Rebecca F. Alford

Carnegie Mellon University, SMC 2858
5000 Forbes Ave, Pittsburgh, PA 15289
ralford@andrew.cmu.edu

EDUCATION

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

The Johns Hopkins University   Baltimore, MD
Visiting Student   *Summer 2010*

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 high-resolution refinement, $\Delta\Delta$G prediction, protein-protein docking, and symmetric docking in the membrane
- Building a new implicit membrane model able to capture different membrane 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 a polygon on the surface of an ellipsoid
- Implemented algorithms calculating the spatial relationship between the polygon and other 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 of this method
- 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

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.* In press. (*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*

SELECTED HONORS AND AWARDS

NIH Undergraduate Diversity Research Supplement   2013–Present
Two years of support for research on computational modeling of membrane proteins

Carnegie Mellon Dean's List High Honors   Fall 2013, Spring 2014, 2015
Awarded to students with a semester GPA of 3.7 or higher

Grace Hopper Celebration Scholar   2014
Scholarship to attend the 2014 Grace Hopper Celebration of Women in Computing

Facebook Open Academy–Technical Report Award   2014

Selected Student Speaker–TEDxCMU   2013

Carnegie Mellon Ruth Welch Walker Scholarship   2013–Present

Davidson Fellowship Honorable Mention   2012
Awarded to 20 students nationwide for significant work in science and technology

Intel International Science and Engineering Fair–Best project in Biochemistry category   2012
First place and top category award for Biochemistry category

Intel Science Talent Search Semifinalist   2012
One of 300 national semifinalists

Max Carpenter Award for Promise in Science and Engineering   2010
Awarded to one student at annual NASA Space Academy for visually impaired students

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.

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-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) "A new object-orieented 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.

TEACHING AND MENTORING EXPERIENCE

Mentor to seven high school research students   2011–Present
Mentored seven female high school students in collaboration with classroom   Commack, NY
teacher in conducting research in computational structural biology

Co-Instructor, Rosetta Intern Boot Camp   May 2015
A week-long workshop for eight undergraduates on C++ programming, software   Chapel Hill, NC
design, and development in Rosetta

Co-Instructor, Rosetta Boot Camp June 2014
A week-long workshop for 15-18 post-doctoral fellows and graduate Chapel Hill, NC
students on C++ programming, software design, and development in Rosetta

Co-Developer and Co-Instructor, ThinkTech 2014–Present
Created and pilot-tested a weekly outreach program for middle Pittsburgh, PA
school girls targeting computational thinking skills

ACTIVITIES AND SCIENCE OUTREACH

Assistant Organizer, Rosetta REU Program 2015
Assisted in recruiting, organization, and admissions for a pilot Research
Experience for Undergraduates (REU) targeted toward increasing diversity

Organizer, Rosetta Team at Grace Hopper 2014
Lead Rosetta team of six students to attend Grace Hopper Conference
for the first time. Coordinated efforts for creating career fair materials

Science Fair Judge, Plainview Old Bethpage Middle School 2014, 2015
Evaluated projects for annual 6th grade science fair

Committee Member, Carnegie Mellon Women in Computer Science 2014–Present

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

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

SKILLS

Molecular Modeling and Computational Chemistry

- Protein structure prediction and design with Rosetta
- Methods development in Rosetta
- Molecular dynamics simulations with NAMD, CHARMM
- 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
- Machine Learning: SVM, Linear Regressions
- Object oriented software design
- Computations with Mathematica, MATLAB
- Statistics and data analysis in R
- Data anlysis 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: 8/27/15