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## EDUCATION

- 1994 **Ph.D., Chemical Engineering** University of Illinois at Urbana-Champaign  
Dissertation: “*Engineering the Yeast Secretory Pathway: The role of BiP and PDI in the secretion of foreign proteins in Saccharomyces cerevisiae.*”  
Advisors: Prof. Douglas A. Lauffenburger, Prof. K. Dane Wittrup
- 1989 **M.S., Chemical Engineering** The Johns Hopkins University  
Thesis: “*Isolation and Characterization of Proteolytic Enzymes from the Hyperthermophilic Archaeobacterium Pyrococcus furiosus.*”  
Advisor: Prof. Robert M. Kelly
- 1988 **B.S., Chemical Engineering** The Johns Hopkins University  
Departmental Honors GPA 3.89/4.0

## PROFESSIONAL EXPERIENCE

- 2008-present **Associate Chair for Biochemical Engineering**  
*University of Delaware, Department of Chemical Engineering*
- 2008-present **Full Professor**  
*University of Delaware, Department of Chemical Engineering*
- 2003-2008 **Associate Professor**  
*University of Delaware, Department of Chemical Engineering*
- 1997-2003 **Assistant Professor**  
*University of Delaware, Department of Chemical Engineering*
- 1994-1997 **Postdoctoral Fellow**  
*Massachusetts Institute of Technology, Department of Biology*  
Advised by Professor Jonathan King.  
Determined the role of cysteine side chains in the folding of the tailspike protein of P22 bacteriophage. Identified a novel intermediate along the folding pathway, a disulfide-bonded association intermediate in a non-disulfide bonded protein. The existence of this intermediate has a major impact on our understanding of the forces that drive protein folding.

## ACADEMIC HONORS

- 2002 Outstanding Junior Faculty Member, College of Engineering, University of Delaware
- 2000-2005 NSF Presidential Early Career Award in Science and Engineering (PECASE/Career)

~400 Career Awards/year. PECASE award for subset of Career Award winners – 20 awarded for all NSF Directorates in 2000, of which only 2 were to chemical engineers.

- 2000-2003 DuPont Young Professor  
 2000 National Academy of Engineering, Sixth Annual Frontiers in Engineering, One of 100 invited participants, Irvine, CA  
 1996-97 NIH Postdoctoral Fellowship (~900 awarded/yr)  
 1992-94 Clare Booth Luce Graduate Fellowship (~350 awarded since 1970)  
 1989-92 Department of Defense Fellowship (NDSEG) (~100 awarded/yr)  
 1988-89 NSF Creativity Award for Scientists and Engineers  
 ~20 awarded/yr following review of proposal and personal interview  
 1988 National Science Foundation Fellowship awarded (declined)  
 (~30 in Chemical Engineering/yr of 900 awarded in all disciplines)  
 1988-89 Tau Beta Pi Fellowship (~30 awarded/yr)  
 1984-88 Beneficial Hodson Scholarship, Johns Hopkins University (~15 awarded/yr)

## PATENTS

- A) Kelly, R.M., A.K.S. Robinson, I.I. Blumentals, S.H. Brown, and C.B. Anfinsen. "Proteolytic Enzymes from Hyperthermophilic Bacteria and Processes for Their Production." Patent # 5,242,817. Filed 9/12/89. Accepted 9/7/93. Licensed to Takara Shuzo.  
 B) Robinson, A.S. and K.D. Wittrup. "Methods for Increasing Secretion of Overexpressed Proteins." Patent # 5,773,245. Filed 10/92. Accepted 6/30/98.  
 C) Robinson, A.S., D. Foguel, J.L. Silva, C.R. Robinson. "Use of Hydrostatic Pressure to Inhibit and Reverse Protein Aggregation and Facilitate Protein Refolding." Patent applied for, 60/161,035. Filed 10/99.

## BOOK PUBLICATION

- 1) Russell, T.W.F., Robinson, A.S., and Wagner, N.J., (2008) Mass and Heat Transfer: Analysis of Mass Contactors and Heat Exchangers, Cambridge University Press, Cambridge, UK (www.cambridge.org/9780521886703).

## PUBLICATIONS

- Blumentals, I. I., R. M. Kelly, A. K. Skaja [Robinson] and J. Shiloach . (1987) "Effect of Culturing Conditions on the Production of Exotoxin A by *Pseudomonas aeruginosa*." *Ann N Y Acad. Sci.* **506**, 663-668.
- Blumentals, I. I., A. S. Robinson and R. M. Kelly . (1990). "Characterization of Sodium Dodecyl Sulfate Resistant Proteolytic Activity in the Hyperthermophilic Archaeobacterium *Pyrococcus furiosus*." *Appl. Envir. Microbiol.* **56**, 1992-1998.
- Blumentals, I.I., S.H. Brown, R.N. Schicho, A.K. Skaja [Robinson], H.R. Costantino, and R.M. Kelly . (1990) "The Hyperthermophilic Archaeobacterium, *Pyrococcus furiosus*: Development of Culturing Protocols, Perspectives on Scale-Up, and Potential Applications." *Ann. N.Y. Acad. Sci.*, **589**, 301-314.
- Robinson, A.S. and K.D. Wittrup (1993) "Role of the Protein Folding Chaperone BiP in Secretion of Foreign Proteins in Eucaryotic Cells." in *Protein Folding: In vivo and In vitro*. ACS Symposium Series 526. Jeffrey Cleland, Ed., 121-132.
- Robinson, A.S., V. Hines, and K.D. Wittrup (1994) "Overexpression of Protein Disulfide Isomerase Increases Secretion of Foreign Proteins in the Yeast *Saccharomyces cerevisiae*." *Bio/Tech.* **12**, 381-384.

- 6) Wittrup , K.D., A.S. Robinson, R.N. Parekh, and K.J. Forrester (1994) “Existence of an Optimal Expression Level for Secretion of Foreign Proteins in Yeast.” *Ann. N.Y. Acad. Sci.* **745**, 321-330.
- 7) Robinson, A.S. and K.D. Wittrup (1995) “Constitutive Overexpression of Secreted Heterologous Proteins Decreases Extractable BiP and PDI Levels in *Saccharomyces cerevisiae*.” *Biotech Prog.* **11**, 171-177.
- 8) King , J., C. Haase-Pettingell, A.S. Robinson, M. Speed, and A. Mitraki (1996) “Thermolabile Folding Intermediates: Inclusion Body Precursors and Chaperonin Substrates” *FASEB J.*, **10**, 57-66.
- 9) Robinson, A.S., J.A. Bockhaus, A.C. Voegler, and K.D. Wittrup (1996) “Reduction of BiP levels decreases heterologous protein secretion in *Saccharomyces cerevisiae*” *J. Biol. Chem.* **271**, 10017-10022.
- 10) Robinson, A.S. and D.A. Lauffenburger (1996) “Model for ER Chaperone Dynamics and Secretory Protein Interactions.” *AICHE J.* **42**, 1443-1453.
- 11) Robinson, A.S. and J. King , (1997) “Disulfide-Bonded Intermediate on the Folding and Assembly Pathway of a Non-Disulfide Bonded Protein.” *Nature Struct. Biol.*, **4**, 450-455.
- 12) Foguel, D., Robinson, C.R., Caetano de Sousa Jr., P., Silva, J. L. and A. S. Robinson (1999), “Hydrostatic Pressure Rescues Protein Aggregates”, *Biotech. Bioeng.* **63**, 552-558.
- 13) Haase-Pettingell, C., Betts, S., Raso, S.W., Stuart, L., Robinson, A.S. and J. King (2001), “Role for Cysteine Residues in the In Vivo Folding and Assembly of the Phage P22 Tailspike,” *Protein Sci.* **10**, 397-410.
- 14) Kauffman, K., P. Dhurjati, A.S. Robinson, and F.J. Doyle III , “Framework for Modeling Information Flow in Biological Processes: Application to the Unfolded Protein Response.” *Proc. IFAC Conf. Comput. Appl. Biotech (CAB)*, 2001.
- 15) Kauffman, K., Pridgen, E.M., Doyle, F.J. III, Dhurjati, P., and A.S. Robinson (2002) “Decreased Protein Expression and Oscillating BiP Levels Result during Heterologous Protein Expression in *S. cerevisiae*,” *Biotech. Prog.*, **18**, 942-940. DOI: [10.1021/bp025518g](https://doi.org/10.1021/bp025518g)
- 16) Sinacola, J. and A.S. Robinson (2002) “Rapid refolding and polishing of single-chain antibodies from *E. coli* inclusion bodies” *Protein Exp. Purif.*, Vol. 26, No. 2, Nov 2002, pp. 301-308. DOI: [10.1016/S1046-5928\(02\)00538-7](https://doi.org/10.1016/S1046-5928(02)00538-7)
- 17) Smith, J.D. and A.S. Robinson (2002) “Expression of an archael enzyme in a eucaryotic host: A secretion bottleneck at the ER,” *Biotech. Bioeng.*, **79**, 7, p. 713-723. DOI: [10.1002/bit.10367](https://doi.org/10.1002/bit.10367)
- 18) Lefebvre, B.G., and A.S. Robinson (2003), “Pressure treatment of tailspike aggregates rapidly produces on-pathway folding intermediates,” *Biotech. Bioeng.*, **82**, 5, p. 595-604. DOI: [10.1002/bit.10607](https://doi.org/10.1002/bit.10607)
- 19) Danek, B.L., and A. S. Robinson (2003) “Non-native interactions between cysteines direct productive assembly of P22 tailspike protein,” *Biophys J.*, **85**, 5, p. 1-11.
- 20) Butz, J., Niebauer, R. T., and A.S. Robinson (2003), “Interaction with ER-resident Proteins is not a Bottleneck for Mammalian G-Protein Coupled Receptor Expression in Yeast,” *Biotech. Bioeng.*, **84**, 3, p. 292-304. DOI: [10.1002/bit.10771](https://doi.org/10.1002/bit.10771).
- 21) Gage, M.J. and A.S. Robinson (2003) “C-terminal Hydrophobic Interactions Play a Critical role in Oligomeric Assembly of the P22 Tailspike Trimer,” *Protein Sci.*, **12**, 12, p. 2732-47.
- 22) Smith, J.D., Tang, B.C., and A.S. Robinson (2004) “Protein disulfide isomerase, but not binding protein, overexpression enhances secretion of a non-disulfide-bonded protein in yeast”, *Biotech. Bioeng.*, **85**, 3, p. 340-50.
- 23) Niebauer, R. T. and A.S. Robinson (2004) “*Saccharomyces cerevisiae* protein expression: From protein production to protein engineering” in *Expression Technologies*, Horizon Scientific Press.
- 24) Lefebvre, B.G., Gage, M.J., and A.S. Robinson (2004) “Maximizing Recovery of Native Protein from Aggregates by Optimizing Pressure Treatment,” *Biotechnology Progress*, **20**, 2, p. 623-629. DOI: [10.1021/bp034221v](https://doi.org/10.1021/bp034221v).

- 25) Lefebvre, B.G., Comolli, N.K., Gage, M.J. and A.S. Robinson \* (2004), “Pressure dissociation studies provide insight into oligomerization competence of temperature-sensitive mutants of P22 tailspike,” *Protein Sci.*, 13 (6) 1538-46.
- 26) Danek, B.L. and A. S. Robinson \* (2004) “P22 tailspike trimer assembly is governed by interchain redox associations,” *Biochem. Biophys. Acta*, 1700(1):105-16. [5]
- 27) Niebauer, R.T., Wedekind, A. † and A.S. Robinson \* (2004) “Decreases in yeast expression yields of the human adenosine receptor are a result of translational or post-translational events”, *Protein Exp. Purif.*, 37 (1) 134-143. [7]
- 28) Xu, P., Raden, D., Doyle, F.J. III, and A.S. Robinson \* (2005) “Analysis of unfolded protein response during single-chain antibody expression in *Saccharomyces cerevisiae* reveals different roles for BiP and PDI in folding”, *Metabolic Engineering*, 7 (4) 269-279. [4]
- 29) Gage, M.J., Zak, J. † and A.S. Robinson \* (2005) “Three Amino Acids that are Critical to Formation and Stability of the P22 Tailspike Trimer”, *Protein Science*, 14 (9) 2333-43. [1]
- 30) Smith, J.D., Richardson, N.E. and A.S. Robinson \* (2005) “Elevated expression temperature in a mesophilic host results in increased secretion of a hyperthermophilic enzyme and decreased cell stress,” *Biochem. Biophys. Acta*, 1752 (1) 18-25. [1]
- 31) Raden, D., Hildebrandt, S, Xu, P., Bell, E. †, Doyle, III, F.J. and A.S. Robinson \* (2005), “Analysis of cellular response to protein overexpression.” IEE Proceedings: Systems Biology 152 (4) 285-289. [1]
- 32) Niebauer, R. T., and A.S. Robinson \* (2006) “Exceptional total and functional yields of the human adenosine (A2a) receptor expressed in the yeast *Saccharomyces cerevisiae*”, *Prot. Exp. Purif.*, 46, p. 204-211. [4]
- 33) Gage, M.J, Lefebvre, B.G., and A.S. Robinson \* (2006) “Determinants of Protein Folding and Aggregation in P22 Tailspike,” in Misbehaving Proteins, ACS Publications, eds. Regina Murphy and Amos Tsai. [not indexed]
- 34) Kim, J. and Robinson, A.S. \* (2006) Dissociation of intermolecular disulfide bonds in P22 tailspike protein intermediates in the presence of SDS, *Protein Science*, 15 (7), p. 1791-3. [1]
- 35) Wedekind, A.L. †, O’Malley, M., Niebauer, R.T., and Robinson, A.S. \* (2006) Optimization of the Human Adenosine A<sub>2a</sub> Receptor Yields in *Saccharomyces cerevisiae*, *Biotechnology Progress*, 22(5):1249-55. [1]
- 36) Powers, S.L., Robinson, C.R., and Robinson, A.S. \* (2007) Denaturation of an Extremely Stable Hyperthermophilic Protein Occurs via a Dimeric Intermediate, *Extremophiles*, 11(1):179-89. [1]
- 37) Forsten-Williams \*, K.F., Cassino, T.R, Delo, L.J., Bellis, A.D., Robinson, A.S., and Ryan, T.E., (2007) Enhanced Insulin-like Growth Factor-I (IGF-I) Cell Association at Reduced pH is Dependent on IGF Binding Protein-3 (IGFBP-3) Interaction, *Journal of Cellular Physiology*, 210(2):298-308.
- 38) Famá, M.C., Raden, D., Zacchi, N., Lemos, D.R., Robinson, A.S., and Silberstein, S. \* (2007) “The *Saccharomyces cerevisiae* YFR041C/ERJ5 gene encoding a type I membrane protein with a J domain is required to preserve the folding capacity of the endoplasmic reticulum” *Biochim Biophys Acta*, 1773(2):232-42.
- 39) Bane, S.E., Velasquez, J.E. †, and A.S. Robinson \* (2007) “Expression and purification of milligram levels of inactive G-protein coupled receptors in *E. coli*”, *Protein Expression and Purification*, 52(2):348:355.
- 40) Powers, S.L. and A.S. Robinson \* (2007) “PDI Improves Secretion of Redox-Inactive  $\beta$ -glucosidase”, *Biotech Prog.*, Mar-Apr;23(2):364-9. E-pub Feb 22, DOI: 10.1021/bp060287p

- 41) McCusker, E., O'Malley, M., Bane, S.E., and A.S. Robinson\* (2007), "Heterologous GPCR expression: A bottleneck to obtaining crystal structures", *Biotech Progress*, May-Jun;23(3):540-7.
- 42) O'Malley, M., Lazarova, T., Britton, Z.T., and Robinson, A.S.\* (2007) "High-level expression in *Saccharomyces cerevisiae* enables isolation and spectroscopic characterization of functional human adenosine A<sub>2a</sub> receptor", *J. Struct Biol.*, 159(2): 166-178.
- 43) McCusker, E., and Robinson, A.S.\*, (2008) Refolding of G protein  $\alpha$  subunits from inclusion bodies expressed in *Escherichia coli*, *Protein Exp. Purif.*, Apr;58(2): 342-55. Epub 2007 Dec 8.
- 44) Hildebrandt, S., D. Raden, L. Petzold, A.S. Robinson, and F.J. Doyle III\* (2008) "A top-down approach to mechanistic biological modeling: application to the single-chain antibody folding pathway", *Biophysical Journal*, 95(8):3535-58. Epub 2008 Jul 18.
- 45) Webber T, Gurung S, Saul J, Baker T, Spataro M, Freyer M, Robinson AS, Gage MJ\* (2009) "The C-terminus of the P22 tailspike protein acts as an independent oligomerization domain for monomeric proteins.", *Biochem J.* Feb 5. [Epub ahead of print] PMID: 19196242
- 46) Spataro ML, Roberts CJ, Robinson AS\* (2009) "Kinetic folding studies of the P22 tailspike beta-helix domain reveal multiple unfolded states." *Biophys Chem.* 141(2-3):214-21. PMID: 19258192
- 47) Xu, P. and Robinson, A.S.\* (2009) "Decreased secretion and unfolded protein response up-regulation are correlated with intracellular retention for single-chain antibody variants produced in yeast" *Biotech & Bioeng*, in press.

#### PEER-REVIEWED CONFERENCE PROCEEDINGS

- 48) Hildebrandt, S., D. Raden, E. Bell<sup>†</sup>, A.S. Robinson, and F.J. Doyle III\* (2005) "Modeling the Unfolded Protein Response in *Saccharomyces Cerevisiae*", Proc. Int. Conf. Foundations of Systems Biology, Santa Barbara, California. [not indexed]
- 49) Griesemer, M., Young, C., Raden, D., Petzold, L., Robinson, A.S., Doyle, F.J.\* (2007) "Computational Modeling of Chaperone Interactions in the Endoplasmic Reticulum of *Saccharomyces cerevisiae*." Proc. Int. Conf. Foundations of Systems Biology, Stuttgart, Germany.
- 50) Yuraszek, T., Raden, D., Robinson, A.S., and Doyle, F.J.\* (2007) "Microarray Analysis of the Unfolded Protein Response in *S. cerevisiae* Reveals Evidence of Down-regulation." Proc. Int. Conf. Foundations of Systems Biology, Stuttgart, Germany.