REBECCA F. ALFORD

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA
B.S. Chemistry, Concentration: Computational Chemistry — *Expected May 2016*

RESEARCH EXPERIENCE

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

- Redesgined and implemented a framework for membrane protein modeling in Rosetta
- Developed new proof-of-concept structure prediction applications for high-resolution refinement, $\Delta\Delta G$ prediction, protein-protein docking, amd assembly of symmetric complexes in the bilayer
- Development of an implicit representation for protein structure prediction and design in membranes of different lipid composition
- Actively involved in development of the Rosetta molecular modeling suite

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

- Applied machine learning and structure prediction to classify mutations as disruptive or non-disruptive to protein function
- Developed a new method to predict the effects of mutations on memrbane protein function
- Contributed to new method to predict effects of mutations on soluble protein funciton

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

- Designed several mutations in the *Drosophila* TRPM gene implicated in human vision
- Studied the behavioral effects of mutations at various developmental stages

PUBLICATIONS

3. Baugh EH, Simmons-Elder R, Muller CL, **Alford RF**, Volovsky N, Lash A, Bonneau R (2016) "Robust classification of protein variation using structural modeling and large-scale data integration," *Nucleic Acids Research* 44(6): 2501-2513.

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 Computational Biology* 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 (**Group Authorship - Full listing in manuscript*).

SELECTED HONORS AND AWARDS

Hertz Foundation Fellowship	2016
National Science Foundation Fellowship	2016
Dr. J. Paul Pugassi and Linda Monteverde Award	2016
Carnegie Mellon Women's Association Award	2016
Handlos Research Award	2016
Senior Leadership Recognition Award	2016
Ruth Welch Walker Scholarship	2012–2016
Grace Hopper Conference Scholarship	2014
Selected Student Speaker–TEDxCMU	2013
Davidson Fellowship Honorable Mention	2012
Intel International Science and Engineering Fair–Best Biochemistry Project	2012
Intel Science Talent Search Semifinalist	2012
Max Carpenter Award for Promise in Science and Engineering	2010

CONFERENCE TALKS

4. **Alford RF Invited Keynote:** "Decoding Biology – Using computers to understand disease" *Winter Rosetta Conference*, Burlington, VT.

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, 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.

CONFERENCE POSTERS

8. Alford RF, Fleming P, Fleming KG, Gray JJ (2015) "Toward an all-atom energy function for membrane protein modeling in bilayers of different lipid composition" *Rosetta Conference*, Leavenworth, WA.

7. Alford RF, Fleming KG, Gray JJ (2015) "Validation of the implicit membrane model in RosettaMP" *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-orieented 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-orieented 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) "Redesigning the framework for membrane protein modeling 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.

TEACHING AND MENTORING EXPERIENCE

Research mentor to seven high school students 2011–Present
Commack, NY

I advised each student in conducting his/her own research project in computational biology.

Co-Instructor, Rosetta Intern Boot Camp Summer 2015
Chapel Hill, NC

An intensive week-long workshop for eight undergraduates on C++ programming, software design, concepts in biomolecular modeling with Rosetta, and collaborative development. I delivered nine lectures and helped students complete lab activities.

Co-Instructor, Rosetta Boot Camp Summer 2014
Chapel Hill, NC

An intensive week-long workshop for 15-18 post-doctoral fellows and graduate students on C++ programming, software design, concepts in biomolecular modeling with Rosetta, and collaborative development. I delivered four lectures and helped students with lab activities.

Co-Developer and Co-Instructor, ThinkTech 2014–Present
Pittsburgh, PA

In a team of three, I created a new curriculum for a weekly science and engineering outreach program for middle school girls. Unlike existing curricula, the lessons focus explicitly on computational skill building. Thus far, we have pilot tested one session and made our materials freely available online.

SPECIAL PROJECTS

Facebook Open Academy Intern, Spatial4j Spring 2014
Advisor: David Smiley

- Implemented module for representing a polygon on the surface of an ellipsoid

- Implemented algorithms calculating the spatial relationship between the polygon and surrounding objects
- Collaborated on team of three students from the United States and Canada

Phage Genomics Research Project Fall 2012-Spring 2013
Advisors: Dr. Margaret Bruan and Dr. Jonathan Jarvik

- Characterized a unique bacteriophage using computational and wet lab techniques
- Analysis contributed to a publication analyzing genetic diversity of bacteriophages

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ACTIVITIES AND OUTREACH

Invited Panelist - STEM Career Expo for students with visual disabilities October 2015
Student representative on panel and round table discussion on overcoming disability-related challenges

Volunteer - Girls Rock Science Weekend at Carnegie Science Center October 2015
Lead computer science demonstrations to cultivate interest of elementary and middle school girls in science and engineering fields

Assistant Organizer, Rosetta REU Program 2015
Helped create the first NSF-funded Rosetta Research Experience for Undergraduates (REU) targeted toward improvidng diversity in the Rosetta Community

Assistant Organizer, Rosetta Team at Grace Hopper 2014
Lead the first Rosetta team of six students to attend Grace Hopper Celebration of Women in Computing. Coordinated efforts for creating career fair materials

Instructor and Volunteer, Carnegie Mellon Creative Technology Nights 2013–Present
Lead and assisted with weekly 2hr workshops for middle school girls designed to increase exposure to science and technology

Committee Member, Carnegie Mellon Women in Computer Science 2013–Present

Team Captain, Foundation Fighting Blindness VisionWalk 2012, 2013
Organized teams in Long Island, NY and Pittsburgh, PA for annual walk dedicated to raising awareness for inherited retinal diseases

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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
- Statistics and data analysis in R
- Machine Learning: Support Vector Machines, Linear Regression
- Computations in Mathematica, MATLAB
- Data anlysis with GNUPlot, Matplotlib