

Rebecca F. Alford  
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## EDUCATION

Carnegie Mellon University  
*B.S. Chemistry, Concentration: Computational Chemistry*

Pittsburgh, PA  
Expected May 2016

The Johns Hopkins University  
*Visiting Student*

Baltimore, MD  
Summer 2010

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## RESEARCH EXPERIENCE

Undergraduate Research Assistant, The Johns Hopkins University 2013–Present  
Advisor: Dr. Jeffrey J. Gray

Topic: *Computational modeling of membrane proteins*

- Developed framework for membrane protein modeling in Rosetta
- Created proof-of-concept applications for refinement,  $\Delta\Delta G$  prediction, protein-protein docking, and symmetric docking in the membrane
- Development of a new implicit membrane model and energy function able to capture different lipid compositions
- Active involvement in development of the Rosetta molecular modeling suite

Facebook Open Academy Intern, Spatial4j 2014  
Advisor: David Smiley

Topic: *Modeling of geodesic shapes in object-oriented Spatial4j*

- Implemented module for representing a polygon on the surface of an ellipsoid
- Implemented algorithms calculating the spatial relationship between the polygon and surrounding shapes

High School Research Assistant, New York University 2011–2013  
Advisor: Dr. Richard Bonneau

Topic: *Prediction of deleterious protein variants using structure prediction*

- Developed a structure-based method for predicting mutation effects on membrane protein function
- Applied machine learning to improve prediction accuracy
- Participated in expanding this method to predicting deleterious variants in soluble proteins

High School Research Assistant, Stony Brook University 2009–2010  
Advisor: Dr. Maurice Kernan

Topic: *Characterization of TRPM ion channel function in *Drosophila**

- Designed several mutations in the *Drosophila* TRPM gene
- Studied the functional effects of mutations at various developmental stages

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## PUBLICATIONS

3. Baugh EH, Simmons-Elder R, Muller C, **Alford RF**, Volovsky N, Lash A, Bonneau R (2015) "Structural modeling improves classification and interpretation of deleterious protein variation," *Under Review - Nucleic Acids Research*
2. **Alford RF\***, Koehler Leman J\*, Weitzner BD, Duran AM, Tilley DC, Elazar A, Gray JJ (2015) "An integrated framework advancing membrane protein modeling and design," *PLoS Comput. Biol.* 11(9): e1004398. (\*equal contribution authors)
1. Pope WH, Bowman CA, Russell DA, Jacobs-Sera D, Asai DJ, Cresawn SG, Jacobs WR, Hendrix RW, Lawrence JG, Hartfull GF, **SEA-PHAGES**, PHIRE (2015) "Whole genome comparison of a large collection of mycobacteriophages reveals a continuum of phage genetic diversity variation" *eLife*, 4, 1-65. \*Full author listing in manuscript

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## SELECTED HONORS AND AWARDS

NIH Undergraduate Diversity Research Supplement <i>Three years of support for research on computational modeling of membrane proteins</i>	2013–Present
Carnegie Mellon Dean's List High Honors <i>Awarded to students with a semester GPA of 3.7 or higher</i>	Fall 2013, Spring 2014, 2015
Grace Hopper Celebration Scholar <i>Scholarship supported by the National Science Foundation to attend the 2014 Grace Hopper Celebration of Women in Computing</i>	2014
Facebook Open Academy–Technical Report Award	2014
Selected Student Speaker–TEDxCMU	2013
Carnegie Mellon Ruth Welch Walker Scholarship	2013–Present
Davidson Fellowship Honorable Mention <i>Awarded to 20 students nationwide for significant work in science and technology</i>	2012
Intel International Science and Engineering Fair–Best project in Biochemistry category <i>First place and top category award for Biochemistry category</i>	2012
Intel Science Talent Search Semifinalist <i>One of 300 national semifinalists</i>	2012
Max Carpenter Award for Promise in Science and Engineering <i>Awarded to one student at annual NASA Space Academy for visually impaired students</i>	2010

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## SCIENTIFIC TALKS

3. Alford RF, Baugh EH, Gray JJ (2014) "Real-time visualization of Rosetta membrane simulations using the PyMOL viewer" *Rosetta Developer's Meeting*, Seattle, WA.
2. Alford RF, Koehler Leman J, Weitzner BD, Gray JJ (2014) "RosettaMP - An object-oriented framework for modeling and design of membrane proteins in Rosetta" *Rosetta Developer's Meeting*, San Francisco, CA
1. Alford RF (2013) "The Dream Machine" *TEDxCMU*, Pittsburgh, PA.

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## SCIENTIFIC POSTERS

8. Alford RF, Fleming P, Fleming KG, Gray JJ (2015) "Toward an all-atom energy function for scoring in membrane environments of diverse lipid composition" *Rosetta Conference*, Leavenworth, WA.
7. Alford RF, Koehler Leman J, Gray JJ (2015) "Validation of an intrinsic lipid bilayer model in the RosettaMP framework" *Gordon Research Conference – Membrane Protein Folding*, Waltham, MA.
6. Alford RF, Koehler Leman J, Weitzner BD, Gray JJ (2014) "An integrated framework advancing membrane protein modeling and design" *Carnegie Mellon Meeting of the Minds Symposium*, Pittsburgh, PA.
5. Alford RF, Koehler Leman J, Weitzner BD, Gray JJ (2014) "A new object-oriented framework for modeling and design of membrane proteins in Rosetta" *Grace Hopper Conference for Women in Computing*, Phoenix, AZ.
4. Alford RF, Koehler Leman J, Weitzner BD, Gray JJ (2014) "A new object-oriented framework for modeling and design of membrane proteins in Rosetta" *Rosetta Conference*, Leavenworth, WA.
3. Alford RF, Koehler Leman J, Weitzner BD, Gray JJ (2014) "A new object-oriented framework for modeling and design of membrane proteins in Rosetta" *Carnegie Mellon Meeting of the Minds Symposium*, Pittsburgh, PA.
2. Alford RF, Koehler Leman J, Gray JJ (2013) "Redesigning the framework for membrane protein modeling in Rosetta" *Rosetta Conference*, Leavenworth, WA.
1. Alford RF, Simmons-Elder R, Poultney C, Halvorsen L, Bonneau R (2012) "A machine-learning based approach to predicting functional effects of mutations in membrane proteins" *Rosetta Conference*, Leavenworth, WA.

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## TEACHING AND MENTORING EXPERIENCE

Mentor to seven high school research students <i>Mentored seven female high school students in collaboration with classroom teacher in conducting computational structural biology research</i>	2011–Present Commack, NY
Co-Instructor, Rosetta Intern Boot Camp <i>A week-long workshop for eight undergraduates on C++ programming, software design, and development in Rosetta</i>	May 2015 Chapel Hill, NC
Co-Instructor, Rosetta Boot Camp <i>A week-long workshop for 15-18 post-doctoral fellows and graduate students on C++ programming, software design, and development in Rosetta</i>	June 2014 Chapel Hill, NC
Co-Developer and Co-Instructor, ThinkTech <i>Created and pilot-tested a weekly outreach program for middle school girls targeting computational thinking skills</i>	2014–Present Pittsburgh, PA

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## ACTIVITIES AND SCIENCE OUTREACH

Assistant Organizer, Rosetta REU Program <i>Assisted in recruiting, organization, and admissions for a pilot Research Experience for Undergraduates (REU) targeted toward increasing diversity</i>	2015
Assistant Organizer, Rosetta Team at Grace Hopper <i>Lead Rosetta team of six students to attend Grace Hopper Conference for the first time. Coordinated efforts for creating career fair materials</i>	2014
Science Fair Judge, Plainview Old Bethpage Middle School <i>Evaluated projects for annual 6th grade science fair</i>	2014, 2015
Committee Member, Carnegie Mellon Women in Computer Science	2014–Present
Instructor and Volunteer, Carnegie Mellon Creative Technology Nights <i>Lead and assisted with weekly 2hr workshops for middle school girls designed to increase exposure to science and technology</i>	2013–Present
Team Captain, VisionWalk <i>Organized teams in Long Island, NY and Pittsburgh, PA for annual walk dedicated to raising awareness for inherited retinal diseases</i>	2012, 2013

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## SKILLS

### Molecular Modeling and Computational Chemistry

- Computational methods development
- Protein structure prediction and design with Rosetta
- Molecular dynamics simulations with NAMD
- Quantum calculations with Gaussian
- Visualization with PyMOL, RasMOL, Jmol, VMD
- Energy function development

### Computation, Analysis and Software Development

- Languages: C++, Python, Java, C, Perl, HTML/CSS, shell scripting
- Version Control: Git, Subversion
- Object oriented software design
- Machine Learning: SVM, Linear Regression
- Computations in Mathematica, MATLAB
- Statistics and data analysis in R
- Data analysis with GNUPlot, Matplotlib

### Experimental Techniques

- Organic chemistry
- Analytical chemistry
- Small molecule synthesis
- NMR Spectroscopy
- IR Spectroscopy

### Professional

- Helped with writing of NSF Molecular and Cellular Biology Grant
- Helped with writing of NIH R01 Supplement

Last Updated: 9/5/15