

# Joshua L. Price, Ph.D.

Department of Chemistry and Biochemistry  
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## PROFESSIONAL APPOINTMENTS

- Brigham Young University** – Provo, Utah  
2022-present Professor, Department of Chemistry and Biochemistry  
2017-2022 Associate Professor, Department of Chemistry and Biochemistry  
2011-2017 Assistant Professor, Department of Chemistry and Biochemistry
- The Scripps Research Institute** – La Jolla, California  
2008-2011 NIH Postdoctoral Research Fellow (Professor Jeffery W. Kelly)  
Stabilizing protein native states by N-glycosylation of enhanced aromatic sequons in reverse turns

## EDUCATION

- University of Wisconsin** – Madison, Wisconsin  
2003-2008 Ph.D., Chemistry (Professor Samuel H. Gellman)  
Dissertation: “Development of  $\alpha/\beta$ -Peptide Foldamer Tertiary and Quaternary Structure”
- Argonne National Laboratory** – Argonne, Illinois  
2005 NIH Chemistry-Biology Interface Training Grant Internship (Professor Brian K. Kay)  
Phage display of peptide libraries for probing coiled-coil pairing specificity
- Brigham Young University** – Provo, Utah  
1997-2003 B.S., Biochemistry, *summa cum laude*, with University Honors  
Undergraduate research:  
2001-2003 Honors Thesis: “Thermodynamics of L-valine and L-2-amino-n-butanoic acid”  
(Professor Earl M. Woolley)  
2003 Synthesis of amino retinoid compounds (Professor Heidi R. Vollmer-Snarr)

## AWARDS AND HONORS

- 2022 Outstanding Teaching, College of Physical and Mathematical Sciences  
2008-2011 NIH Ruth L. Kirschstein NRSA Postdoctoral Fellowship  
2008 Hirschmann/Rich Graduate Award in Bioorganic Chemistry, University of Wisconsin  
2004-2007 NIH Chemistry-Biology Interface Training Grant Fellowship  
2003 Samuel L. McElvain Fellowship, University of Wisconsin  
2003 Keith P. Anderson Outstanding Senior Student in Chemistry, Brigham Young University  
2003 Cancer Research Fellowship, Brigham Young University  
2002-2003 Barry M. Goldwater Scholarship  
2002 Office of Research and Creative Activities Fellowship, Brigham Young University  
1997-2003 Kimberly Clark Bright Futures Scholarship  
1997-2003 National Merit Scholarship, Brigham Young University

## RESEARCH SUPPORT

Title: The Mechanism of Pausing and Restarting Translation in Bacteria  
Agency: National Institutes of Health, National Institute of General Medical Sciences  
Number: 5R01GM110113-02  
PI: Allen R. Buskirk  
Total: \$50,000 (subcontract to Joshua L. Price)  
Dates: 6/30/2014 – 5/31/2016

Title: Predictive Structure-based Guidelines for Identifying Optimal PEGylation Sites within Proteins  
Agency: National Institutes of Health, National Institute of General Medical Sciences  
Number: 1R15GM116055-01  
PI: Joshua L. Price  
Total: \$345,600  
Dates: 9/1/15 – 8/31/18

Title: Predictive Structure-based Guidelines for Identifying Optimal PEGylation Sites within Proteins and Understanding the Context-Dependence of Noncovalent Interactions  
Agency: National Institutes of Health, National Institute of General Medical Sciences  
Number: 2R15GM116055-02  
PI: Joshua L. Price  
Total: \$435,751  
Dates: 5/1/20 – 3/31/24

## PUBLICATIONS (Corresponding author denoted by asterisk)

45. Dalley, N.A.; Stern, K.L.; Kitchen, R.R.; Lloyd, K.B.; **Price, J.L.\*** “Electrostatic origin of a stabilizing synergistic interaction among b-, c-, and f-residues in a trimeric coiled coil.” *Peptide Sci.* **2023**, e24336.
44. Coram, A.E.; Morewood, R.; Voss, S.; **Price, J.L.\***; Nitsche, C.\* “Exploring biocompatible chemistry to create stapled and photoswitchable variants of the antimicrobial peptide aurein 1.2.” *J. Peptide Sci.* **2023**, e3551. doi: 10.1002/psc.3551.
43. Stern, J.A.; Free, T.J.; Stern, K.L.; Gardiner, S.; Dalley, N.A.; Bundy, B.C.; **Price, J.L.**; Wingate, D.; Della Corte, D.\* “A probabilistic view of protein stability, conformational specificity, and design.” *Scientific Reports* **2023**, *13*, 15493. doi: 10.1038/s41598-023-42032-1.
42. Xiao, Q.; Jones, Z.B.; Hatfield, S.C.; Ashton, D.S.; Dalley, N.A.; Dyer, C.D.; Evangelista, J.L.; **Price, J.L.\*** “Structural guidelines for stabilization of  $\alpha$ -helical coiled coils via PEG stapling.” *RSC Chem. Biol.* **2022**, *3*, 1096–1104. doi: 10.1039/D1CB00237F.
41. Stern, K.L.; Dalley, N.A.; McMurray, N.T.; Billings, W.M.; Loftus, T.J.; Jones, Z.B.; Hatfield, J.R.; **Price, J.L.\*** “Prerequisites for Stabilizing Long-Range Synergistic Interactions among b-, c-, and f-Residues in Coiled Coils.” *Biochemistry* **2022**, *61*, 319–326. doi: 10.1021/acs.biochem.1c00760.
40. Draper, S.R.E.; Jones, Z.B.; Earl, S.O.; Dalley, N.A.; Ashton, D.S.; Carter, A.J.; Conover, B.M.; **Price, J.L.\*** “PEGylation Increases the Strength of a Nearby NH- $\pi$  Hydrogen Bond in the WW Domain.” *Biochemistry*, **2021**, *60*, 2064–2070. doi: 10.1021/acs.biochem.1c00132.
39. Xiao, Q.; Ashton, D.S.; Jones, Z.B.; Thompson, K.P.; **Price, J.L.\*** “Long-range PEG stapling: macrocyclization for increased protein conformational stability and resistance to proteolysis.” *RSC Chem. Biol.* **2020**, *1*, 273–280. doi: 10.1039/D0CB00075B.

38. Stern, K.L.; Smith, M.S.; Billings, W.M.; Loftus, T.J.; Conover, B.M.; Della Corte, D.; **Price, J.L.\*** “Context-Dependent Stabilizing Interactions among Solvent-Exposed Residues along the Surface of a Trimeric Helix Bundle.” *Biochemistry* **2020**, *59*, 1672–1679. doi: 10.1021/acs.biochem.0c00045.
37. Draper, S.R.E.; Ashton, D.S.; Conover, B.M.; Carter, A.J.; Stern, K.L.; Xiao, Q.X.; **Price, J.L.\*** “PEGylation near a Patch of Nonpolar Surface Residues Increases the Conformational Stability of the WW domain.” *J. Org. Chem.* **2020**, *85*, 1725–1730. doi: 10.1021/acs.joc.9b02615.
36. Xiao, Q.; Draper, S.R.E.; Smith, M.S.; Brown, N.; Pugmire, N.A.B.; Ashton, D.S.; Carter, A.J.; Lawrence, E.E.K.; **Price, J.L.\*** “Influence of PEGylation on the Strength of Protein Surface Salt Bridges.” *ACS Chem. Biol.* **2019**, *14*, 1652–1659. doi: 10.1021/acscchembio.9b00432.
35. Xiao, Q.; Bécar, N.A.; Brown, N.P.; Smith, M.S.; Stern, K.L.; Draper, S.R.E.; Thompson, K.P.; **Price, J.L.\*** “Stapling of two PEGylated side chains increases the conformational stability of the WW domain via an entropic effect.” *Org. Biomol. Chem.* **2018**, *16*, 8933–8939. doi: 10.1039/c8ob02535e.
34. Kinghorn, M.J.; Berroeta, G.A.V.; Chantry, D.R.; Smith, M.S.; Ence, C.C.; Draper, S.R.E.; Duval, J.S.; Masino, B.M.; Cahoon, S.B.; Flansburg, R.R.; Conder, C.J.; **Price, J.L.\***, Michaelis, D.J.\* “Proximity-Induced Reactivity and Product Selectivity with a Rationally Designed Bifunctional Catalyst.” *ACS Catal.* **2017**, *7*, 7704–7708. doi: 10.1021/acscatal.7b02699.
33. Draper, S.R.E.; Lawrence, P.B.; Billings, W.M.; Xiao, Q.; Brown, N.P.; Bécar, N.A.; Matheson, D.J.; Stephens, A.R.; **Price, J.L.\*** “PEG-based Changes to  $\beta$ -sheet Protein Conformational and Proteolytic Stability Depend on Conjugation Strategy and Location.” *Bioconjugate Chem.* **2017**, *28*, 2507–2513. doi: 10.1021/acs.bioconjchem.7b00281.
32. Smith, M.S.; Lawrence, E.E.K.; Billings, W.M.; Larsen, K.S.; Bécar, N.A.; **Price, J.L.\*** “An anion- $\pi$  Interaction Strongly Stabilizes the  $\beta$ -sheet Protein WW.” *ACS Chem. Biol.* **2017**, *12*, 2535–2537. doi: 10.1021/acscchembio.7b00768.
31. Jalan, A.; Kastner, D.W.; Webber, K.G.I.; Smith, M.S.; **Price, J.L.\***; Castle, S.L.\* “Bulky Dehydroamino Acids Enhance Proteolytic Stability and Folding in  $\beta$ -Hairpin Peptides.” *Org. Lett.* **2017**, *19*, 5190–5193. doi: 10.1021/acs.orglett.7b02455.
30. Smith, M.S.; Billings, W.M.; Whitby, F.G.; Miller, M.B.; **Price, J.L.\*** “Enhancing a long-range salt bridge with intermediate aromatic and nonpolar amino acids.” *Org. Biomol. Chem.* **2017**, *15*, 5882–5886. doi: 10.1039/C7OB01198A.
29. Lawrence, P.B.; **Price, J.L.\*** “How PEGylation Influences Protein Conformational Stability.” *Curr. Opin. Chem. Biol.* **2016**, *34*, 88–94.
28. Lawrence, P.B.; Billings, W.M.; Miller, M.B.; Pandey, B.K.; Stephens, A.R.; Langlois, M.I.; **Price, J.L.\*** “Conjugation Strategy Strongly Impacts the Conformational Stability of a PEG-Protein Conjugate.” *ACS Chem. Biol.* **2016**, *11*, 1805–1809.
27. Lawrence, P.B.; Gavrillov, Y.; Matthews, S.S.; Langlois, M.I.; Shental-Bechor, D.; Greenblatt, H.M.; Pandey, B.K.; Smith, M.S.; Paxman, R.; Torgerson, C.B.; Merrell, J.P.; Ritz, C.; Prigozhin, M.B.; Levy, Y.\*; **Price, J.L.\*** “Criteria for Selecting PEGylation Sites on Proteins for Higher Thermodynamic and Proteolytic Stability.” *J. Am. Chem. Soc.* **2014**, *136*, 17547–17560.
26. Pandey, B. K.; Smith, M. S.; Price, J. L.\* “Cys<sub>i</sub>-Lys<sub>i+3</sub>-Lys<sub>i+4</sub> Triad: A General Approach for PEG-Based Stabilization of  $\alpha$ -Helical Proteins.” *Biomacromolecules* **2014**, *15*, 4643–4647.
25. Chao, S. -H.; Matthews, S. S.; Paxman, R.; Aksimentiev, A.; Gruebele, M.\*; **Price, J. L.\*** “Two Structural Scenarios for Protein Stabilization by PEG.” *J. Phys. Chem. B.* **2014**, *118*, 8388–8395.

24. Pandey, B. K.; Enck, S.; **Price, J. L.\*** “Stabilizing Impact of N-Glycosylation on the WW Domain Depends Strongly on the Asn-GlcNAc Linkage.” *ACS Chem. Biol.* **2013**, *8*, 2140–2144.
23. Pandey, B. K.; Smith, M. S.; Torgerson, C.; Lawrence, P.B.; Matthews, S. S.; Watkins, E.; Groves, M. L.; Prigozhin, M. B.; **Price, J. L.\*** “Impact of site-specific PEGylation on the conformational stability and folding rate of the Pin WW domain depends strongly on PEG oligomer length.” *Bioconjugate Chem.* **2013**, *24*, 796–802.

#### **Publications from postdoctoral research at The Scripps Research Institute**

22. Chen, W.; Enck, S.; **Price, J. L.**; Powers, D. L.; Powers, E. T.; Wong, C. –H.\*; Dyson, H. J.\*; Kelly, J. W.\* “Structural and energetic basis of carbohydrate-aromatic packing interactions in proteins.” *J. Am. Chem. Soc.* **2013**, *135*, 9877–9884.
21. **Price, J. L.**; Culyba, E. K.; Chen, W.; Murray, A. N.; Hanson, S. R.; Wong, C. –H.; Powers, E. T.\*; Kelly, J. W.\* “N-glycosylation of enhanced aromatic sequons to increase glycoprotein stability.” *Peptide Sci.* **2012**, *98*, 195–211.
20. **Price, J. L.**; Powers, E. T.\*; Kelly, J. W.\* “N-PEGylation of a Reverse Turn is Stabilizing in Multiple Sequence Contexts unlike N-GlcNAcylation.” *ACS Chem. Biol.* **2011**, *6*, 1188–1192.
19. **Price, J. L.**; Powers, D. L.; Powers, E. T.\*; Kelly, J. W.\* “Glycosylation of the enhanced aromatic sequon is similarly stabilizing in three distinct reverse turn contexts.” *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 14127–14132.
18. Bourgault, S.; Choi, S.; Buxbaum, J. N.; Kelly, J. W.; **Price, J. L.**; Reixach, N.\* “Mechanisms of transthyretin cardiomyocyte toxicity inhibition by resveratrol analogs.” *Biochem. Biophys. Res. Commun.* **2011**, *410*, 707–713
17. Culyba, E. K.; **Price, J. L.**; Hanson, S. R.; Dhar, A.; Wong, C. –H.; Gruebele, M.; Powers, E. T.\*; Kelly, J. W.\* “Protein Native State Stabilization by Placing Aromatic Side Chains in N-Glycosylated Reverse Turns.” *Science* **2011**, *331*, 571–575. (EKC and JLP share equal authorship)  
featured in *Chemical & Engineering News*, February 7, 2011, Vol. 89, pg. 26; and in *Science-Business eXchange*, February 17, 2011, Vol. 4, doi:10.1038/scibx.2011.184
16. **Price, J. L.**; Shental-Bechor, D.; Dhar, A.; Turner, M. J.; Powers, E. T.; Gruebele, M.; Levy, Y.\*; Kelly, J. W.\* “Context-Dependent Effects of Asparagine Glycosylation on Pin WW Folding Kinetics and Thermodynamics.” *J. Am. Chem. Soc.* **2010**, *132*, 15239–15367.
15. Wiseman, R. L.; Zhang, Y.; Lee, K. P. K.; Harding, H. P.; Haynes, C. M.; **Price, J.**; Sicheri, F.\*; Ron, D.\* “Flavonol Activation Defines an Unanticipated Ligand-Binding Site in the Kinase-RNase domain of IRE1.” *Mol. Cell.* **2010**, *38*, 291–304.
14. Solomon, J. P.; Yonemoto, I. T.; Murray, A. N.; **Price, J. L.**; Powers, E. T.; Balch, W. E.; Kelly, J. W.\* “The 8 and 5 kDa Fragments of Plasma Gelsolin Form Amyloid Fibrils by a Nucleated Polymerization Mechanism, while the 68 kDa Fragment is Not Amyloidogenic.” *Biochemistry* **2009**, *48*, 11370–11380.

#### **Publications from graduate research at the University of Wisconsin**

13. **Price, J. L.**; Horne, W. S.; Gellman, S. H.\* “Structural Consequences of  $\beta$ -Amino Acid Preorganization in a Self-Assembling  $\alpha/\beta$ -Peptide: Fundamental Studies of Foldameric Helix Bundles.” *J. Am. Chem. Soc.* **2010**, *132*, 12378–12387.

12. **Price, J. L.**; Hadley, E. B.; Steinkruger, J. D.; Gellman, S. H.\* “Detection and Analysis of Chimeric Tertiary Structure via Backbone Thioester Exchange: Packing of an  $\alpha$  Helix against an  $\alpha/\beta$ -Peptide Helix.” *Angew. Chem. Int. Ed.* **2010**, *49*, 368–371.
11. Horne, W. S.; **Price, J. L.**; Gellman, S. H.\* “Interplay among side chain sequence, backbone composition, and residue rigidification in polypeptide folding and assembly.” *Proc. Nat. Acad. Sci., USA* **2008**, *105*, 9151–9156.
10. **Price, J. L.**; Horne, W. S.; Gellman, S. H.\* “Discrete Heterogeneous Quaternary Structure Formed by  $\alpha/\beta$ -Peptide Foldamers and  $\alpha$ -Peptides.” *J. Am. Chem. Soc.* **2007**, *129*, 6376–6377.
9. Horne, W. S.; **Price, J. L.**; Keck, J. L.; Gellman, S. H.\* “Helix Bundle Quaternary Structure from  $\alpha/\beta$ -Peptide Foldamers.” *J. Am. Chem. Soc.* **2007**, *129*, 4178–4180.

#### Publications from undergraduate research at Brigham Young University

8. Vollmer-Snarr, H. R.\*; Pew, M. R.; Alvarez, M. L.; Cameron, D. J.; Chen, Z.; Walker, G. L.; **Price, J. L.**; Swallow, J. L. “Amino-Retinoid Compounds in the Human Retinal Pigment Epithelium.” *Adv. Exp. Med. Biol.* **2006**, *572*, 69–74.
7. Ziemer, S. P.; Niederhauser, T. L.; **Price, J. L.**; Woolley, E. M.\* “Thermodynamics of proton dissociations from aqueous alanine at temperatures from (278.15 to 393.15) K, molalities from (0.0075 to 1.0) mol · kg<sup>-1</sup>, and at the pressure 0.35 MPa: Apparent molar heat capacities and apparent molar volumes of alanine, alaninium chloride, and sodium alaninate.” *J. Chem. Thermodyn.* **2006**, *38*, 939–951.
6. Ziemer, S. P.; Niederhauser, T. L.; Merkley, E. D.; **Price, J. L.**; Sorenson, E. C.; McRae, B. R.; Patterson, B. A.; Woolley, E. M.\* “Thermodynamics of proton dissociations from aqueous serine at temperatures from (278.15 to 393.15) K, molalities from (0.01 up to 1.0) mol · kg<sup>-1</sup>, and at the pressure 0.35 MPa: Apparent molar heat capacities and apparent molar volumes of serine, serinium chloride, and sodium serinate.” *J. Chem. Thermodyn.* **2006**, *38*, 634–648.
5. Ziemer, S. P.; Niederhauser, T. L.; Merkley, E. D.; **Price, J. L.**; Sorenson, E. C.; McRae, B. R.; Patterson, B. A.; Origlia-Luster, M. L.; Woolley, E. M.\* “Thermodynamics of proton dissociations from aqueous glycine at temperatures from 278.15 to 393.15 K, molalities from 0 to 1.0 mol · kg<sup>-1</sup>, and at the pressure 0.35 MPa: Apparent molar heat capacities and apparent molar volumes of glycine, glycinium chloride, and sodium glycinate.” *J. Chem. Thermodyn.* **2006**, *38*, 467–483.
4. **Price, J. L.**; Sorenson, E. C.; Merkley, E. D.; McRae, B. R.; Woolley, E. M.\* “Thermodynamics of proton dissociations from aqueous L-valine and L-2-amino-n-butanoic acid: apparent molar volumes and apparent molar heat capacities of the protonated cationic, neutral zwitterionic, and deprotonated anionic species at temperatures from 278.15 ≤ T/K ≤ 393.15, at molalities 0.015 ≤ m/mol · kg<sup>-1</sup> ≤ 0.67, and pressure p = 0.35 MPa.” *J. Chem. Thermodyn.* **2003**, *35*, 1425–1467.
3. Sorenson, E. C.; **Price, J. L.**; McRae, B. R.; Woolley, E. M.\* “Thermodynamics of proton dissociations from aqueous L-proline: apparent molar volumes and apparent molar heat capacities of the protonated cationic, zwitterionic, and deprotonated anionic forms at temperatures from 278.15 K to 393.15 K and at the pressure 0.35 MPa.” *J. Chem. Thermodyn.* **2003**, *35*, 529–553.
2. Origlia-Luster, M. L.; Ballerat-Busserolles, K.; Merkley, E. D.; **Price, J. L.**; McRae, B. R.; Woolley, E. M.\* “Apparent molar volumes and apparent molar heat capacities of aqueous phenol and sodium phenolate at temperatures from 278.15 to 393.15 K and at the pressure 0.35 MPa.” *J. Chem. Thermodyn.* **2003**, *35*, 331–347.

1. **Price, J. L.;** Jardine, J. J.; Call, T. G.; Patterson, B. A.; Origlia-Luster, M. L.; Woolley, E. M.\*  
“Thermodynamics for proton dissociations from aqueous L-histidine at temperatures from 278.15 to 393.15 K and at the pressure 0.35 MPa: apparent molar volumes and apparent molar heat capacities of the protonated cationic, neutral zwitterionic, and deprotonated anionic forms.” *J. Chem. Thermodyn.* **2003**, 35, 195–198.

## PRESENTATIONS AND TALKS

22. 6/28/23 Talk at 2023 American Peptide Symposium – Scottsdale, AZ
23. 10/20/21 Talk at 2023 Rocky Mountain Regional ACS meeting – Tucson, AZ
22. 10/20/21 Virtual talk at 2023 Japanese Peptide Symposium
21. 6/22/19 Poster at 2019 American Peptide Symposium – Monterey, CA
20. 4/4/19 Talk at 2019 American Chemical Society Meeting – Orlando, FL
19. 4/18/16 Dept. of Chemistry, University of Alberta – Edmonton, Alberta
18. 4/13/16 Dept. of Chemistry, The Scripps Research Institute – La Jolla, CA
17. 3/23/16 Dept. of Chemistry, New York University – New York, NY
16. 3/22/16 Dept. of Biochemistry, Albert Einstein Medical College – New York, NY
15. 3/9/16 Dept. of Chemistry, Massachusetts Institute of Technology – Boston, MA
14. 3/8/16 Dept. of Chemistry, Tufts University – Medford, MA
13. 3/7/16 Dept. of Chemistry, Boston College – Boston, MA
12. 2/23/16 Seminar at Peptides Gordon Research Conference – Ventura, CA
11. 2/11/16 Dept. of Chemistry, University of Pittsburgh – Pittsburgh, PA
10. 2/08/16 Dept. of Chemistry, Rice University – Houston, TX
9. 1/21/16 Dept. of Chemistry, University of Wisconsin – Madison, WI
8. 1/20/16 Dept. of Chemistry, University of Minnesota – Minneapolis, MN
7. 6/20/15 Poster at American Peptide Symposium – Orlando, FL
6. 6/18/15 Seminar at 6<sup>th</sup> Chemical Protein Synthesis Meeting – St. Augustine, FL
5. 2/23/14 Poster at Peptides Gordon Research Conference – Ventura, CA
4. 10/10/13 Seminar at Dept. of Chemistry, Southern Utah University – Cedar City, UT
3. 9/25/13 Seminar at Dept. of Chemistry, Utah State University – Logan, UT
2. 3/28/13 Seminar at Dept. of Chemical Engineering, Brigham Young University – Provo, UT
1. 1/24/13 Seminar at Dept. of Chemistry, Brigham Young University Idaho – Rexburg, ID

## PROFESSIONAL SERVICE

Manuscript reviewer for *J. Am. Chem. Soc.*; *J. Phys. Chem.*; *Bioconjugate Chem.*; *Nature Comm.*; *Carbohydrate Research*; *PLOS One*; *BBA General Subjects*

Ad hoc proposal reviewer for ETH Zürich; Research Corporation for Scientific Advancement, National Science Foundation

2015–2017 Member of the American Peptide Society Nominating Committee

2014–present Member of BYU pre-health advising committee

2011–present ORCA proposal reviewer for BYU CPMS College Review Committee

2011 Abstract Reviewer for the 2012 National Conference for Undergraduate Research

2011–present Presenter at National Chemistry Week Magic Show at BYU