

# Hays S. Rye

Texas A&M University  
Department of Biochemistry & Biophysics  
Rm. 239A Bio/Bio Building  
MS 2128 TAMU  
College Station, TX 77845  
Tel: 979-862-1123  
Fax: 979-845-9274  
e-mail: [haysrye@tamu.edu](mailto:haysrye@tamu.edu)

## EDUCATION

1989-1995 Ph.D., Molecular and Cell Biology, University of California at Berkeley  
1985-1989 B.A., Biochemistry, Rice University

## RESEARCH EXPERIENCE

2009-present **Associate Professor**, Department of Biochemistry and Biophysics, Texas A&M University, College Station, TX  
2000-2009 **Assistant Professor**, Department of Molecular Biology, Princeton University, Princeton, NJ. Studies of protein folding and unfolding by the GroEL-GroES chaperonin system  
1995-2000 **Postdoctoral Fellow**, Arthur Horwich, M.D., Yale University Medical School, New Haven, CT. Studies of the ATP-driven protein folding cycle of the GroEL-GroES chaperonin system  
1989-1995 **Graduate Research Assistant**, Alexander Glazer, Ph. D., University of California at Berkeley, Berkeley, CA. Studies of a novel class of nucleic acid intercalating dye: properties and applications  
1987-1989 **Undergraduate Research Assistant**, Frederick Rudolph, Ph. D., Rice University, Houston, TX. Enzymology of dihydrofolate reductase  
1981-1985 **High school Research Assistant**, James Stewart, Ph.D., University of Texas at Tyler, Tyler, TX. Investigation of the determinants of bacterial viability following exposure to ultraviolet light

## TEACHING EXPERIENCE

2015 **Instructor**, *Special Topics in Physical Biochemistry* (BICH 489), Texas A&M University  
2011-2014 **Instructor**, *Horizons in Biological Chemistry* (BICH 407), Texas A&M University  
2010-present **Instructor**, *Biochemistry* (BICH 603), Texas A&M University  
2010-present **Instructor**, *Protein Structure, Function and Folding* (BICH 674), Texas A&M University  
2009-2014 **Guest Lecturer**, graduate biochemistry course (BICH 605), Texas A&M University  
2004-2007 **Instructor**, *Biochemistry* (MOL 345; co-taught with Prof. Jane Flint), Princeton University

2001-2007	<b>Instructor</b> , <i>Macromolecular Structure and Mechanism in Disease</i> (MOL 434; new course developed and co-taught with Prof. Yigong Shi), Princeton University
2001-2006	<b>Guest Lecturer</b> , graduate biochemistry course (MOL 504), Princeton University
1991	<b>TA, recitation instructor</b> , undergraduate biochemistry lecture course, University of California, Berkeley
1990	<b>TA, laboratory and recitation instructor</b> , undergraduate biochemistry laboratory course, University of California, Berkeley

#### ACADEMIC AWARDS AND POSITIONS

2001	Beckman Young Investigator Award
1994	President of the Biochemistry, Molecular Biology and Genetics Graduate Student Organization, University of California at Berkeley
1992	Outstanding Teaching Award, University of California at Berkeley
1989	Conferred Magna cum Laude, Rice University
1989	Induction into Phi Beta Kappa Society, Rice University

#### DEPARTMENTAL SERVICE

2014-present	Member, Commons Use Equipment Committee (CUE)
2012	Member, NMR Faculty Search Committee, Texas A&M University
2010-present	Member, Graduate Admissions Committee, Texas A&M University
2004-2007	Member, Undergraduate Committee, Princeton University
2003-2007	Member, Graduate Admissions Committee, Princeton University
2002-2003	Member, Faculty search committee (2 years), Princeton University
2001-2002	Co-chair, Molecular Biology Departmental Retreat Committee (2 years), Princeton University

#### EXTRAMURAL SERVICE

2014	Gene Ontology Consortium, ac hoc consultant
2014	Review Editor, <i>Frontiers in Molecular Biosciences</i>
2013	NIH Peer Review: Outside Reviewer, K99 Award
2011	NIH Peer Review Committee, <i>Macromolecular Structure and Function</i> , C, ad hoc reviewer
2007	Member, Beckman Foundation review panel for BYI Award
2000-present	Ad hoc Reviewer for the following journals: <i>Chemistry &amp; Biology</i> , <i>Biochemistry</i> , <i>European Journal of Biochemistry</i> , <i>Journal of Cell Science</i> , <i>Journal of Biological Chemistry</i> , <i>Journal of Molecular Biology</i> , <i>Molecular Cell</i> , <i>Nature Structural and Molecular Biology</i> , <i>PLoS</i> , <i>PNAS</i> , <i>Cell and Science</i>

#### PROFESSIONAL MEMBERSHIPS

2014-present	ASBMB, AAAS
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## RESEARCH FUNDING

2001-2004	Beckman Young Investigator Award	Direct Costs: \$240,000
2003-2008	NIH 1RO1GM065421	Direct Costs: \$1,000,000 Indirect Costs: \$550,000
2010-2015	NIH 2RO1GM065421	Direct Costs: \$820,000  Indirect Costs: \$400,000

## PERSONAL PROFILE

Date of Birth: August 13, 1967  
Male, marital status: Married

## RESEARCH PUBLICATIONS

Brooks, A., Shoup, D., Kustigian, L., Puchalla, J., Carr, C. M., and **Rye, H. S.** (2015) Single particle fluorescence burst analysis of Epsin induced membrane fission, *PloS One*, (in press).

Weaver, J., Watts, T., Li, P., & **Rye, H. S.** (2014) Structural basis of substrate selectivity of *E. coli* prolidase, *PloS One*, 9: e111531.

Weaver, J., & **Rye, H. S.** (2014) The C-terminal Tails of the Bacterial Chaperonin GroEL Stimulate Protein Folding by Directly Altering the Conformation of a Substrate Protein, *J. Biol. Chem.*, 289: 23219–23232.

Lin, Z., Puchalla, J., Shoup., and **Rye, H.S.**, (2013) Repetitive unfolding by the *trans* ring of the GroEL/GroES complex stimulates folding, *JBC*, **288**: 30944-30955.

Krantz, K., Puchalla, J., Thapa, R., Kobayashi, C., Bisher, M., Viehweg, J., Carr, C.M. and **Rye, H. S.** (2013) Single-particle dynamics of yeast clathrin coat disassembly in free solution, *JBC*, **288**: 26721-26730.

Chen, D., Maddan, D., Weaver, J., Lin, Z., Chiu, W., and **Rye, H. S.** (2013) Visualizing GroEL/ES in the act of encapsulating a non-native substrate protein, *Cell*, **153**: 1354-1365.

Karuri, N., Lin, Z., Kirillova, O., **Rye, H. S.**, and Schwarzbauer, J. E. (2009) Probing the conformation of the fibronectin III<sub>1-2</sub> domain with intramolecular fluorescence resonance energy transfer, *J. Biol. Chem.*, **284**: 3445-34452.

Madan, D., Lin, Z., and **Rye, H. S.** (2008) Triggering protein folding within the GroEL-GroES chaperonin complex, *J. Biol. Chem.* **283**:32003-32013.

- Puchalla, J., Krantz, K., Austin, R., and **Rye, H. S.** (2008) Burst analysis spectroscopy: a versatile, single-particle approach for studying the distributions of protein aggregates and fluorescent assemblies, *PNAS*, **105**: 14400-14405.
- Lin, Z., Madan, D. and **Rye, H. S.** (2008) GroEL stimulates protein folding through forced unfolding, *Nat Struct Mol Bio*, **15**: 303-311.
- Lin, Z. and **Rye, H.S.** (2006) GroEL-mediated protein folding: making the impossible, possible. *Crit Rev Biochem Mol Biol.*, **41**: 211-239.
- Rye, H. S.** (2004) Fluorescence Resonance Energy Transfer, *Ergito.com* in Techniques.
- Lin, Z and **Rye, H. S.** (2004) Expansion and compression of a protein folding intermediate by GroEL. *Mol. Cell* **16**:23-24.
- Chaudhry C., Farr G.W., Todd M.J., **Rye H.S.**, Brunger A.T., Adams P.D., Horwich A.L., Sigler P.B. (2003) Role of the gamma-phosphate of ATP in triggering protein folding by GroEL-GroES: function, structure and energetics. *EMBO J.* **22**:4877-87.
- Rye, H.S.** (2001) Application of fluorescence resonance energy transfer to the GroEL-GroES chaperonin reaction. *Methods* **24**: 278-288.
- Rye, H.S.**, Roseman, A. M., Saibil, H. R., Furtak, K. and Horwich, A. L. (1999) Cycling of the GroEL-GroES machine: nucleotide and non-native polypeptide direct alternation of folding-active rings. *Cell* **97**:325-338.
- Sigler, P. B., Xu, Z., **Rye, H. S.**, Burston, S. G., Fenton, W. A., and Horwich, A. L. (1998) Structure and function in GroEL-mediated protein folding. *Annu. Rev. Biochem.* **67**:581-608.
- Rye, H. S.**, Burston, S. G., Fenton, W. A., Beechem, J. M., Xu, Z., Sigler, P. B., Horwich, A. L. (1997) Distinct actions of *cis* and *trans* ATP within the double ring of the chaperonin GroEL. *Nature* **388**:792-798.
- Horwich, A. L., Burston, S. G., **Rye, H. S.**, Weissman, J. S. and Fenton, W. A. (1997) Construction of single-ring and two-ring versions of bacterial chaperonin GroEL. *Methods Enzymol.* **290**: 141-146.
- Drees, B. L., **Rye, H. S.**, Glazer, A. N. and Nelson, C. M. (1996) Environment-sensitive labels in multiplex fluorescence analysis of protein-DNA complexes. *J. Biol. Chem.* **271**:32168-32173.
- Weissman, J. S., **Rye, H. S.**, Fenton W. A., Beechem, J. M., and Horwich, A. L. (1996) Characterization of the active intermediate of a GroEL-GroES-mediated protein folding reaction. *Cell* **84**:481-490.
- Rye, H. S.** and Glazer, A. N. (1995) Interaction of dimeric intercalating dyes with single stranded DNA. *Nucleic Acids Res.* **23**:1215-1222.

Zhu, H., Clark, S. M., Benson, S. C., **Rye, H. S.**, Glazer, A. N. and Mathies, R. A. (1994) High-sensitivity capillary electrophoresis of double-stranded DNA fragments using monomeric and dimeric fluorescent intercalating dyes. *Anal. Chem.* **66**:1941-1948.

Mathies, R. M., Scherer, J. R., Quesada, M. A., **Rye, H. S.** and Glazer, A. N. (1994) Laser-excited confocal-fluorescence gel scanner. *Rev. Sci. Instrum.* **65**:807-812.

**Rye, H. S.**, Yue, S., Quesada, M. A., Haugland, R. P., Mathies, R. A. and Glazer, A. N. (1993) Picogram detection of stable dye-DNA intercalation complexes with a two-color laser-excited confocal fluorescence gel scanner. *Methods Enzymol.* **217**:414-431.

**Rye, H. S.**, Drees, B. L., Nelson, H. C. M. and Glazer, A. N. (1993) Stable fluorescent dye-DNA complexes in high sensitivity detection of protein-DNA interactions. *J. Biol. Chem.* **268**:25229-25238.

**Rye, H. S.**, Dabora, J. M., Quesada, M. A., Mathies, R. A. and Glazer, A. N. (1993) Fluorometric assay using dimeric dyes for double and single stranded DNA and RNA with picogram sensitivity. *Anal. Biochem.* **208**:144-150.

Glazer, A. N. and **Rye, H. S.** (1992) Stable dye-DNA intercalation complexes as reagents for high-sensitivity fluorescence detection. *Nature* **359**:859-861.

**Rye, H. S.**, Yue, S., Wemmer, D. E., Quesada, M. A., Haugland, R. P., Mathies, R. A. and Glazer, A. N. (1992) Stable fluorescent complexes of double-stranded DNA with bis-intercalating asymmetric cyanine dyes: properties and applications. *Nucleic Acids Res.* **20**:2803-2812.

**Rye, H. S.**, Quesada, M. A., Peck, K., Mathies, R. A. and Glazer, A. N. (1991) High-sensitivity two-color detection of double-stranded DNA with a confocal fluorescence gel scanner using ethidium homodimer and thiazole orange. *Nucleic Acids Res.* **19**:327-333.

## INVITED LECTURES

Rye, H.S. (2015) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, Kansas University Medical Center, Kansas City, Department of Biochemistry and Molecular Biology, departmental seminar.

Rye, H.S. (2014) Epsin induced membrane fission resolved by single particle fluorescence burst analysis, 9th International Weber Symposium on Innovative Methodologies in Biochemistry and Medicine, Kauai, HI.

Rye, H.S. (2014) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, International Symposium on Chaperonin Protein Folding, Arolla, Switzerland.

Rye, H.S. (2013) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, University of Texas Medical School, Houston, Department of Microbiology and Molecular Genetics, departmental seminar.

Rye, H.S. (2013) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, University of Texas, Southwestern Medical School, Department of Biophysics, departmental seminar.

Rye, H.S. (2013) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, Zentrum für Molekulare Biologie, Universität Heidelberg, Heidelberg, Germany, departmental seminar.

Rye, H.S. (2013) Substrate protein encapsulation and the initiation of protein folding by GroEL-ES, EMBO Research Conference, "The Biology of Molecular Chaperones: From molecules, organelles and cells to misfolding diseases," Santa Margherita di Pula, Sardinia, Italy.

Rye, H.S. (2012) Visualizing GroEL/ES in the act of encapsulating a non-native substrate protein, FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, VT.

Rye, H. S. (2012) Visualizing GroEL/ES in the act of encapsulating a non-native substrate protein, Cold Spring Harbor Laboratory Meeting, "Molecular Chaperones and the Heat Shock Response," Cold Spring Harbor, New York.

Rye, H.S. (2011) Substrate protein loading and unfolding on a GroEL ring, Department of Biochemistry and Molecular Biology, University of Georgia, Athens, GA, departmental seminar

Rye, H.S. (2011) Substrate protein loading and unfolding on a GroEL ring, Department of Biology, Texas A&M University, College Station, TX, departmental seminar.

Rye, H.S. (2010) Substrate protein loading and unfolding on a GroEL ring, Symposium on Macromolecular Machines, Universität Heidelberg, Heidelberg, Germany

Rye, H.S. (2010) Substrate protein loading and unfolding on a GroEL ring, FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, VT.

Rye, H. S. (2010) In search of control: protein folding, self-assembly and molecular chaperones, Texas Protein Folders Meeting, Camp Allen, TX.

Rye, H.S. (2009) Frozen in Time: A snapshot of protein folding inside the GroEL-GroES cavity, Baylor College of Medicine, National Center for Macromolecular Imaging, Advances in Applications of Cryo-EM Symposium

Rye, H. S. (2009) In search of control: protein folding, self-assembly and molecular chaperones, IUPUI, Indianapolis, IN, Department of Biology, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Texas A&M University, College Station, TX, Department of Biochemistry and Biophysics, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, University of Michigan, Ann Arbor, MI, Department of Molecular, Cellular and Developmental Biology, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Wesleyan University, Middletown, CT, Department of Molecular Biology and Biochemistry, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Public Health Research Institute, UMDNJ, Newark, NJ, departmental seminar.

Rye, H. S. (2008) GroEL stimulates protein folding through forced unfolding, Cold Spring Harbor Laboratory Meeting, "Molecular Chaperones and the Heat Shock Response," Cold Spring Harbor, New York.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Rutgers University, Piscataway, NJ, Department of Molecular Biology and Biochemistry, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Purdue University, West Lafayette, Indiana, Department of Biological Sciences, departmental seminar.

Rye, H. S. (2008) In search of control: protein folding, self-assembly and molecular chaperones, Cornell University, Ithaca, New York, Biophysics Colloquium.

Rye, H. S. (2007) In search of control: protein folding, self-assembly and molecular chaperones, Princeton University, Princeton, New Jersey, Department of Molecular Biology, departmental seminar.

Rye, H. S. (2006) How do molecular chaperones assist in protein folding and why are they required? Tarrant County College, Bedford, Texas, Department of Biology, departmental seminar.

Rye, H.S. (2006) Unfolding, compaction and release of substrate proteins by GroEL, University of Massachusetts, Worcester, Massachusetts, Department of Biochemistry and Molecular Pharmacology, departmental seminar.

Rye, H. S. (2006) Unfolding, compaction and release of substrate proteins by GroEL, Cold Spring Harbor Laboratory Meeting, "Molecular Chaperones and the Heat Shock Response," Cold Spring Harbor, New York.

Rye, H.S. (2005) Unfolding, compaction and release of substrate proteins by GroEL, University of Pennsylvania, Department of Biochemistry and Biophysics, departmental seminar.

Rye, H. S. (2005) Expansion and compression of a protein folding intermediate by GroEL, New Zealand Society for Biochemistry and Molecular Biology (NZSBMB) Conference, Dunedin, NZ.

Rye, H.S. (2005) Expansion and compression of a protein folding intermediate by GroEL, UMDNJ-Newark, Department of Biochemistry, departmental seminar.

Rye, H. S. (2004) Expansion and compression of a protein folding intermediate by GroEL, University of Maryland, Biophysics Colloquium.

Rye, H. S. (2004) Expansion and compression of a protein folding intermediate by GroEL, FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, Vermont.

Rye, H. S. (2004) Expansion and compression of a protein folding intermediate by GroEL, Cold Spring Harbor Laboratory Meeting, "Molecular Chaperones and the Heat Shock Response," Cold Spring Harbor, New York.

Rye, H. S. (2000) The two-stroke protein folding cycle of the GroEL/GroES chaperonin machine, Princeton University, Department of Molecular Biology, departmental seminar.

Rye, H. S. (2000) The two-stroke protein folding cycle of the GroEL/GroES chaperonin machine, University of Illinois, Urbana-Champaign, Department of Biochemistry, departmental seminar.

Rye, H. S. (2000) The two-stroke protein folding cycle of the GroEL/GroES chaperonin machine, Johns Hopkins University, Department of Biophysics, departmental seminar.

Rye, H. S. (2000) The two-stroke protein folding cycle of the GroEL/GroES chaperonin machine, Cell Biology and Metabolism Branch, NICHD, National Institutes of Health, departmental seminar.

#### POSTERS PRESENTED AT SCIENTIFIC MEETINGS

Lin, Z. and Rye, H.S. (2006) Multi-axis expansion and unfolding of a GroEL substrate protein. FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, Vermont.

Lin, Z., McGarrah R. and Rye, H.S. (2002) The influence of cavity lifetime and substrate conformation on GroEL-mediated protein folding. FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, Vermont.

Rye, H.S., Chaudhry, C. and Horwich, A.L. (2000) Non-hydrolyzable ATP analogs made from metal-fluorides and the lifetime of the GroEL-GroES folding cavity. FASEB Summer Research Conference, "Protein Folding and Assembly in the Cell," Saxtons River, Vermont.



Rye, H.S., Furtak, K., and Horwich, A.L. (1998) Dynamics and directionality of the GroEL-GroES reaction cycle studied by fluorescence resonance energy transfer, Cold Spring Harbor Laboratory Meeting, "Molecular Chaperones and the Heat Shock Response," Cold Spring Harbor, New York.

Rye, H.S., Furtak, K., and Horwich, A.L. (1998) Dynamics and directionality of the GroEL-GroES reaction cycle studied by fluorescence resonance energy transfer, EMBO Workshop, "Protein Folding and Misfolding Inside and Outside the Cell," Oxford, UK.

Rye, H. S., Burston, S.G., Fenton, W. A., Beechem, J. M., Xu, Z., Sigler, P. B., Horwich, A. L. (1997) Nature of GroEL as a double ring chaperonin: Distinct actions of ATP in *cis* and *trans*. European Science Foundation, European Research Conference, "Biology of Molecular Chaperones" (97-015), Obernai, France.

## REFERENCES

Dr. Arthur Horwich  
Yale University School of Medicine  
New Haven, CT  
arthur.horwich@yale.edu  
203-737-4431

Dr. Thomas Silhavy  
Princeton University  
Princeton, NJ  
tsilhavy@Princeton.EDU  
609-258-5899

Dr. George Lorimer  
University of Maryland  
College Park, MD  
glorimer@umd.edu  
301-405-1828

Dr. Frederick Hughson  
Princeton University  
Princeton, NJ  
hughson@princeton.edu  
609-258-4982