physics I	A
2014	Dance Appreciation	A
2014	Research in Biotechnology	A
2015	Data Structures	B+
2015	Physics II	A
2015	American Government	A
2015	Research in Biotechnology	A
2015	Honors Seminar II	A
2015	Elementary German	A

YEAR	COURSE TITLE	GRADE
2015	General Biochemistry I	A
2015	Molecular Genetics	A
2015	Science of Food	A
2015	General Microbiology	A
2016	Social Media for the Arts	A
2016	General Biochemistry II	A
2016	Sequence Analysis	A
2016	Molecular Genetics Lab	A
2016	Living in a Microbial World	A
2016	Peer Instructor Education	A
2016	Basic Probability and Statistics	A
2016	GH Cook Honors	A
2016	Intro Biochem Lab	A
2016	Meth. & App. Molecular Bio	A
2016	Bioinformatics	A
2016	Wellness Behavior	A
2016	Logic Reason Persuasion	A
2016	Prin. Biophys. Chem	A
2016	Tools Bioinformatics	A
	UNIVERSITY OF PENNSYLVANIA – CUMULATIVE GPA: 4.0	
2017	Cell Biology	A-
2017	Macromolecular Biophysics	A
2017	Macromolecular Crystallography	A
2017	Lab Rotation	A
2018	Structural and Mech. Biochemistry	A
2018	Data Analysis	A
2018	Drug Discovery and Design	A
2018	Lab Rotation	A
2018	Cancer Biology	A+
2018	Tutorial	A+
2019	Candidacy Exam Course	A
2019	Pre-Dissertation Lab	A

GRE Scores: (test taken Aug. 6, 2016)

Section	**Score**	**Percentile**
Verbal Reasoning	160 (out of 170)	86
Quantitative Reasoning	162 (out of 170)	79
Analytical Writing	5 (out of 6)	92