BIOGRAPHICAL SKETCH

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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	05/2024	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 an academic 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 extensive 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 three research publications in collaboration with the Lappalainen (U. Helsinki, Finland), Leschziner (UCSF), and Holzbaur (U. Penn) 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. A 1st author paper regarding this expression method is in preparation to share this technique with the community. 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 an independent research scientist where I can positively influence the cytoskeleton field and other trainees. Support from the Blavatnik Award 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. Baker R, Reimer J, **Carman PJ**, Turegun B, Arakawa T, Dominguez R, Leschziner A. (2021). Structural insights into assembly and function of the RSC chromatin remodeling complex. *Nature Struct Mol Biol.*
4. 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.*

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. This research was in collaboration with the Lappalainen

lab and has recently been published. In a collaboration with the Leschziner lab we solved the structure and mechanism 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, with a paper under revision. 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. (Under revision: *Journal of Cell Biology*).
e. **Carman PJ**, Barrie K, Dominguez R. (2021). Pairing the intein purification system with mammalian expression to produce unadulterated native proteins. (*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
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

YEAR	COURSE TITLE	GRADE
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