

Douglas Henry Juers

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Education

- 2000 PhD, Department of Physics, University of Oregon, Eugene, OR. Brian W. Matthews, Advisor. Dissertation: *A Structural View of Beta-Galactosidase in Action*
- 1987 A.B., Department of Physics, Cornell University, Ithaca, NY

Professional Positions

- 2009 – present
Visiting Scientist, Institute de Biologie Structurale, Laboratoire de Biophysique Moléculaire, Grenoble, France.

Projects: Raman spectroscopic investigations of protein crystal cooling, humidity control of protein crystal cooling, the temperature dependence of protein conformation, and the temperature behavior of lipidic cubic phases.

- 2004 - present
Assistant Professor, Department of Physics and Program in Biophysics, Biochemistry and Molecular Biology, Whitman College.

Current research projects: Understanding the nature of cooling-induced crystal damage to develop predictive methods for crystal cooling. Structural biology studies on myelin basic protein, PIRL protein (with D. Vernon, Biology), aldehyde dehydrogenase (with J. Russo, Chemistry), and dioxygenases (with T. Machonkin, Chemistry).

Courses taught: Introductory Mechanics with Lab, Introductory Electricity & Magnetism with Lab, Thermal Physics, 20th Century Physics Lab, Advanced Electricity & Magnetism, Biophysics with Lab.

- 2000 - 2004
Post-doctoral research fellow, Department of Physics, Howard Hughes Medical Institute and Institute of Molecular Biology. Brian W. Matthews, Advisor.

Studies on long-range order in macromolecular crystals and the catalytic activity of *E. coli* β -galactosidase.

- 1993 - 2000

Graduate Research Assistant, Department of Physics, Howard Hughes Medical Institute and Institute of Molecular Biology. Brian W. Matthews, Advisor.

Structural and functional studies on *E. coli* β -galactosidase and thermolysin.

1988 - 1992

Teacher, coach & dorm parent. Carrabassett Valley Academy, Kingfield, ME.

Publications

1. Alcorn, T. & Juers, D.H. Progress in Rational Methods of Cryoprotection in Macromolecular Crystallography. *Submitted to Acta Crystallographica Section D*.
2. Juers, D.H. Rob, B., Dugdale, M., Rahimzadeh, N., Giang, C., Lee, M., Matthews, B.W. & Huber, R.E. Direct and Indirect Roles of His-418 in Metal Binding and in the Activity of β -Galactosidase (*E. coli*). (2009) *Accepted by Protein Science*.
3. Juers, D.H., Lovelace, J., Bellamy, H.D., Snell, E.H., Matthews, B.W. and Borgstahl, G.E.O. (2007) Changes to Crystals of *E. coli* β -galactosidase During Room-Temperature Low-Temperature Cycling and Their Relation to Cryo-Annealing. *Acta Crystallographica*. D63, 1139-1153.
4. Juers, D.H., Kim J., Sieburth, S. McN., and Matthews, B.W. Structural Analysis of Silendiols as Transition-State-Analogue Inhibitors of the Benchmark Metalloprotease Thermolysin. (2005) *Biochemistry* 44, 16524-16528.
5. Juers, D.H. and Matthews, B.W. Cryo-cooling in macromolecular crystallography: advantages, disadvantages and optimization. (2004) *Quarterly Reviews of Biophysics* 37, 2 pp. 1-15. Review commissioned to BWM.
6. Juers, D.H. and Matthews, B.W. (2004) The Role of Solvent Transport in Macromolecular Crystal Annealing. *Acta Crystallographica*, D60, 412-421.
7. Juers, D.H., Hadka, S., Matthews, B.W., and Huber, R.E. (2003) The Structural Basis for the Altered Activity of Gly 794 Variants of *E. coli* β -Galactosidase. *Biochemistry* 42: 13505-13511.
8. Shoemaker, G.K., Juers, D.H., Coombs, J.M.L., Matthews, B.W. and Craig, D.B. (2003) Crystallization of β -Galactosidase Does Not Reduce the Range of Activity of Individual Molecules. *Biochemistry* 42: 1707-1710.
9. Juers, D.H., Heightman, T.D., Vasella, A., McCarter, J.D., Mackenzie, L., Withers, S.G. and Matthews, B.W. (2001) A Structural View of the Action of *E. coli* (*lac Z*) β -Galactosidase. *Biochemistry* 40: 14781-14794.

10. Juers, D.H. and Matthews, B.W. (2001) Reversible Lattice Repacking Illustrates the Temperature Dependence of Macromolecular Interactions. *Journal of Molecular Biology* **311** 851-862.
11. Juers, D.H., Jacobson, R.H., Wigley, D., Zhang, X.J., Huber, R.E., Tronrud, D.E. and Matthews, B.W. (2000) High resolution refinement of β -galactosidase in a new crystal form reveals multiple metal-binding sites and provides a structural basis for α -complementation. *Protein Science* **9**: 1685-1699.
12. Juers D.H., Huber, R.E. and Matthews, B.W. (1999) Structural comparisons of TIM barrel proteins suggest functional and evolutionary relationships between β -galactosidase and other glycohydrolases. *Protein Science* **8**:122-136.
13. Holland, D.R., Hausrath, A.C., Juers, D.H. and Matthews B.W. (1995) Structural analysis of zinc substitutions in the active site of thermolysin. *Protein Science* **4**: 1955-1965.

Invited Lectures

1. Rational Approaches to Crystal Cooling. CCP4 Study Weekend. Nottingham, UK. January, 2009.
2. Rational Approaches to Cryocrystallography. Gordon Conference: Diffraction Methods in Structural Biology. Bates College, Lewiston, Maine. July, 2008.
3. The Role of Cryoprotectants in the Successful Cooling of Protein Crystals. 10th Annual Meeting of the Northwest Section of the American Physical Society. Lewis & Clark College, Portland, OR. May, 2008.
4. The Role of Water Transport in Cryo-Annealing. Lecture. Annual Meeting of the American Crystallographic Association, Cincinnati, OH June 2003.

Other Presentations

1. Physical Properties of Cryoprotective Solutions for Macromolecular Crystallography. Poster. Frontiers in Microrheology Workshop, UCLA, Los Angeles, CA, Feb 2008.
2. Ibid. Poster. 52nd Annual Meeting of the Biophysical Society, Long Beach, CA, Feb 2008.
3. Hysteresis in Cryo-Cooling Crystals of E. coli β -galactosidase and its Relations to Cryo-Annealing. Poster. 51st Annual Meeting of the Biophysical Society, Baltimore, MD, March 2007.
4. Ibid. Poster. The 18th West Coast Protein Crystallography Workshop, Asilomar, CA, March 2007.
5. Turning off a Carbon-Based Enzyme with a Silicon-Based Inhibitor. Poster. 50th Annual Meeting of the Biophysical Society, Salt Lake City, UT, Feb 2006.
6. The Role of Cryoprotectants in Cryo-Cooling and Annealing. Poster. 48th Annual Meeting of the Biophysical Society, Long Beach, CA, Feb 2005.

7. Ibid. Lecture. Northwest Crystallography Workshop, Seattle, WA, June 2004.
8. The Role of Solvent Transport in Annealing. Lecture. 7th Northwest Crystallography Workshop, Vancouver, BC, June 2002.
9. Temperature Dependent Structural Changes in Frozen Crystals of β -Galactosidase. Poster. 45th Annual Meeting of the Biophysical Society, Boston MA, Feb 2001.
10. Ibid. Poster. The 15th West Coast Protein Crystallography Workshop, Asilomar CA, Mar 2001.
11. Reversible Changes in *E. coli* (*lac Z*) β -Galactosidase Crystal Packing with Freezing. Lecture. 6th Northwest Crystallography Workshop, Eugene OR, July 2000.
12. Structural Enzymology of *E. coli* β -Galactosidase: The Role of a Ligand-Induced Switch in the Dual Activity of the Enzyme. Poster. The 14th West Coast Protein Crystallography Workshop, Asilomar CA, March 1999.
13. High Resolution Structures of β -Galactosidase Inhibitor Complexes. Poster. 12th Symposium of the Protein Society, San Diego CA, July 1998.
14. Structural Studies Directed Towards the Mechanism of Action of β -Galactosidase. Poster. 11th Symposium of the Protein Society, Boston MA, July 1997.
15. Engineering by Nature and Why β -Galactosidase is So Big. Lecture. 4th Northwest Crystallography Workshop, Eugene OR, June 1996.
16. A Structural Basis for the Activity of β -Galactosidase. Lecture. 12th West Coast Protein Crystallography Workshop, Asilomar CA, March 1995.

Grant Activity

Submitted

“New Predictive Methods for Cryoprotection in Macromolecular Crystallography”, PI, National Institutes of Health AREA program.

Funded

“MRI: Acquisition of an X-ray Diffraction Instrument for Interdisciplinary and Collaborative Research and Education in an Undergraduate Setting”, PI, with J. Russo, D. Vernon, T. Machonkin & K. Nicolaysen. National Science Foundation. \$464,934. July, 2007.

Not Funded

“ Investigations of the solvent confined within macromolecular crystals to rapid temperature changes”. PI. Research Corporation. \$45,404. Nov, 2005.

“Biophysical Studies and Crystallization of Myelin Basic Protein Chimeras”. PI. Research Corporation. \$32,000. Nov, 2006.

Student Research Projects Supervised

Tracey Park, “The Role of the Depletion Effect in Lysozyme Crystal Stability”, BBMB Senior Thesis, 2007-8.

Jessica Bruhn, “Biophysical Studies and Crystallization of Myelin Basic Protein – Actin Chimeras”, Whitman Perry Research Award, 2007; Murdock Undergraduate Research Symposium, 2007.

Rob Jefferson, Biophysical Studies and Crystallization of Myelin Basic Protein – Calmodulin Chimeras”, BBMB Senior Thesis, 2007-8.

Matthew Queral, “Cloning of a Myelin Basic Protein – Calmodulin Chimera”, BBMB Senior Thesis, 2007, Murdock Undergraduate Research Symposium, 2006.

Thuy Dao, “Biophysical Studies of PIRL1 Protein – A Gene Product important for Arabidopsis Development”, BBMB Senior Thesis, 2006-7; Murdock Undergraduate Research Symposium, 2006.

Thomas Alcorn, “Characterization of the Thermal Contraction of Cryoprotective Solutions”, BBMB Senior Thesis, 20067; Murdock Undergraduate Research Symposium, 2007; to be presented at Biophysical Society Annual Meeting, 2008.

Kyle Gotchy, “Investigations of Entropic Mechanisms of Trypsin Crystal Growth and Degradation”, Whitman Abshire Research Award, 2006-7.

Honors

Fulbright Alternate for research in France, 2009.

Other Interests

Hiking and climbing, skiing, ultimate frisbee, music (piano).