Elizabeth Murphy Topp
Dane O. Kildsig Chair and Department Head
Department of Industrial and Physical Pharmacy
Purdue University
West Lafayette, Indiana 47907

Education

University of Delaware, Newark, Delaware. Bachelor of Chemical Engineering (B.Ch.E.) with distinction and honors, 1979.

University of Pennsylvania, Philadelphia, Pennsylvania. Master of Engineering (M.E.) in Chemical and Biochemical Engineering, 1984.

University of Michigan, Ann Arbor, Michigan. Doctor of Philosophy (Ph.D.) in Pharmaceutics, 1986.

Experience

1979-1981:	Chemical Engineer, Mobil Research and Development Corporation, Paulsboro, New Jersey.
1981-1983:	Graduate Research Assistant, The University of Pennsylvania, Philadelphia, Pennsylvania.
1983-1986:	Graduate Research Assistant, The University of Michigan, Ann Arbor, Michigan.
1986-1992:	Assistant Professor, Department of Pharmaceutical Chemistry, The University of Kansas, Lawrence, Kansas.
1992-2000:	Associate Professor, Department of Pharmaceutical Chemistry, The University of Kansas, Lawrence, Kansas.
1998-2004:	Associate Department Chair, Department of Pharmaceutical Chemistry, The University of Kansas, Lawrence, Kansas.
2000-2009:	Professor, Department of Pharmaceutical Chemistry, The University of Kansas, Lawrence, Kansas.
2001-2005:	Courtesy Professor, Department of Humanities and Western Civilization, The University of Kansas, Lawrence, Kansas.
2002-2004:	Director of Graduate Studies, School of Pharmacy, The University of Kansas, Lawrence, Kansas.
2004:	Acting Department Chair, Department of Pharmaceutical Chemistry, The University of Kansas, Lawrence, Kansas.
2005:	Visiting Scientist, Vertex Pharmaceuticals, Cambridge, Massachusetts (summer).
2008-2011:	Courtesy Research Professor, Bioengineering Research Center, The University of Kansas, Lawrence, Kansas.
2009-date:	Dane O. Kildsig Chair and Department Head, Department of Industrial and Physical Pharmacy, Purdue University, West Lafayette, Indiana.

Honors

Undergraduate: Diamond Shamrock Corporation Scholarship (1977), American Institute of Chemical Engineers Scholarship Award (1978), Tau Beta Pi (engineering honor fraternity), Phi Kappa Phi (honor fraternity).

Graduate: American Foundation for Pharmaceutical Education Fellow (1985, 1986), Rackham (University of Michigan graduate school) Predoctoral Fellow (1986).

Professional: American Association of Pharmaceutical Scientists Young Investigator Award (1988), Eli-Lilly and Company Young Investigator Award (1988), American Association of Colleges of Pharmacy Young Investigator Award (1990), University of Kansas Center for Teaching Excellence, Excellence in Teaching Award (1999), American Association of Colleges of Pharmacy "Teachers of the Year" honoree (1999), Madison and Lila Self Graduate Mentor Award (2001, 2002), Outstanding Graduate and Professional Mentor, University of Kansas Graduate and Professional Association (2002), Dane O. Kildsig Professor, Purdue University (2009), American Association of Pharmaceutical Scientists Fellow (2010), Seeds for Success Award, Purdue University (2013), Committee on Institutional Cooperation (CIC) Academic Leadership Fellow (2014).

Professional societies and groups

American Chemical Society, member
American Society for Mass Spectrometry, member
American Association of Pharmaceutical Scientists, member

Current editorial activities

Editorial Advisory Board, *Drugs and the Pharmaceutical Sciences*, 2002-date
Editorial Advisory Board, *Molecular Pharmaceutics*, 2013-date

Selected administrative and service activities

National

Chair, Pharmaceutics Section, American Association of Colleges of Pharmacy, 1998-2001
Associate Editor, *European Journal of Pharmaceutical Sciences*, 2000-2001
Associate Editor, *Journal of Pharmaceutical Sciences*, 2001-2005
Biomaterials and Biointerfaces (BMBI) study section, National Institute for Biomedical Imaging and Bioengineering (NIBIB), National Institutes of Health, standing member, 2004-2006
Advisory Committee on the Pharmaceutical Sciences, U.S. Food and Drug Administration, member, 2006-2009 and chair, 2009-date
Boulder Peptide Meeting Scientific Advisory Board, member, 2013-date
Gene and Drug Delivery (GDD) study section, National Institute of General Medical Sciences, National institutes of Health, standing member, 2013-date

Purdue University

Department Head, Department of Industrial and Physical Pharmacy, College of Pharmacy, Purdue University, 2009-date

University of Kansas

Curriculum Planning Committee, School of Pharmacy, University of Kansas, member, 1987-1998 and chair, 1993-1994
Associate Department Chair, Department of Pharmaceutical Chemistry, School of Pharmacy, University of Kansas,1998-2004
Executive Committee, School of Pharmacy, The University of Kansas, member, 1999-2004 and chair, 2001-2002
Director of Graduate Studies, School of Pharmacy, The University of Kansas, 2002-2004
Interim Department Chair, Department of Pharmaceutical Chemistry, School of Pharmacy, The University of Kansas, 2004
Internal Advisory Board, Bioengineering Research Center, The University of Kansas, 2006-2009

Major research interests: Stability of peptide and protein drugs in amorphous solids, chemistry of the amorphous solid state, drug stability, immune response to protein drugs and biomaterials, mass transport in physical and biological systems.

Publications

Research and review papers published, accepted for publication, under review or in preparation. Peer-reviewed publications are marked with an asterisk.

1. Cyanocobalamin, a stability monograph, E. D. Murphy in *The Chemical Stability of Pharmaceuticals*, 2nd ed. K. A. Connors, G. L. Amidon and V. J. Stella (Eds.), John Wiley & Sons Inc., New York, 1984. pp. 377-384.

2. Physicochemical aspects of drug delivery to and via the skin, Gordon L. Flynn, Elizabeth M. Topp and Gordon L. Amidon in *Topics in Pharmaceutical Sciences 1985*, Elsevier Science Publishers, New York, 1985. pp. 313-328.

*3. Microwave drying of aqueous tablet film coatings: a study on free films, H. N. Joshi, M. A. Kral and E. M. Topp. *International Journal of Pharmaceutics* , 51: 19-25, 1989.

*4. Buccal absorption. III. Simultaneous diffusion and metabolism of an aminopeptidase substrate in the hamster cheek pouch, K. W. Garren, E. M. Topp and A. J. Repta. *Pharmaceutical Research*, 6/11: 966-970, 1989.

5. A novel drug delivery system: microspheres of hyaluronic acid derivatives, L. M. Benedetti, E. M. Topp and V. J. Stella, in *Biomedical and Biotechnological Advances in Industrial Polysaccharides*, V. Crescenzi, I. C. M. Dea, S. Paoletti, S. S. Stivala and I. W. Sutherland (Eds.), Gordon and Breach Science Publishers, 1989. pp. 27 - 33.

6. Characterization of polymeric films prepared from ester derivatives of hyaluronic acid, J. A. Hunt, V. J. Stella and E. M. Topp, in *Biomedical and Biotechnological Advances in Industrial Polysaccharides*, V. Crescenzi, I. C. M. Dea, S. Paoletti, S. S. Stivala and I. W. Sutherland (Eds.), Gordon and Breach Science Publishers, 1989. pp. 55 - 61.

*7. Diffusion and drug release in polymeric films prepared from ester derivatives of hyaluronic acid, J. A. Hunt, H. N. Joshi, V. J. Stella and E. M. Topp. *Journal of Controlled Release*, 12: 159-169, 1990.

*8. Microspheres of hyaluronic acid esters - fabrication methods and in vitro hydrocortisone release, L. M. Benedetti, E. M. Topp and V. J. Stella. *Journal of Controlled Release*, 13: 33-41, 1990.

*9. Topical drug delivery from thin applications: theoretical predictions and experimental results, W. Addicks, N. Weiner, G. Flynn, R. Curl and E. Topp, *Pharmaceutical Research*, 7/10: 1048-1054, 1990.

*10. Influence of Azone® and lauryl alcohol on the transport of acetaminophen and ibuprofen through shed snake skin, P. P. Bhatt, J. H. Rytting and E. M. Topp. *International Journal of Pharmaceutics*, 72: 219-226, 1991.

*11. Dosage forms from polymeric prodrugs: hydrocortisone esters of hyaluronic acid, L. M. Benedetti, H. N. Joshi, L. Goei, J. A. Hunt, L. Callegaro, V.J. Stella and E. M. Topp. *New Polymeric Materials*, 3/1: 41-48, 1991.

12. Drug release from hydrocortisone esters of hyaluronic acid: influence of ester hydrolysis rate on release rate, L. Goei, L. Benedetti, F. Biviano, L. Callegaro, E. Topp and V. Stella, *Proceedings of the Fourth International Conference on Polymers in Medicine: Biomedical and Pharmaceutical Applications*. Technomic Publishing Company, Inc., Lancaster, PA, 1992. pp. 85-92.

13. Polymeric prodrugs: recent experience with devices formed from steroid esters of hyaluronic acid, H. Joshi, L. Hume, L. Benedetti, L. Callegaro, V. Stella, E. Topp, *Proceedings of the Fourth International Conference on Polymers in Medicine: Biomedical and Pharmaceutical Applications*. Technomic Publishing Company, Inc., Lancaster, PA, 1992. pp. 93-101.

*14. Hydration in hyaluronic acid and its esters using differential scanning calorimetry, H. N. Joshi and E. M. Topp. *International Journal of Pharmaceutics,* 80: 213 - 225, 1992.

*15. Methylprednisolone esters of hyaluronic acid in ophthalmic drug delivery - *in vitro* and *in vivo* release studies. K. Kyyronen, L. Hume, L. Benedetti, A. Urtti, E. Topp and V. Stella. *International Journal of Pharmaceutics*, 80: 161 - 169, 1992.

*16. Enzymic and non-enzymic hydrolysis of a polymeric prodrug - hydrocortisone esters of hyaluronic acid, L. G. Rajewski, A. A. Stinnett, V. J. Stella and E. M. Topp. *International Journal of Pharmaceutics*, 82: 205 - 213, 1992.

*17. Drug release from membranes of hyaluronic acid and its esters, H. N. Joshi, V. J. Stella and E. M. Topp. *Journal of Controlled Release*, 20: 109 - 122, 1992.

*18. Gellan-based systems for ophthalmic sustained delivery of methylprednisolone. Y. Sanzgiri, S. Maschi, V. Crescenzi, L. Callegaro, E. M. Topp and V. J. Stella. *Journal of Controlled Release*, 26: 195-201, 1993.

*19. Examination of recovery profiles in a hydrodynamic microdialysis system. J. A. Stenken, M. Z. Southard, E. M. Topp and C. E. Lunte. *Analytical Chemistry*, 65: 2324 - 2328, 1993.

*20. Diffusion of macromolecules in membranes of hyaluronic acid esters. D. Papini, V. J. Stella and E. M. Topp. *Journal of Controlled Release*, 27: 47-57, 1993.

*21. Ocular sustained delivery of prednisolone using hyaluronic acid benzyl ester films (Note). L. R. Hume, H. Lee, L. Benedetti, Y. D. Sanzgiri, E. M. Topp and V. J. Stella. *International Journal of Pharmaceutics*, 111: 295-298, 1994.

*22. Evaluation of mucoadhesive properties of hyaluronic acid benzyl esters. Y. D. Sanzgiri, E. M. Topp, L. Benedetti and V. J. Stella. *International Journal of Pharmaceutics*, 107: 91-97, 1994.

*23. Swelling of hyaluronic acid ester membranes. K. C. Sung and E. M. Topp. *Journal of Membrane Science*, 92: 157-167, 1994.

*24. Effect of pH on theophylline release from partially esterified alginic acid matrices. L. D. Simon, L. Ruiz-Cardona, E. M. Topp and V. J. Stella. *Drug Development and Industrial Pharmacy*, 20: 2341-2351, 1994.

*25. Effect of drug hydrophilicity and membrane hydration on diffusion in hyaluronic acid ester membranes. K. C. Sung and E. M. Topp. *Journal of Controlled Release*, 37: 95 - 104, 1995.

*26. Diffusion of an anti-transferrin receptor antibody in cultured murine melanoma cell layers. V. Vijaykumar and E. M. Topp. *Pharmaceutical Research*, 12: 1907 - 1916, 1995.

*27. Automated analytical systems for drug development studies. IV - A microdialysis system to study the partitioning of lomefloxacin across an erythrocyte membrane in vitro. S. R. Knaub, M. F. Chang, C. E. Lunte, E. M. Topp and C. M. Riley. *Journal of Pharmaceutical and Biomedical Analysis*, 14: 121-129, 1995.

*28. Application of benzyl hyaluronate membranes as wound dressings: Evaluation of water vapor and gas permeabilities. L. Ruiz-Cardona, Y. D. Sanzgiri, V. J. Stella and E. M. Topp. *Biomaterials*, 17: 1639-1643, 1996.

*29. High density culture of mammalian cells in a nonwoven polyester matrix (letter). Venkatramani Vijaykumar, Paul Kitos and Elizabeth M. Topp. *In Vitro Cellular and Developmental Biology - Animal,* 32: 465-468, 1996.

*30. Effect of formulation variables on drug and polymer release from HPMC-based matrix tablets. K. C. Sung, P. R. Nixon, J. W. Skoug, T. Robert Ju, Ping Gao, E. M. Topp and M. V. Patel. *International Journal of Pharmaceutics*, 142: 53-60, 1996.

*31. Development of a cell culture system to study antibody convection in tumors. Binodh S. DeSilva, Tina L. Hendrickson and Elizabeth M. Topp. *Journal of Pharmaceutical Sciences,* 86: 858-864, 1997.

*32. Antibody transport in cultured tumor cell layers. E. M. Topp, P. A. Kitos, V. Vijaykumar, B. S. DeSilva and T. L. Hendrickson. *Journal of Controlled Release*, 53: 15-23, 1998.

*33. Capillary electrophoresis separation of an asparagine containing hexapeptide and its deamidation products. Mei Lai, David Skanchy, John Stobaugh and Elizabeth Topp. *The Journal of Pharmaceutical and Biomedical Analysis*, 18: 421-427, 1998.

34. Barriers to delivery of macromolecules (invited review). E. M. Topp. *Medicinal Chemistry Research* , 7/9: 493-508, 1997.

*35. The solid-state chemical instability of peptides and proteins (invited mini-review). M. C. Lai and E. M. Topp. *Journal of Pharmaceutical Sciences*, 88/5: 489-500, 1999.

36. Principles of mass transfer. E. M. Topp. In *Transport Processes in Pharmaceutical Systems*, G. L. Amidon, P. I. Lee and E. M. Topp (Eds.), Marcel Dekker, Inc, New York, 1999. Pp. 1-22.

*37. Deamidation of a model hexapeptide in poly(vinyl alcohol) hydrogels and xerogels. M. C. Lai, R. L. Schowen, R. T. Borchardt and E. M. Topp. *The Journal of Peptide Research,* 55/2: 93-101, 2000.

*38. Chemical stability of peptides in polymers. 1. Effect of water on peptide deamidation in poly(vinyl alcohol) and poly(vinyl pyrrolidone) matrices. M. C. Lai, M. J. Hageman, R. L. Schowen, R. T. Borchardt and E. M. Topp. *Journal of Pharmaceutical Sciences*, 88/10: 1073-1080, 1999.

*39. Chemical stability of peptides in polymers. 2. Discriminating between solvent and plasticizing effects of water on peptide deamidation in poly(vinyl pyrrolidone). M. C. Lai, M. J. Hageman, R. L. Schowen, R. T. Borchardt, B. B. Laird and E. M. Topp. *Journal of Pharmaceutical Sciences*, 88/10: 1081-1089, 1999.

40. Solid-state chemical stability of peptides and proteins: application to controlled release formulations. Y. Song, A. Wilson, R. Li, M. J. Hageman, R. L. Schowen, and E. M. Topp, in *Handbook of Pharmaceutical Controlled Release Technology*, D. L. Wise (Ed.), Marcel Dekker, Inc., New York, 2000. pp. 693-724.

41. Mechanisms of drug release from hyaluronic acid esters. L.G. Rajewski, E.M. Topp, E.M. Phillips and V.J. Stella. *New Frontiers in Medical Sciences: Redefining Hyaluronan*, G. Abatangelo and P.H. Weigel (Eds.), Elsevier Science B.V., 2000. pp. 149-161.

*42. Reactivity toward deamidation of asparagine residues in β-turn structures. M. Xie, J. Aubé, R.T. Borchardt, M. Morton, E.M. Topp, D. Vander Velde and R.L. Schowen. *The Journal of Peptide Research*, 56: 165-171, 2000.

*43. S. Siddhaye, K. V. Camarda, E. Topp and M. Z. Southard, Design of novel pharmaceutical products via combinatorial optimization," *Comp. Chem. Eng.,* 24: 701-704, 2000.

*44. Formaldehyde production by Tris buffer in peptide formulations at elevated temperature. Y. Song, R.L. Schowen, R.T. Borchardt and E. M. Topp. (Note). *Journal of Pharmaceutical Sciences*, 90/8: 1198-1203, 2001.

*45. Effect of solution polarity and viscosity on peptide deamidation. Rong Li, Ajit J. D'Souza, Brian B. Laird, Richard L. Schowen, Ronald T. Borchardt and Elizabeth M. Topp. *The Journal of Peptide Research*, 56: 326 – 334, 2000.

*46. Effect of 'pH' on the rate of asparagine deamidation in polymeric formulations: 'pH'-rate profile. Y. Song, R.L. Schowen, R.T. Borchardt and E.M. Topp. *Journal of Pharmaceutical Sciences*, 90/2: 141-156, 2001.

*47. Multidrug resistance associated protein 1 (MRP1) functional activity in Calu-3 cells. K.O. Hamilton, I. Makagiansar, E.M. Topp, M. Yazdanian and K.L. Audus. *Journal of Pharmacology and Experimental Therapeutics*, 298: 1199-1205, 2001.

*48. Effect of viscosity on the deamidation rate of a model Asn-hexapeptide. R. Li, M.J. Hageman and E. M. Topp. *The Journal of Peptide Research*, 59: 211-220, 2002.

*49. Effect of polymer molecular weight on peptide deamidation in a model dosage form. R. Li, M. J. Hageman and E. M. Topp. Submitted to *European Journal of Pharmaceutical Sciences*, May 23, 2002.

*50. Reaction of a peptide with polyvinylpyrrolidone in the solid state. A.J.M. D'Souza, R.L. Schowen, R.T. Borchardt, E. Munson, T. Offerdahl and E.M. Topp. *Journal of Pharmaceutical Sciences*, 92: 585-593, 2003.

*51. Pharmaceutical product design using combinatorial optimization. S. Siddhaye, K. Camarda, M. Z. Southard and E.M. Topp. *Computers and Chemical Engineering*, 24: 701-704, 2000.

*52. Degradation pathways of lyophilized proteins. C.E. Stotz, S. Winslow, M. L. Houchin, A. J. M. D'Souza, J. Ji and E. M. Topp, in *Lyophilization of Biomaterials*, M. Pikal and R. Costantino (Eds.), AAPS Press, Arlington, VA, 2004. pp. 443-480.

*53. Secondary structure of a dynamic Type I' beta-hairpin peptide. C.E. Stotz, D. Vander Velde, C.R. Middaugh and E.M. Topp. *Journal of Peptide Research*, 63/4: 371-382, 2004.

*54. Rapid, specific racemization of an asparagine residue during peptide deamidation. B. Li, R.T. Borchardt, E.M. Topp, D. VanderVelde and R.L. Schowen. *Journal of the American Chemical Society*, 125: 11486-11487, 2003.

*55. Gastric function in the elderly: effects on absorption of ketoconazole. A. Hurwitz, C.E. Ruhl, B.F. Kimler, E.M. Topp and M.S. Mayo. *Journal of Clinical Pharmacology*, 43/9: 996-1002, 2003.

*56. Polyvinylpyrrolidone-drug conjugate: synthesis and release mechanism. A.J.M. D'Souza, R.L. Schowen and E.M. Topp. *Journal of Controlled Release*, 94/1: 91-100, 2004.

*57. Solid-state NMR studies of pharmaceutical solids in polymer matrices. J.W. Lubach, B.E. Padden, S.L. Winslow, J.S. Salsbury, D.B. Masters, E.M. Topp and E.J. Munson. *Analytical and Bioanalytical Chemistry*, 378: 1504-1510, 2004.

*58. Release from polymeric prodrugs: linkages and their degradation. A.J.M. D'Souza and E.M. Topp. *Journal of Pharmaceutical Sciences*, 93/8: 1962-1979, 2004.

*59. Applications of model beta-hairpin peptides. C.E. Stotz and E.M. Topp. *Journal of Pharmaceutical Sciences*, 93/12: 2881-2894, 2004.

*60. The effect of sucrose and mannitol on the rate of deamidation of asparagine residues in model peptides in the solid state. B. Li, M. O'Meara, R.L. Schowen, J.W. Lubach, R.L. Schowen, E.M. Topp, E.J. Munson, R.T. Borchardt. *Journal of Pharmaceutical Sciences*, 94/8: 1723-1735, 2005.

*61. The effects of acidic N+1 residues on asparagine deamidation rates in solution and in the solid state. B. Li, E. Gorman, K. Moore, T. Williams, R.L. Schowen, E.M. Topp, R.T. Borchardt, *Journal of Pharmaceutical Sciences*, 94/3: 666-675, 2005.

*62. Deamidation of model beta-turn cyclic peptides in the solid state. Stephanie L. Krogmeier, D. Srinivasa Reddy, David Vander Velde, Gerald H. Lushington, Teruna J. Siahaan, C. Russell Middaugh, Ronald T. Borchardt, Elizabeth M. Topp. *Journal of Pharmaceutical Sciences*, 94/12: 2616-2631, 2005.

63. Effect of N-1 and N-2 residues on peptide deamidation rate in solution and solid state. Bei Li, Richard L. Schowen, Elizabeth M. Topp, Ronald T. Borchardt, Ronald T. *AAPS Journal*, 8/1, E166-E773, 2006. PMID: 16584125

*64. Deamidation, acylation and proteolysis of a model peptide in PLGA films. M.L. Houchin, K. Heppert and E.M. Topp, *Journal of Controlled Release*, 112/1: 111-119, 2006.

65. A molecular design approach to peptide drug stabilization. S.M. Thompson, S. Sinha, E.M. Topp and K.V. Camarda. *Molecular Simulation*, 32: 291-295, 2006.

66. Crystal engineering to enhance the solubility of a novel anti-viral, VX-950. K. Stavropolos, M. Hurrey, E. M. Topp, G. Rao and I. Kadiyala, in preparation. Submission delayed until after 9/07 due to patent filing and internal legal review.

*67. Physical properties of PLGA films during polymer degradation. M. Houchin and E.M. Topp, *Journal of Applied Polymer Science*,114/5: 2848-2854, 2009.

*68. Effect of excipients on PLGA film degradation and on the stability of an incorporated peptide. M.L. Houchin, S.A. Neuenswander and E.M. Topp, *Journal of Controlled Release*, 117: 413-420, 2007. PMID: 17207882

*69. Chemical degradation of peptides and proteins in PLGA: A review of reactions and mechanisms (invited minireview). M.L. Houchin and E.M. Topp, *Journal of Pharmaceutical Sciences*, 97/7: 2395-2404, 2008. DOI: 10.1002/jps.21176

70. Successful protein therapeutics: the interconnection of formulation, process development and manufacturing (meeting review). E.M. Topp, Investigational Drugs Database Meeting Review Alert, Thompson Scientific, July 2006.

*71. Trehalose and calcium exert site-specific effects on calmodulin conformation in amorphous solids (Communication). Y. Li, T.D. Williams, R.L. Schowen and E.M. Topp, *Biotechnology and Bioengineering*, 97/6: 1650-1653, 2007. PMID: 17286268

*72. Characterizing protein structure in amorphous solids using hydrogen/deuterium exchange with mass spectrometry. Y. Li, T.D. Williams, R.L. Schowen and E.M. Topp, *Analytical Biochemistry*, 366:18-28, 2007. PMID: 17490599

*73. Effects of excipients on protein conformation in lyophilized solids by hydrogen/deuterium exchange with mass spectrometry. Y. Li, T. D. Williams and E. M. Topp, *Pharmaceutical Research*, 25/2: 259-267, 2008. PMID: 17597380

*74. Preparation and properties of novel dentin adhesives with esterase resistance. Jong-Gu Park, Qiang Ye, Elizabeth M. Topp, Elisabet Kostoryz, Yong Wang, Sarah Kieweg and Paulette Spencer. *Journal of Applied Polymer Science*, 107/6: 3588-3597, 2008.

*75. In vitro performance of nano-heterogeneous dentin adhesive. Qiang Ye, Jong-Gu Park, Elizabeth Topp, Yong Wang, Anil Misra and Paulette Spencer, *Journal of Dental Research*, 87/9:829-833, 2008.

76. Recent U.S. patents on protein drug formulation: 2000-2007, Hong Zhao and Elizabeth M. Topp, *Recent Patents on Drug Delivery & Formulation*, 2/3: 200-208, 2008.

*77. Comparison of LC and LC/MS methods for quantifying N-glycosylation in recombinant IgGs. Sandipan Sinha, Gary Pipes, Elizabeth Topp, Pavel V. Bondarenko, Michael Treuheit, and Himanshu S. Gadgil. *Journal of the American Society for Mass Spectrometry*, 19/11: 1643-54, 2008. DOI: 10.1016/j.jasms. 2008.07.004.

*78. Effect of secondary structure on deamidation in the Fc fragment of an IgG1 monoclonal antibody. Sandipan Sinha, Lei Zhang, Shaofeng Duan, Todd Williams, Josef Vlasak, Roxana Ionescu and Elizabeth Topp. *Protein Science*, 18/8: 1573-1584, 2009. DOI: 10.1002/pro.173. PMCID: PMC2776945

*79. Effect of photo-initiators on the in vitro performance of a dentin adhesive exposed to simulated oral environment. Qiang Ye, Yong Wang, Elizabeth Topp and Paulette Spencer. *Dental Materials*, 25/4: 452-458, 2009.

*80. A computational molecular design framework for crosslinked polymer networks, J.C. Eslick, Q. Ye, J. Park, E.M. Topp, P. Spencer, K.V. Camarda. *Computers and Chemical Engineering*, 33: 954-963, 2009.

*81. Reversibility and regioselectivity of thiol/disulfide exchange in lyophilized solids, L. Zhang, T.D. Williams and E.M. Topp. *Journal of Pharmaceutical Sciences*, 98/9: 3312-3318, 2009. PMID:18683877

*82. Protein conformation in amorphous solids by FTIR and by hydrogen/deuterium exchange with mass spectrometry. S. Sinha, Y. Li, T.D. Williams and E.M. Topp, *Biophysical Journal*, 95/12: 5951–5961, 2008. DOI:10.1529/biophysj.108.139899. PMCID: PMC2599811

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*85. Water sorption and dynamic mechanical properties characteristics of dentin adhesives with a urethane-based multifunctional methacrylate monomer. Jong-Gu Park, Qiang Ye, Elizabeth M. Topp, Anil Misra and Paulette Spencer, *Dental Materials*, 25: 1569-1575, 2009. PMCID: PMC2783757

86. Chemical instability in peptide and protein pharmaceuticals. Elizabeth M. Topp, Lei Zhang, Hong Zhao, Robert W. Payne, Gabriel J. Evans and Mark C. Manning. *Formulation and Process Development Strategies for Manufacturing of a Biopharmaceutical,* F. Jameel and S.

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87. Protein conformation and reactivity in amorphous solids. S. Sinha, S. Xie and E.M. Topp, in *Formulation and Process Development Strategies for Manufacturing of a Biopharmaceutical*, F. Jameel and S. Hershenson, eds., John Wiley and Sons, Hoboken, NJ, 2010. ISBN: 978-0-470-11812-2. pp. 493-506.

*88. Immune response to controlled release of immunomodulating peptides in an experimental autoimmune encephalomyelitis (EAE) mouse model. Hong Zhao, Paul Kiptoo, Todd D. Williams, Teruna J. Siahaan and Elizabeth M. Topp. *Journal of Controlled Release,* 141: 145-152, 2010. DOI: 10.1016/j.jconrel.2009.09.002. PMCID: PMC3903655

*89. Effect of photoinitiator system and water content on dynamic mechanical properties of a light-cured bisGMA/HEMA dental resin. J. Park, Q. Ye, E.M. Topp, S.L. Kieweg and P. Spencer. *Journal of Biomedical Materials Research: Part A*, 93A/4: 1245-1251, 2010. DOI: 10.1002/jbm.a.32617. PMCID: PMC2860647

*90. Thiol-disulfide interchange in the tocinoic acid/glutathione system during freezing and drying. M. Thing, J. Zhang, J. Laurence and E.M. Topp. *Journal of Pharmaceutical Sciences*, 99/12: 4849-4856, 2010. DOI 10.1002/jps.22206. PMID: 24549831

*91. Adhesive/dentin interface: the weak link in the composite restoration. P. Spencer, Q. Ye, J. Park, E. M Topp, A. Misra, O. Marangos, Y. Wang, B.S. Bohaty, V. Singh, F. Sene, J. Eslick, K.V. Camarda, J.L. Katz. *Annals of Biomedical Engineering*, 38(6): 1989-2003, 2010. PMCID: PMC2871971

*92. Localized effects of hydration on lyophilized myoglobin by hydrogen/deuterium exchange mass spectrometry. 1. Exchange mapping. A.M. Sophocleous, J. Zhang and E.M. Topp, *Molecular Pharmaceutics*, 9/4: 718-726, 2012. Invited manuscript for special issue, “Advances in Biophysical and Bioanalytical Protein Characterization”. PMCID: PMC3319197

93. Proteins and peptides: Chemical and physical stability. Andreas Sophocleous, Jun Zhang, Lavanya Iyer, Saradha Chandra Sekhar, Esben Bertelsen and Elizabeth M. Topp. *Encyclopedia of Pharmaceutical Science and Technology*, 4th ed., James Swarbrick, D.Sc., Ph.D., Editor. Taylor & Francis, New York, NY, 2013. Chapter 268, pp. 2594-2606, 2013.

*94. Use of glass transitions in carbohydrate excipient design for lyophilized protein formulations. B.C. Roughton, E.M. Topp and K.V. Camarda. *Computers and Chemical Engineering*, 36: 208-216, 2012. DOI:10.1016/j.compchemeng.2011.07.018. PMCID: PMC3876287

*95. Localized effects of hydration on lyophilized myoglobin by hydrogen/deuterium exchange mass spectrometry. 2. Exchange kinetics. A. Sophocleous and E.M. Topp, *Molecular Pharmaceutics*, 9/4: 727-733, 2012. Invited manuscript for special issue, “Advances in Biophysical and Bioanalytical Protein Characterization”. PMCID: PMC3319266

*96. Protein G, Protein A and Protein-A-derived peptides inhibit the agitation induced aggregation of IgG. J. Zhang and E. M. Topp, *Molecular Pharmaceutics*, 9(3): 622-628, 2012. DOI: 10.1021/mp200548x. PMCID: PMC3295918

*97. Optimizing protein-excipient interactions for the development of aggregation-reducing lyophilized formulations. B.C. Roughton, A.I. Pokphanh, E.M. Topp and K.V. Camarda, *Proceedings of the 11th International Symposium on Process Systems Engineering*, I. a Karimi and R. Srinivasan (eds.), Elsevier, Oxford, UK, 2012. pp. 1351-1355.

98. Process systems engineering, 4. Process and product synthesis, design, and analysis. R. Gani, M.R. Eden, T. Gundersen, M.C. Georgiadis, J.M. Woodley, T. Lopez-Arenas, M. Sales-Cruz, E. S. Perez-Cisneros, C.C. Solvason, N. G. Chemmangattuvalappil, P. Lutze, B.C. Roughton, K.V. Camarada and E.M. Topp, in *Ullman's Encyclopedia of Industrial Chemistry*, Wiley-VCH Verlag GmbH & Co., Mannheim, Germany, 2013. Pp. 1-80. DOI: 10.1002/14356007.o22_o08; online posting April 15, 2012.

99. Commentary: Current perspectives on the aggregation of protein drugs. E. M. Topp, *AAPS Journal*, 16/3: 413-414, 2014. DOI: 10.1208/s12248-014-9580-0. PMCID: PMC4012046

100. Effect of hydrolytic degradation on the in vivo properties of monoclonal antibodies. B.S. Moorthy, B. Xie, E.M. Moussa, L.K. Iyer, S. Chandrasekhar, J. Panchal and E.M. Topp, in *Biobetters: Protein Engineering to Approach the Curative*, A. Rosenberg and B. Demeule (eds.), *Advances in Pharmaceutical Sciences* series, Academic Press, New York. Submitted September 15, 2013. Revised version submitted April 15, 2014. Second revision submitted July xx, 2014.

101. Structure of monoclonal antibodies. B.S. Moorthy, B. Xie, E.M. Moussa, L.K. Iyer, S. Chandrasekhar, J. Panchal and E.M. Topp, in *Biobetters: Protein Engineering to Approach the Curative*, A. Rosenberg and B. Demeule (eds.), *Advances in Pharmaceutical Sciences* series, Academic Press, New York. Revised version submitted, as a new chapter separated from the item above, April 15, 2014. Second revision submitted July xx, 2014.

102. Solid-state hydrogen deuterium exchange. B.S. Moorthy, B. Xie, J. Panchal and E.M. Topp, in *Hydrogen-Deuterium Exchange Mass Spectrometry: Fundamentals, Techniques and Applications*, D. Weis (ed.), Wiley, New York, submitted November 1, 2013. Reviewers' comments received January 29, 2014. Revised version submitted March 10, 2014. Revised figures for production submitted January 13, 2015.

103. Microarrays and mirconeedle arrays for delivery of peptides, proteins, vaccines and other applications. S. Chandrasekhar, L.K. Iyer, J.P. Panchal, E.M. Topp, J.B. Cannon and V.V. Ranade, *Expert Opinion in Drug Delivery*, 10/8: 1155-1170, 2013. PMID: 23662940

104. Predicting protein aggregation during storage in lyophilized solids using solid state amide hydrogen/deuterium exchange with mass spectrometric analysis (ssHDX-MS). B.S. Moorthy, S. Schultz, S. Kim and E.M. Topp. *Molecular Pharmaceutics*, 11/6: 1869-1879, 2014. DOI: 10.1021/mp500005v. PMCID: PMC4051254

105. Analyzing subvisible particles in protein drug products: A comparison of dynamic light scattering (DLS) and resonant mass measurement (RMM). J. Panchal, J. Kotarek, E. Marszal and E. M. Topp, *AAPS Journal*, 16/3: 440-451, 2014. DOI: 10.1208/s12248-014-9579-6. PMID: 24570341

106. Photolytic labeling to probe protein-protein and protein-matrix interactions in lyophilized powders. L.K. Iyer, B.S. Moorthy and E.M. Topp, *Molecular Pharmaceutics*, 10: 4629-4639, 2013. DOI: 10.1021/mp4004332. PMCID: PMC3913734

107. Protein aggregation and lyophilization: Protein structural descriptors as predictors of aggregation propensity. B.C. Roughton, L.K. Iyer, E. Bertelsen, E.M. Topp and K.V. Camarda, *Journal of Computers and Chemical Engineering*, 58/11: 369-377, 2013. PMCID: PMC3917556

108. Thiol-disulfide exchange in peptides derived from human growth hormone. S. Chandrasekhar, A. Sophocleous and E.M. Topp, *Journal of Pharmaceutical Sciences*, 103/4: 1032-1042, 2014. DOI: 10.1002/jps.23906. PMCID: PMC4283463

109. Mass spectrometric approaches to study protein structure and interactions in lyophilized powders. B.S. Moorthy, L.K. Iyer and E.M. Topp, *Journal of Visualized Experiments (JoVE)* (98), e52503, doi:10.3791/52503 (2015). Published 04/14/2015. NIHMS ID: NIHMS653055.

110. Thiol-disulfide exchange in peptides derived from human growth hormone during lyophilization and storage in the solid-state. Saradha Chandrasekhar and Elizabeth M. Topp. *Journal of Pharmaceutical Sciences*, 104/4: 1291-1302, 2015. PMID: 25631887

111. Structural transitions and interactions in the early stages of human glucagon amyloid fibrillation. Balakrishnan S. Moorthy, Hamed T. Ghomi, Markus A. Lill and Elizabeth M. Topp. *Biophysical Journal*, 108/4: 937-948, 2015. PMCID: PMC4336368

112. Cocrystalline solids of telaprevir with enhanced oral absorption. K. Stavropoulos, S. Johnston, Y. Zhang, G. Bhisetti, M. Hurrey, P. Hurter, E. Topp and I. Kadiyala, *Journal of Pharmaceutical Sciences*, submitted January 14, 2015.

113. Photolytic crosslinking to probe protein-protein and protein-matrix interactions in lyophilized powders. Lavanya K. Iyer, Balakrishnan S. Moorthy and Elizabeth M. Topp, submitted to *Molecular Pharmaceutics*, March 5, 2015.

Books

Editor

Transport Processes in Pharmaceutical Systems, G. L. Amidon, P. I. Lee and E. M. Topp (Eds.), Marcel Dekker, Inc., New York, 1999. ISBN: 0-8247-6610-5. 752 pp.

Journal of Pharmaceutical Sciences Compendium of Reviews, E.M. Topp (Ed.), American Pharmacists Association, Washington, DC, 2004. ISBN: 1-58212-073-0. 368 pp.

Patents

1. Novel monomer 1,1,1-tri-[4-(methacryloxyethylaminocarbonyloxy)-phenyl]ethane for dental compositions. Jong-Gu Park, Paulette Spencer, Elizabeth Topp and Qiang Ye. US 20090247660, October 1, 2009; WO 2009146067, December 3, 2009.

2. Protein drug formulations and packages. Elizabeth M. Topp, Fred E. Regnier and Jun Zhang. Provisional application filed April 23, 2010; Provisional application no. 61/327,371. Patent filed April 22, 2011. Application no. 13/642,333. Pub. No. US 2013/0052209 A1. Pub. Date: February 28, 2013.

3. Protein G, Protein A and Protein-A-Derived Peptides Inhibit the Agitation-Induced Aggregation of IgG. Elizabeth M. Topp, Fred E. Regnier and Jun Zhang. Invention disclosure filed November 4, 2011. Provisional patent filed January 13, 2012; Patent application number 61/586,556.

Invited podium presentations

Where multiple authors are listed, the presenter's name is underlined.

1. Physiological flow modeling of the GI tract and its use in oral dosage form design and assessment, Elizabeth M. Topp and Gordon L. Amidon, American Pharmaceutical Association /Academy of Pharmaceutical Sciences National Meeting, Minneapolis, Minnesota, October 1985.

2. Choosing a mathematical model for drug delivery from an ointment, University of Kansas Department of Chemical Engineering seminar, Lawrence, Kansas, February, 1987.

3. Mathematical models for drug delivery from ointment media, FIDIA Corporation, Abano Terme, Italy, March 1987.

4. Mathematical models for tumor distribution of immunotoxin, XOMA Corporation, Berkeley, California, August 1987.

5. Tumor penetration of monoclonal antibody/drug conjugates, Pfizer Central Research, Groton, Connecticut, February 1989.

6. Tumor penetration of monoclonal antibody/drug conjugates, Eli-Lilly and Company, Indianapolis, Indiana, May 1989.

7. Development of drug delivery devices from ester derivatives of hyaluronic acid, University of Missouri - Kansas City, Department of Pharmaceutics, Kansas City, October 17, 1989.

8. Development of drug delivery devices from ester derivatives of hyaluronic acid, Fidia, S.p.A., Abano Terme, Italy, December 5, 1989.

9. Development of polymeric drug delivery devices - recent experience with hyaluronic acid esters, Department of Chemistry, St. Cloud State University, St. Cloud, Minnesota, December 5, 1991.

10. Ophthalmic drug delivery using hyaluronic acid esters, Alcon Laboratories, Fort Worth, Texas, February 28, 1992.

11. Ophthalmic drug delivery using hyaluronic acid esters, Ciba Vision Ophthalmics, Duluth, Georgia, September 4, 1992.

12. Mechanisms of drug release from hyaluronic acid ester devices, Sixth Annual Symposium of the Johnson and Johnson Drug Delivery Subcommittee, November 9, 1992.

13. Mechanisms of drug release from hyaluronic acid ester devices, Pittsburgh State University, Pittsburgh, Kansas, February 3, 1993.

14. Mechanisms of drug release from hyaluronic acid ester devices, The Upjohn Company, Kalamazoo, Michigan, September 1, 1993.

15. Transport of binding antibodies in tumors - in vitro studies. Abbott Laboratories, North Chicago, Illinois, October 29, 1993.

16. Identifying mechanisms in controlled drug release: an example using a polymeric prodrug. Kansas City Discussion Group of the American Association of Pharmaceutical Scientists, Overland Park, Kansas, February 22, 1994.

17. Delivery of immunoconjugates to tumors - in vitro studies of the mechanisms of mass transport. Kansas Health Foundation Annual Symposium, Kansas City, Kansas, April 14-15, 1994.

18. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry. Drew University, Madison, New Jersey, June 10-14, 1996.

19. Development of an integrated laboratory course sequence. American Association of Colleges of Pharmacy Annual Meeting, Reno, Nevada, July 14-18, 1996.

20. In vitro models for tumor penetration of macromolecules. University of Nebraska Medical Center, Omaha, Nebraska, December 12-13, 1996.

21. Antibody transport in cultured tumor cell layers. Eighth International Symposium on Recent Advances in Drug Delivery Systems, Salt Lake City, Utah, February 24-27, 1997.

22. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry. Drew University, Madison, New Jersey, June 15-19, 1997.

23. Barriers to delivery of macromolecular drugs. Southeast Regional Meeting of the American Association of Pharmaceutical Scientists, Chapel Hill, North Carolina, June 23, 1997.

24. Chemical instabilities of proteins and peptides in formulations in drug delivery devices. 1997 Colorado Biopharmaceutical Delivery Conference, Breckenridge, Colorado, July 24-26, 1997.

25. Peptide deamidation in polymeric matrices. Protein Stability in Drug Delivery Systems Short Course, American Association of Pharmaceutical Scientists Annual Meeting, Boston, Massachusetts, November 2, 1997.

26. Delivery of macromolecular drugs: biological barriers and mass transport considerations. University of Notre Dame, Department of Chemical Engineering, Notre Dame, Indiana, December 2, 1997.

27. Peptide degradation in polymer matrices. The University of Kansas, Department of Chemical Engineering, Lawrence, Kansas, January 21, 1998.

28. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry. Drew University, Madison, New Jersey, June 8-12, 1998.

29. Pharmacokinetics Short Course. Presented to employees of Mitotix, Inc., Boston Cambridge Marriott, Cambridge, Massachusetts, January 11, 1999.

30. Deamidation of a model peptide in PVP matrices. Alza Corporation, Palo Alto, California, February 18, 1999.

31. Chemical engineers in the pharmaceutical industry. American Institute of Chemical Engineers Student Chapter, The University of Kansas, Lawrence, Kansas, April 13, 1999.

32. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry. Drew University, Madison, New Jersey, June 14-18, 1999.

33. Pharmacokinetics and ADME. Bristol-Myers Squibb, Inc., Princeton, New Jersey, January 14, 2000.

34. Pharmacokinetics and ADME. ArQule, Inc., Woburn, Massachusetts, April 3, 2000.

35. Balancing career and family. Iota Sigma Pi Spring Event, University of Kansas, Lawrence, Kansas, April 5, 2000.

36. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry. Drew University, Madison, New Jersey, June 11-15, 2000.

37. Pharmacokinetics and ADME. Bristol-Myers Squibb, Inc., Hopewell and New Brunswick, New Jersey, June 12 and 19, 2000.

38. Peptide deamidation in polymer matrices. Bristol-Myers Squibb, Inc., New Brunswick, New Jersey, June 20, 2000.

39. Hydrolytic mechanisms of peptide and protein degradation. GPEN 2000, Uppsala, Sweden, September 13-15, 2000.

40. Peptide deamidation in polymer matrices. American Association of Pharmaceutical Scientists Annual Meeting, Indianapolis, Indiana, November 2000.

41. Pharmacokinetics and ADME. R.W. Johnson Pharmaceutical Research Institute, La Jolla, California, February 26, 2001.

42. Pharmacokinetics and ADME. Twelfth International Symposium on Pharmaceutical and Biomedical Analysis, Monterey, California, May 13, 2001.

43. Peptide degradation in polymer matrices. Inhale Therapeutics, Inc., San Carlos, California, May 11, 2001.

44. Peptide degradation in polymer matrices. Genentech, Inc., South San Francisco, California, May 14, 2001.

45. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry, Drew University, Madison, NJ, June 12-14, 2001.

46. Pharmacokinetics and ADME. Bristol-Myers Squibb, Inc., Hopewell, New Jersey, September 10, 2001.

47. Introduction to pharmacodynamics. Bristol-Myers Squibb, Inc., Hopewell, New Jersey, September 10, 2001.

48. Pharmacokinetics and ADME. BAS, Inc., West Lafayette, Indiana, October 15, 2001.

49. Introduction to pharmacodynamics. BAS, Inc., West Lafayette, Indiana, October 15, 2001.

50. Pharmacokinetics and ADME. Residential School on Medicinal Chemistry, Drew University, Madison, NJ, June 11-13, 2002.

51. Students who work. E. M. Topp and T. Mullinazzi. University of Kansas Center for Teaching Excellence Teaching Summit, Lawrence, KS, August 20, 2002.

52. Introduction to the afternoon session. Reactivity of Organic Molecules in the Solid State Symposium, Pfizer, Inc., Groton, Connecticut, October 10-11, 2002.

53. Hydrolytic mechanisms of peptide and protein degradation. GPEN 2002, Ann Arbor, Michigan, November 6-8, 2002.

54. Teaching dosage forms in the pharmaceutics curriculum. American Association of Pharmaceutical Scientists Annual Meeting, Toronto, Canada, November 10, 2002.

55. Chemical degradation of peptides in amorphous solids. Department of Chemical and Petroleum Engineering, The University of Kansas, Lawrence, Kansas, December 4, 2003.

56. Hydrolytic mechanisms of peptide and protein degradation. GPEN 2004, Kyoto, Japan, May 25-28, 2004.

57. Peptide degradation reactions in lyophilized solids. CPPR Freeze-Drying Conference, Breckenridge, CO, July 29-31, 2004.

58. Chemical degradation of peptides and proteins in amorphous solids. Nektar Therapeutics, Inc., August 13, 2004.

59. Deamidation in solutions and solids. IBC's 4th Annual Formulation Strategies for Protein Therapeutics, Boston, MA, October 4-6, 2004.

60. Campus tour: a view from inside the university. InterVarsity Staff Conference '05, Saint Louis, MO, January 5-8, 2005.

61. Chemical degradation of protein drugs in the solid state. University of Missouri Kansas City, Center for Research on Interfacial Structure and Properties (UMKC-CRISP), Kansas City, MO, April 21, 2005.

62. Introduction to pharmacokinetics. Vertex Pharmaceuticals, Cambridge, MA, July 2005.

63. Effect of secondary structure on deamidation in solution and in the solid state. 2005 Colorado Protein Stability Conference, Breckenridge, CO, July 14-16, 2005.

64. Scientific foundations of protein formulation (keynote). IBC's 5th Annual Formulation Strategies for Protein Therapeutics, Boston, MA, September 19-21, 2005.

65. Chemical degradation of peptides in amorphous solids. National Institute of Standards and Technology (NIST), Gaithersburg, MD, October 17, 2005.

66. Nanotech approaches to drug formulation and delivery. Missouri Nanotechnology Alliance, November 11-12, 2005.

67. Chemical degradation of peptides in amorphous solids. Durect Pharmaceuticals, Inc., Cupertino, CA, June 26, 2006.

68. Deamidation in solution and solid formulations. Successful Protein Therapeutics: The Interconnection of Formulation, Process Development and Manufacturing (ACS ProSpectives Series), San Diego, July 23-26, 2006.

69. Deamidation in solid protein formulations. Amgen, Inc., Thousand Oaks, CA, July 27, 2006.

70. Chemical degradation of peptides and proteins in the amorphous solid state. KBI Biopharma, Durham, NC, July 31, 2006.

71. Deamidation in solution and solid formulations. Pfizer, Inc., St. Louis, MO, August 18, 2006.

72. The chemistry of peptide and protein degradation in amorphous solids. Freeze-Drying of Pharmaceuticals and Biologicals Conference (sponsors: University of Munich, University of Connecticut, Dane O. Kildsig Center), Garmisch-Partenkirchen, Germany, October 3-6, 2006.

73. Gamma-irradiation induced modifications in IgG. Clearant, Inc., Fort Collins, CO, October 18, 2006.

74. Roundtable: Solid-state chemical reactions of significance in the formulation and stability of solid dosage forms. American Association of Pharmaceutical Scientists Annual Meeting, San Antonio, TX, October 29 – November 2, 2006.

75. Proteins in amorphous solids – a new approach to structure characterization. University of Missouri Center for Research on Interfacial Properties, Kansas City, MO, February 20, 2007.

76. Chemical characterization of monoclonal antibodies. KBI Biopharma, Durham, NC, May 3, 2007.

77. Proteins in amorphous solids. Department of Pharmaceutical Chemistry, The University of Kansas, Department Retreat, Lawrence, KS, October 12, 2007.

78. Albumin deamidation in uremia. Sullivan Conference (Grand Rounds), The University of Kansas Medical Center, Kansas City, Kansas, December 14, 2007.

79. Deamidation in protein drug formulations. Formulation & Forced Degradation of Biomolecules, San Diego, CA, January 21-23, 2008.

80. Panel discussion: Orthogonal methods and characterization technologies to characterize degradants and aggregates. Formulation & Forced Degradation of Biomolecules, San Diego, CA, January 21-23, 2008.

81. Protein stability in amorphous solids. Tenth Annual Conference on the Formulation and Delivery of Bioactives, Dunedin, New Zealand, February 13-15, 2008.

82. Effect of secondary structure on deamidation in Fc-IgG. Victorian College of Pharmacy, Monash University, Melbourne, Australia, February 18-19, 2008.

83. Protein stability in amorphous solids. Hospira, Inc., McPherson, KS, April 15, 2008.

84. Ten tips for success as a woman in science. STEM Graduate Women's Luncheon, The University of Kansas, Lawrence, KS, April 19, 2008.

85. Effects of secondary stucture on deamidation of the Fc portion of a recombinant monoclonal antibody IgG, S. Sinha, L. Zhang, T.D. Williams, J. Vlasak, R. Ionescu and E.M. Topp. American Chemical Society National Meeting, Philadelphia, PA, August 17-21, 2008.

86. Ten tips for success as a woman in science. Graduate Women in Mathematics meeting, The University of Kansas, Lawrence, KS, May 12, 2008.

87. H/D exchange for protein conformational analysis in the solid state. Freeze Drying of Pharmaceuticals and Biologicals Conference, Breckenridge, CO, August 6-9, 2008.

88. Protein structure and stability in amorphous solids. School of Pharmacy, Purdue University, West Lafayette, IN, August 28, 2008.

89. Protein instability: What can go wrong and what are the implications? Globalization of Pharmaceutics Education Network (GPEN) meeting, Leuven, Belgium, September 10-12, 2008.

90. H/D exchange for protein conformational analysis in amorphous solids. Abbott GmbH & Co., Ludwigshafen, Germany, September 12, 2008.

91. Ten tips for success as a woman in science. Women in Science and Mathematics Learning Community, The University of Kansas, Lawrence, KS, September 16, 2008.

92. Stability and conformation of protein drugs in amorphous solids. Bioengineering (BIOE) Colloquium, University of Kansas, Lawrence, KS. September 26, 2008.

93. Protein-excipient interactions in lyophilized solids by hydrogen/deuterium exchange with mass spectrometry. IBC's Fourth Annual BioProcess International Analytical and Quality Summit, La Jolla, CA, May 4-6, 2009.

94. Lyophilization and thiol-disulfide exchange. Colorado Protein Stability Conference, Breckenridge, CO, July 16-18, 2009.

95. Pharmaceutical and healthcare engineering. Chemical Engineering of the Future Symposium, Purdue University, West Lafayette, IN, September 24, 2009.

96. Ten tips for success as a human in science. AAPS Student Chapter Meeting, Purdue University, West Lafayette, IN, October 22, 2009.

97. Effects of lyophilization on protein chemical and physical stability. University of Strasbourg, Alsace, France, November 2, 2009.

98. Wish I'd known. Intervarsity Graduate Student and Faculty Fellowship, Purdue University, West Lafayette, IN, November 5, 2009.

99. Effects of lyophilization on thiol-disulfide exchange.CHI Peptalk, Lyophilization and Spray Drying 2010, San Diego, CA, January 14-15, 2010.

100. Structure and stability: Protein degradation in solution and in the solid state. Eli Lilly and Co., Indianapolis, IN, September 10, 2010.

101. Medicines for the new millenium: Challenges and opportunities in drug discovery and development (plenary). Ph.D. Students and Young Scientists Conference, Warsaw, Poland. September 13-16, 2010.

102. Structure and stability: Protein degradation in solution and in the solid state. University of Kentucky College of Pharmacy, Lexington, KY, September 17, 2010.

103. Structure and stability: Protein degradation in solution and in the solid state. University of Grenoble, Grenoble, France, September 27-28, 2010.

104. Effects of lyophilization on thiol-disulfide exchange. Freeze-Drying of Pharmaceuticals and Biologicals Conference, Garmisch-Partenkirchen, Germany, September 28 to October 1, 2010.

105. Large molecule, small molecule. Catalent Basic Pharmaceutical Sciences Course, Somerset, NJ, October 5-8, 2010.

106. Introduction to protein drugs. Catalent Basic Pharmaceutical Sciences Course, Somerset, NJ, October 5-8, 2010.

107. Structure and stability: Protein degradation in solution and in the solid state. University of Illinois Chicago College of Pharmacy, Chicago, IL, October 20, 2010.

108. Hydrogen/deuterium exchange for lyophilized proteins. CHI PepTalk, San Diego, CA, January 10-14, 2011.

109. Proteins in amorphous solids: Through the looking glass. University of Michigan College of Pharmacy, Ann Arbor, MI, February 23, 2011.

110. Effects of lyophilization on protein chemical and physical properties. Abbott Laboratories, North Chicago, December 8, 2011.

111. Aggregation of protein drugs. University of Connecticut, College of Pharmacy, Storrs, CT, February 1, 2012.

112. Aggregation of protein drugs. University of Kansas, Department of Chemical Engineering, Lawrence, KS, March 6, 2012.

113. Effects of lyophilization on protein drugs. 2012 Annual Meeting of the Midwest Chapter of the International Society for Lyophilization – Freeze Drying (ISLFD), Chicago, IL, April 12, 2012.

114. Degradation of protein drugs: Mechanisms and risk assessment. Pfizer Global Supply Webex, September 4, 2012.

115. Introduction to the Department of Industrial and Physical Pharmacy. Shenyang Pharmaceutical University, Shenyang, China, September 16, 2012.

116. Aggregation of protein drugs: Risk assessment and mitigation strategies. U.S. Food and Drug Administration, Center for Biologics Evaluation and Research (CBER), Rockville, MD, November 27, 2012.

117. Aggregation of protein drugs: Risk assessment and mitigation strategies. University of Illinois Chicago, Chicago, IL, January 30, 2013.

118. Challenges and opportunities in pharmacy. University of Wisconsin-Madison, School of Pharmacy, Madison, WI, April 8, 2013.

119. New methods for characterizing aggregates and pre-aggregates in lyophilized solids. Ninth Annual PEGS Summit; Analytical Stream – Biophysical Analysis of Biotherapeutics, Boston, MA, May 2, 2013.

120. High resolution characterization of proteins in amorphous solid powders, E.M. Topp, L.K. Iyer, S.M. Balakrishnan and B. Xie, International Symposium on Polymer Analysis and Characterization, New Orleans, LA, June 9-12, 2013.

121. Ten tips for success as a woman in tech (WebEx). Seagate Women's Leadership Network, August 26, 2013.

122. High resolution characterization of proteins in lyophilized powders. Pfizer, Inc., Pearl River, NY, September 11, 2013.

123. Intermolecular interactions in drug development. Lilly Tech Day, Eli Lilly and Company, Indianapolis, IN, September 30, 2013.

124. Protein aggregation: Mechanisms and characterization, Part I. CHI PepTalk, Palm Springs, CA, January 14, 2014.

125. Analytical challenges in detecting protein aggregates. CHI PepTalk, Palm Springs, CA, January 16, 2014.

126. High resolution mass spectrometric monitoring of early aggregates. ECI Biological and Pharmaceutical Complex Fluids, Durham, NC, August 10-14, 2014.

127. High resolution MS characterization of glucagon fibrillation to design stable formulations. American Association of Pharmaceutical Scientists Annual Meeting, San Diego, CA, November 2-6, 2014.

128. High resolution structural characterization of proteins in lyophilized powders: Hydrogen deuterium exchange and photolytic labeling with mass spectrometric analysis. Baxter Pharmaceuticals, Inc., Bloomington, IN, April 16, 2014.

129. Lyophilized formulations of protein drugs: Toward chemical definition of the amorphous solid state. University of Iowa, Department of Pharmaceutical Sciences and Experimental Therapeutics, Iowa City, IA, April 20, 2014.

130. Protein aggregation: Mechanisms and characterization, Part I. PEGS: the Essential Protein Engineering Summit. Short Course 16: Protein Aggregation: Mechanism, Characterization and Immunogenic Consequences, Boston, MA, May 8, 2014.

131. High resolution characterization of protein structure and interactions in formulation design. MedImmune, Gaithersburg, MD, June 10, 2014.

132. Leadership and the end of higher education. InterVarsity Midwest Faculty Conference, Cedar Campus, Cedarville, MI, June 22-27, 2014.

133. High resolution structural characterization of proteins in amorphous solids: Hydrogen deuterium exchange and photolytic labeling with mass spectrometric analysis. AMORPH 2014, Cambridge, UK, July 14-16, 2014.

134. High resolution characterization of proteins in formulation design. Roche, Basel, Switzerland, July 22, 2014.

135. High resolution characterization of protein structure and interactions in formulation design. Eli Lilly and Company, Grand Rounds, Indianapolis, IN, August 6, 2014.

136. Top ten tips for success as a woman in pharma. Women in Lilly Discovery and Development (WiLDD), Eli Lilly and Company, Indianapolis, IN, August 6, 2014.

137. Leadership and the end of higher education. Union University, Jackson, TN, November 18-19, 2014.

138. Protein conformation in lyophilized solids by hydrogen/deuterium exchange with mass spectrometric analysis (ssHDX-MS). BITC Roundtable, Genentech, South San Francisco, CA, February 3, 2015.

139. The well-lived academic life. InterVarsity Faculty Ministry webinar, February 28, 2015.

140. Ten tips for pre-tenure faculty. ADVANCE FAST workshop, Purdue University, West Lafayette, IN March 24, 2015.

141. Effect of lyophilization on protein aggregation. 2015 Annual Meeting of the Midwest Chapter of the International Society for Lyophilization – Freeze Drying (ISLFD), Chicago, IL, April 9, 2015.

142. Characterizing protein higher order structure in the design of lyophilized formulations. Gordon Conference, “Preclinical Form and Formulation in Drug Discovery”, Waterville Valley Resort, NH, June 7-12, 2015.

143. High resolution characterization of glucagon fibrillation to design stable formulations. Colorado Protein Stability Conference, Beaver Run Resort, Breckenridge, CO, July 21-23, 2015.

144. Protein conformation in lyophilized solids by hydrogen/deuterium exchange with mass spectrometric analysis (ssHDX-MS). NIST/University of Maryland Biomanufacturing Summit, Rockville, MD, June 25, 2015.

145. Formulating to optimize peptide physical and chemical stability. 2015 American Association of Pharmaceutical Scientists Annual Meeting and Exposition, Orlando, FL, October 25-31, 2015.

Contributed podium presentations

Where multiple authors are listed, the presenter's name is underlined.

1. Relating traditional and physiological pharmacokinetic models, 20th Annual Higuchi Conference, Lake of the Ozarks, Missouri, March 1987.

2. A novel drug delivery system: microspheres of hyaluronic acid derivatives. L. M. Benedetti, E. M. Topp and V. J. Stella, 3rd International Workshop on Recent Developments in Industrial Polysaccharides: Biomedical and Biotechnological Advances, Trieste, Italy, October, 1988.

3. Characterization of polymeric films prepared from esterified hyaluronic acid. J. A. Hunt, V. J. Stella and E. M. Topp, 3rd International Workshop on Recent Developments in Industrial Polysaccharides: Biomedical and Biotechnological Advances, Trieste, Italy, October, 1988.

4. A mathematical model for tumor penetration of chemotherapeutic agents. J. S. Claudius, B. Subramaniam, E. M. Topp, American Institute of Chemical Engineers National Meeting, session on Engineering Fundamentals in the Life Sciences, Washington, D.C., November, 1988.

5. Drug release from microspheres made of corticosteroid esters of hyaluronic acid. L. Benedetti, E. M. Topp, L. Callegaro and V. Stella, Seventh International Symposium on Microencapsulation, Glasgow, Scotland, April 2-4, 1990.

6. Drug release from hyaluronic acid corticosteroid esters. L. Benedetti, L. Goei, F. Biviano, L. Callegaro, E. Topp, V. Stella, Fourth International Conference on Polymers in Medicine, Riva del Garda, Italy, September 11-13, 1990.

7. An application of DSC to determine types of water of hydration in hyaluronic acid and its esters. H. N. Joshi, V. J. Stella and E. M. Topp, AAPS National Meeting, Las Vegas, Nevada, November 1990.

8. Microspheres of hyaluronic acid in sustained release of methylprednisolone. L. Hume, L. Benedetti, J. Bresnahan, E. Topp and V. Stella, 17th Annual Meeting of the Society for Biomaterials, Scottsdale, Arizona, May 1-5, 1991.

9. Alginic acid esters for oral drug delivery. L. Ruiz-Cardona, V. J. Stella and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Washington, DC, November 1991.

10. Mechanism of drug release from hydrocortisone (HC) hyaluronate ester tablets. L. G. Rajewski, E. M. Phillips, E. M. Topp, V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, San Antonio, Texas, November 1992.

11. Mass transport properties of microdialysis membranes in hydrodynamic systems. J. A. Stenken, J. Seippel, E. M. Topp, M. Z. Southard and C. E. Lunte, Third International Sympsoium on Microdialysis and Allied Analytical Techniques, Indianapolis, May 19-21, 1993.

12. Quantitative microdialysis for hydrodynamic and living systems. J. A. Stenken, E. M. Topp, M. Z. Southard and C. E. Lunte. Department of Chemical and Petroleum Engineering, The University of Kansas, October, 1993.

13. Transport of binding antibodies in tumors - in vitro studies. Twenty-Seventh Annual Higuchi Research Seminar, Lake of the Ozarks, Missouri, March 13-16, 1994.

14. Tissue penetration of macromolecular drugs. Twenty-Ninth Annual Higuchi Research Seminar, Lake of the Ozarks, Missouri, March 10-13, 1996.

15. Tissue penetration of macromolecular drugs. First Meeting of the Globalization of Pharmaceutics Education Network, Lawrence, Kansas, October 24-26, 1996.

16. Effect of water on peptide deamidation in solid polymeric formulations. M. C. Lai, M. J. Hageman, R. L. Schowen, R. T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists National Meeting, Boston, Massachusetts, November 2 through 6, 1997.

17. Antibody penetration in solid tumors. (Focused Podium Session) American Association of Pharmaceutical Scientists National Meeting, Boston, Massachusetts, November 2 through 6, 1997.

18. Mechanisms of drug release from hyaluronic acid esters. L. Rajewski, E. Phillips, E. Topp and V. Stella. New Frontiers in Medical Sciences: Redefining Hyaluronan, Padua, Italy, June 17-19, 1999.

19. Design of novel pharmaceutical products via combinatorial optimization. S. Siddhaye, K.V. Camarda, E.M. Topp and M.Z. Southard. Process Systems Engineering Meeting, Breckenridge, Colorado, July 16-23, 2000.

20. Deamidation in a lyophilized protein formulation and structural characterization by solid state hydrogen/deuterium exchange. Yunsong Li and Elizabeth M. Topp, 38th Annual Pharmaceutics Graduate Student Research Meeting, Minneapolis, MN, June 8-10, 2006.

21. Effect of protein structure on deamidation in amorphous solids. E.M. Topp, American Chemical Society 232nd National Meeting, San Francisco, CA, September 10-14, 2006.

22. Gamma irradiation-induced damage in proteins and peptides. Sheng-Xue Xie, Todd D. Williams, Dru Willey and Elizabeth M. Topp. American Chemical Society 233rd National Meeting, Boston, MA, August 19-23, 2007.

23. Development of quantitative structure-property relations for crosslinked polymethacrylate resins for dental applications (plenary). John Eslick, Qiang Ye, Jong-Gu Park, Elizabeth Topp, Yong Wang, Paulette Spencer and Kyle Camarda, American Institute of Chemical Engineers Annual Meeting, Salt Lake City, UT, November 4-9, 2007.

24. Effect of secondary structure on deamidation of the Fc portion of a recombinant monoclonal antibody IgG. Lei Zhang, Sandipan Sinha, Todd D. Williams, Roxana Ionescu, Josef Vlasak and Elizabeth M. Topp. American Chemical Society 234th National Meeting, Philadelphia, PA, August 17-21, 2008.

25. Analysis of protein-excipient interactions in amorphous solids by hydrogen/deuterium exchange with mass spectrometry. Sandipan Sinha, Yunsong Li, Todd D. Williams and Elizabeth M. Topp. American Chemical Society 234th National Meeting, Philadelphia, PA, August 17-21, 2008.

26. Reversibility and regioselectivity in thiol/disulfide interchange of tocinoic acid with glutathione in lyophilized solids. L. Zhang, T.D. Williams and E.M. Topp. American Chemical Society National Meeting, Philadelphia, PA, August 17-21, 2008.

27. Medicines for the new millennium: Challenges and opportunities in drug discovery and development. E.M. Topp, Department of Industrial and Physical Pharmacy, Purdue University, August 26, 2010.

28. Use of aggregation prediction as a function of protein and excipient properties for lyophilized formulation design. Brock C. Roughton, Lavanya K. Iyer, Haider Tarar, Anthony I. Pokphanh, Elizabeth M. Topp, Kyle V. Camarda, American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA, October 28-November 2, 2012.

Poster presentations

Where multiple authors are listed, the presenter's name is underlined.

1. A physiological flow model for the gastrointestinal absorption and plasma kinetics of aspirin, Elizabeth D. Murphy, Jennifer B. Dressman and Gordon L. Amidon, American Pharmaceutical Association/Academy of Pharmaceutical Sciences National Meeting, Philadelphia, Pennsylvania, November 1984.

2. A physiological flow model for the gastrointestinal absorption and plasma kinetics of aspirin, Elizabeth M. Topp and Gordon L. Amidon, American Association of Pharmaceutical Scientists National Meeting, Washington, D.C., October 1986.

3. A mathematical model for the tumor penetration of chemotherapeutic agents, J. S. Claudius, B. Subramaniam and E. M. Topp, American Association of Pharmaceutical Scientists Midwest Regional Meeting, May 15, 1988.

4. Characterization of polymeric films prepared from ester derivatives of hyaluronic acid. J. A. Hunt, V. J. Stella and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November, 1988.

5. Microwave drying of aqueous tablet film coating - a study on free films. H. N. Joshi and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November, 1988.

6. A novel drug delivery system: microspheres of hyaluronic acid derivatives. L. M. Benedetti, E. M. Topp and V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November, 1988.

7. Effect of Azone® and lauryl alcohol of transport of acetaminophen through shed snake skin. P. P. Bhatt, J. H. Rytting, E. M. Topp and T. Higuchi, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November, 1988.

8. A mathematical model for the tumor penetration of chemotherapeutic agents. J. S. Claudius, B. Subramaniam and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November, 1988.

9. *In vitro* diffusion and metabolism of a model peptide in the hamster cheek pouch. K. W. Garren, E. M. Topp and A. J. Repta, American Association of Pharmaceutical Scientists National Meeting, Orlando, Florida, November,1988.

10. Drug release from hydrocortisone esters of hyaluronic acid. L. Goei, L. Benedetti, E. M. Topp and V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, Atlanta, Georgia, October, 1989.

11. Drug release from films of hyaluronic acid and its esters. H. Joshi, V. J. Stella and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Atlanta, Georgia, October, 1989.

12. Polymeric prodrugs: mechanism of drug release from hyaluronic acid ester films. Hemant Joshi, Valentino Stella and Elizabeth Topp, The 17th International Symposium on the Controlled Release of bioactive Materials, Reno, Nevada, July 22-25, 1990.

13. Use of hyaluronic acid ester microspheres in the treatment of rheumatoid arthritis. Lisbeth Hume, Elizabeth Topp, James Bresnahan and Valentino Stella, The 17th International Symposium on the Controlled Release of bioactive Materials, Reno, Nevada, July 22-25, 1990.

14. Drug delivery devices from polymeric prodrugs. H. Joshi, L. Benedetti, L. Callegaro, V. Stella, E. Topp, Fourth International Conference on Polymers in Medicine, Riva del Garda, Italy, September 11-13, 1990.

15. Steroid esters of hyaluronic acid in the treatment of rheumatoid arthritis. Lisbeth Hume, Elizabeth Topp and Valentino Stella, American Association of Pharmaceutical Scientists National Meeting, Las Vegas, Nevada, November 1990.

16. Diffusion of peptides in polymer films prepared from ester derivatives of hyaluronic acid, D. Papini, S. Hejri, V. J. Stella and E. M. Topp, The 18th International Symposium on the Controlled Release of Bioactive Materials, Amsterdam, The Netherlands, July 8-11, 1991.

17. Effect of hydration and hydrolysis on drug release from tablets of hydrocortisone esters of hyaluronic acid. L. Goei, L. M. Benedetti, E. M. Topp and V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, Washington, DC, November 1991.

18. Esters of hyaluronic acid for controlled release of polypeptides: *in vitro* studies on membranes. D. Papini, L. Callegaro, V. J. Stella and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Washington, DC, November 1991.

19. Use of films of hyaluronic acid esters in ophthalmic drug delivery. K. Kyyronen, L. Hume, L. Benedetti, A. Urtti, E. Topp and V. Stella, American Association of Pharmaceutical Scientists National Meeting, Washington, DC, November 1991.

20. Methylprednisolone ester of gellan for ophthalmic drug delivery: in vitro and in vivo studies. Y. Sanzgiri, S. Maschio, E. Topp, L. Callegaro, V. Crescenzi, V. Stella. Biomaterials and Intelligent Materials; Technological Aspects and Medical Applications.

21. Gellan-based systems for ophthalmic sustained delivery of methylprednisolone. Y.D. Sanzgiri, S. Maschi, V. Crescenzi, L. Callegaro, E. M. Topp and V. J. Stella, The 20th International Symposium on the Controlled Release of Bioactive Materials, Washington, DC, July 25-28, 1993.

22. Swelling properties of hyaluronic acid ester films. K. C. Sung, L. Callegaro and E. M. Topp, The 20th International Symposium on the Controlled Release of Bioactive Materials, Washington, DC, July 25-28, 1993.

23. Mucoadhesive properties of hyaluronic acid benzyl esters. Y.D. Sanzgiri, L. Benedetti, E. M. Topp and V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

24. In vitro and in vivo characterization of ocular prednisolone delivery using hyaluronate ester films and prodrugs. L. R. Hume, H. Y. Lee, L. Benedetti, Y.D. Sanzgiri, E. M. Topp and V. J. Stella, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

25. Determination of hydraulic conductivity in B16 melanoma cell layers. Tina L. Hendrickson and Elizabeth M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

26. An in vitro model for antibody diffusion in solid tumors. V. Vijaykumar, P. A. Kitos and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

27. Permeation of solutes through hyaluronic acid ester membranes. K. C. Sung and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

28. A diffusion model for the transport of drugs by using shed snake skin as a model membrane. Danchen Gao, Elizabeth Topp and J. Howard Rytting, American Association of Pharmaceutical Scientists National Meeting, Orlando, FL, November 1993.

29. Placental transport of pentamidine in the rhesus monkey. L. E. Ridgway, T. S. King, E. M. Topp, G. I. Henderson , S. Schenker and R. S. Schenken. Society for Gynecologic Investigation, 1993.

30. High density growth of mammalian cells for coculture studies. V. Vijaykumar and E. M. Topp, Watkins Life Science Conference, Wichita, KS, April 15-16, 1994.

31. Determination of immunoconjugate transport by convection in B16 melanoma cell layers. Binodh S. DeSilva and Elizabeth M. Topp, American Association of Pharmaceutical Scientists National Meeting, San Diego, CA, November 1994.

32. Diffusion of specific antibodies in a cell culture model of a solid tumor. V. Vijaykumar and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, San Diego, CA, November 1994.

33. Mass transport properties of dextrans in a model basement membrane. D. Thompson, M. Khossravi, V. Vijaykumar and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, San Diego, CA, November 1994.

34. Effect of hydroxypropylmethylcellulose (HPMC) concentration and viscosity grade on the swelling kinetics and drug release of HPMC-based, matrix extended-release tablets. K.C. Sung, T.C.R. Ju, P.R. Nixon, M. V. Patel, J.W. Skoug, P. Gao and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, San Diego, CA, November 1994.

35. An automated analytical system used to study the in vitro partitioning of lomefloxacin across an erythrocyte membrane. S.R. Knaub, M.F. Chang, C.E. Lunte, E.M. Topp and C.M. Riley, Sixth International Symposium on Pharmaceutical and Biomedical Analysis, St. Louis, MO, April 1995.

36. The use of a novel fully automated technique to study the binding of warfarin to human serum albumin. R. M. Trewyn, S.R. Knaub, C.E. Lunte, E.M. Topp and C.M. Riley, Sixth International Symposium on Pharmaceutical and Biomedical Analysis, St. Louis, MO, April 1995.

37. Convective transport of antibodies through B16F10 melanoma cell layers. Binodh S. DeSilva and Elizabeth M. Topp. Kansas Health Foundation Annual Symposium, Lawrence, Kansas, April 3-4, 1995.

38. Partitioning of lomefloxacin into human erythrocytes using an automated in vitro microdialysis system. S. R. Knaub, M. F. Chang, C. E. Lunte, E. M. Topp and C. M. Riley. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 22, 1995.

39. The stability of a model hexapeptide in poly(vinyl alcohol) matrices. M. C. Lai, E. M. Topp, R. L. Schowen and R. T. Borchardt. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 22, 1995.

40. Convective transport of antibodies through B16F10 melanoma cell layers. Binodh S. DeSilva and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 22, 1995.

41. Diffusion of antibodies in a cell culture model of a solid tumor. V. Vijaykumar and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 22, 1995.

42. Solute diffusion in ionizable hydrogels. E. M. Topp and K.C. Sung. Twenty-Second International Symposium on the Controlled Release of Bioactive Materials, Seattle, Washington, July 30 to August 2, 1995.

43. Peptide stability in polymer matrices. M. C. Lai and E. M. Topp. Twenty-Second International Symposium on the Controlled Release of Bioactive Materials, Seattle, Washington, July 30 to August 2, 1995.

44. Penetration of binding antibodies through cultured B16 mouse melanoma cell layers. V. Vijaykumar, B. S. DeSilva and E. M. Topp. Whitaker Foundation Fifth Annual Conference for Principal Investigators, Snowbird, Utah, August 4-6, 1995.

45. Mechanisms of lomefloxacin partitioning into human erythrocytes: an in vitro microdialysis study. S. R. Knaub, K. L. Audus, C. E. Lunte, E. M. Topp and C. M. Riley, American Association of Pharmaceutical Scientists National Meeting, Miami, FL, November 1995.

46. Effect of the growth matrix on the hydraulic conductivity of B16F10 melanoma cell layers. B. S. DeSilva and E. M. Topp, American Association of Pharmaceutical Scientists National Meeting, Miami, FL, November 1995.

47. Mechanisms of lomefloxacin partitioning into human erythrocytes by in vitro microdialysis and fluorescence anisotropy. S. R. Knaub, K. L. Audus, C. E. Lunte, E. M. Topp and C. M. Riley. Fifth International Workshop on Bioanalysis, Lawrence, KS, June 5-8, 1996.

48. Separation of a model hexapeptide and its degradation products using capillary electrophoresis. M. C. Lai, D. J. Skanchy, J. F. Stobaugh and E. M. Topp. Fifth International Workshop on Bioanalysis, Lawrence, KS, June 5-8, 1996.

49. Processes and innovations in implementation of the doctor of pharmacy as the sole entry-level degree at the University of Kansas. David W. Henry and Elizabeth M. Topp. American Association of Colleges of Pharmacy Annual Meeting, Reno, Nevada, July 15-18, 1996.

50. Antibody transport across cultured tumor cells: influence of ligand concentration and receptor density. V. Vijaykumar and E. M. Topp. Kansas Health Foundation Annual Symposium, Lawrence, Kansas, April 8, 1996.

51. Effect of water on the solid state deamidation of a hexapeptide in polymer matrices. M. C. Lai, R. L. Schowen, R. T. Borchardt, M. J. Hageman and E. M. Topp. Southeast Regional Meeting of the American Association of Pharmaceutical Scientists, Research Triangle Park, North Carolina, June 23, 1997.

52. Evaluation of the first semester of an "integrated" laboratory course at the University of Kansas. Lawrence W. Davidow and Elizabeth Topp. American Association of Colleges of Pharmacy Annual Meeting, Indianapolis, Indiana, July 1997.

53. The effect of water and glass transition temperature on the solid state stability of a model peptide in polymers. M. C. Lai, R. L. Schowen, R. T. Borchardt, M. J. Hageman and E. M. Topp. 1997 Colorado Biopharmaceutical Delivery Conference, Breckenridge, Colorado, July 24-26, 1997.

54. The effect of glass transition temperature and plasticizer on the stability of a hexapeptide in polymeric formulations. M. C. Lai, R. L. Schowen, R. T. Borchardt, M. J. Hageman and E. M. Topp. American Association of Pharmaceutical Scientists National Meeting, Boston, Massachusetts, November 2 through 6, 1997.

55. Effect of processing conditions on the water vapor sorption behavior of poly(vinyl alcohol) and poly(vinyl pyrrolidone). M. C. Lai, R. L. Schowen, R. T. Borchardt, E. M. Topp and M. J. Hageman. American Association of Pharmaceutical Scientists National Meeting, Boston, Massachusetts, November 2 through 6, 1997.

56. Effect of temperature on peptide deamidation in polymer matrices. P. Berglund, R. L. Schowen, R. T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 18, 1998.

57. Effect of dielectric constant and viscosity changes on the deamidation rate of Asn-hexapeptide in PVP and glycerol solutions. R. Li, R. L. Schowen, R. T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 18, 1998.

58. Temperature effects on peptide deamidation in polymer matrices. P. Berglund, R. L. Schowen, R. T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists Annual Meeting, San Francisco, CA, November 15-19, 1998.

59. Effects of polarity [ET(30)] and viscosity changes on the deamidation rate of Asn-hexapeptide in PVP and glycerol solutions. R. Li, R. L. Schowen, R. T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists Annual Meeting, San Francisco, CA, November 15-19, 1998.

60. Peptide deamidation in solution state analogs of polymeric media. Susanne Soenderkaer, Jesper Ostergaard, Bente Steffansen, Ronald T. Borchardt, Richard L. Schowen and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 17, 1999.

61. The effects of water content and glass transition temperature (Tg) on the degradation rate of a cyclic imide (Asu) containing model peptide in the presence of poly(vinyl pyrrolidone) (PVP) in the solid state. Ashley D. Wilson, Jean Dehadashti, Ronald T. Borchardt, Elizabeth M. Topp and Richardt L. Schowen. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 17, 1999.

62. Effect of pH on peptide deamidation in polymeric matrices. Yuan Song, Ronald T. Borchardt, Richard L. Schowen and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 17, 1999.

63. Effects of viscosity and solvent polarity on peptide deamidation: comparison of experimental and theoretical results. R. Li, B. Laird, R.L. Schowen, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, New Orleans, LA, November 14-18, 1999.

64. Asparagine deamidation in polymeric matrices: effect of pH. Yuan Song, Richard L. Schowen, Ronald T. Borchardt and Elizabeth M. Topp. American Association of Pharmaceutical Scientists National Meeting, New Orleans, LA, November 14-18, 1999.

65. Deamidation of a model hexapeptide in solution state analogs of polymeric media. Jesper Ostergaard, Susanne Soenderkaer, Bente Steffansen, Ronald T. Borchardt, Richard L. Schowen and Elizabeth M. Topp. American Association of Pharmaceutical Scientists National Meeting, New Orleans, LA, November 14-18, 1999.

66. Effect of polyvinylpyrrolidone on peptide deamidation in solid state: evidence for complexation. Ajit D'Souza, Richard L. Schowen, Ronald T. Borchardt and Elizabeth M. Topp. American Association of Pharmaceutical Scientists National Meeting, New Orleans, LA, November 14-18, 1999.

67. Effect of pH on asparagine deamidation in a polymeric formulation. I. Kinetics, product distributions, side reactions and mass balance. Y. Song, R.T. Borchardt, R.L. Schowen and E.M. Topp, Millennial World Congress, San Francisco, CA, April 15-20, 2000.

68. Effect of pH on asparagine deamidation in a polymeric formulation. II. Construction of a pH-rate profile and mechanistic analysis. Y. Song, R.T. Borchardt, R.L. Schowen and E.M. Topp, Millennial World Congress, San Francisco, CA, April 15-20, 2000.

69. Chemical stability of type I' β-turn peptide: assay development. C.E. Stotz, Y. Song and E.M. Topp, American Association of Pharmaceutical Scientists Midwest Regional Meeting, Chicago, IL, May 22, 2000.

70. Development of an assay for deamidation in a type I' β-hairpin turn peptide. C.E. Stotz, Y. Song, R.L. Schowen, R.T. Borchardt and E.M. Topp. Colorado Protein Stability Conference, Breckenridge, CO, July 13-15, 2000.

71. Effect of viscosity on the deamidation rate of Asn-hexapeptide. R. Li, M.J. Hageman, R.L. Schowen, R.T. Borchardt and E.M. Topp. GPEN 2000, Uppsala, Sweden, September 13-25, 2000.

72. Mechanistic interpretation of pH effect on asparagine deamidation in polymer formulation. Y. Song, R.T. Borchardt, R.L. Schowen and E.M. Topp, American Association of Pharmaceutical Scientists National Meeting, Indianapolis, IN, October 30 to November 2, 2000.

73. Reaction of poly(vinyl pyrrolidone) with Asn-hexapeptide (VYPNGA) during stability studies. A.J. S'Souza, R.L. Schowen, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Indianapolis, IN, October 30 to November 2, 2000.

74. Development of an assay for deamidation in a type I' β-hairpin turn peptide. C.E. Stotz, Y. Song, R.L. Schowen, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Indianapolis, IN, October 30 to November 2, 2000.

75. Photolysis of glutathione in aqueous solution and in polymeric films. Y. Song, J. Ji, S. Hovorka, J. Haslam, R.L. Schowen, E. M. Topp and C. Schöneich. American Association of Pharmaceutical Scientists National Meeting, Denver, CO, October 20-24, 2001.

76. Synthesis of polyvinyl pyrrolidone based polymeric prodrug. A. J. M. D'Souza, R.L. Schowen, R.T.Borchardt, E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Denver, CO, October 20-24, 2001.

77. Synthesis of model cyclic beta turn mimetics and their linear analogs. S. Winslow, Q. Yu, T. Siahaan, R. Borchardt and E. Topp. American Association of Pharmaceutical Scientists National Meeting, Denver, CO, October 20-24, 2001.

78. The degradation of D,L-PLGA and its effects on the deamidation of an incorporated Asn-hexapeptide. M.L. Houchin, R.T. Borchardt, R.L. Schowen and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Denver, CO, October 20-24, 2001.

79. An investigation of the degradation of DL-PLGA matrices using the deamidation of an incorporated Asn-hexapeptide. M.L. Houchin, R.T. Borchardt, R.L. Schowen and E.M. Topp. Critical Issues in the Design and Applications of Polymeric Biomaterials in Drug Delivery (American Association of Pharmaceutical Scientists Workshop), Washington, DC, February 28-March 1, 2002.

80. Influence of structure on deamidation in model β-turn peptides in solution and solid states. S.L. Winslow, Q. Yu, R. Borchardt, T. Siahaan and E.M. Topp. Protein Stability Conference, Breckenridge, CO, July 17-20, 2002.

81. Epimerization of asparagine residues in model peptides. B. Li, R.L. Schowen, E.M. Topp, D. Vander Velde and R.T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

82. Effects of secondary structure and physical state in peptide deamidation. B. Li, R.L. Schowen, E.M. Topp, D. Vander Velde and R.T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

83. Kinetics of asparagine deamidation in a β-hairpin peptide. C.E. Stotz, D. Vander Velde and E. M. Topp. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

84. Polymeric prodrug: enhanced release due to intramolecular ring closure. A.M. D'Souza and E. M. Topp. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

85. Synthesis and deamidation of model ß-turn peptides in the solution and solid state. S.L. Winslow, Q. Yu, R. Borchardt, T. Siahaan and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

86. Glutathione disulfide photolytic degradation produces an aldehyde. J. Ji, C. Schöneich, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

87. Effect of PLGA film incorporation on peptide deamidation. M.L. Houchin, R.T. Borchardt, and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Toronto, Canada, November 10-14, 2002.

88. Characterization and deamidation of model cyclic β-turn peptides and their linear analogs in solution and the solid state. S.L. Winslow, D.S. Reddy, R.T. Borchardt and E.M. Topp. Colorado Protein Stability Conference, Breckenridge, CO, July 17-19, 2003. Third runner-up for the Timasheff award for best student poster presentation.

89. The effects of a carboxylate side chain on the C-terminal side of an asparagine residue on its rate of deamidation. B. Li, R.L. Schowen, E.M. Topp and R.T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

90. The effects of sucrose and mannitol on the rate of deamidation of asparagine residues in model peptides in the solid state. B. Li, M. O'Meara, R.L. Schowen, E.M. Topp and R.T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

91. The effects of the residues on the N-terminal side of an asparagine residue on its rate of deamidation in the solid state. B. Li, R.L. Schowen, E.M. Topp and R.T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

92. Peptide degradation and recovery in PLGA films. M.L. Houchin, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

93. Characterization and deamidation of model cyclic β-turn peptides and their linear analogs. S.L. Winslow, D.S. Reddy, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

94. Products of glutathione disulfide photolytic degradation in solution. J. Ji, C. Schöneich, R.T. Borchardt and E. M. Topp. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

95. Deamidation rates within β-turn containing peptides. C.E. Stotz, D. Vander Velde, R.T. Borchardt and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

96. Polymer-peptide conjugates. A.J.M. D'Souza, R.T. Borchardt, R.L. Schowen, J. Salsbury, E.J. Munson, E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, Salt Lake City, Utah, October 26-30, 2003.

97. Effect of histidine in the N+1 and the N+2 positions on asparagine deamidation in the solid state. Aditya A. Wakankar, Richard L. Schowen, Elizabeth M. Topp and Ronald T. Borchardt. American Association of Pharmaceutical Scientists National Meeting, Baltimore, Maryland, November 7-11, 2004.

98. Stability of model cyclic β-turn peptides and their linear analogs in solution and PVP solids. Stephanie Winslow, D.S. Reddy, David Vander Velde, Ronald Borchardt, Elizabeth Topp. Globalization of Pharmaceutics Education Network Meeting, Kyoto, Japan, May 25-28, 2004.

99. Stability of model cyclic β-turn peptides and their linear analogs in solution and PVP solids. Stephanie Winslow, D.S. Reddy, David Vander Velde, Ronald Borchardt, Elizabeth Topp. Pharmaceutical Sciences World Congress, Kyoto, Japan, May 29-June 3, 2004.

100. The effect of hydrogen ion activity on the deamidation, acylation and recovery of a model Asn-hexapeptide incorporated in PLGA films. M.L.Houchin, R.T. Borchardt and E.M. Topp. Globalization of Pharmaceutics Education Network Meeting, Kyoto, Japan, May 25-28, 2004.

101. The effect of hydrogen ion activity on the deamidation , acylation and recovery of a model Asn-hexapeptide incorporated in PLGA films. M.L.Houchin, R.T. Borchardt and E.M. Topp. Pharmaceutical Sciences World Congress, Kyoto, Japan, May 29-June 3, 2004.

102. Effect of protein secondary structure and tertiary structure on its deamidation in the amorphous solid state. Y. Li and E.M. Topp, American Association of Pharmaceutical Scientists National Meeting, Nashville, TN, November 6-10, 2005.

103. Engineering peptides to promote stabilizing interactions in the solid state. S. Sinha, S. Thompson, K. Camarda, E. Topp, American Chemical Society 232nd National Meeting, San Francisco, CA, September 10-14, 2006.

104. Deamidation in a lyophilized protein formulation and structural characterization by solid state hydrogen/deuterium exchange. Yunsong Li, Todd D. Williams, Richard L. Schowen and Elizabeth M. Topp, 38th Annual Pharmaceutics Graduate Student Research Meeting, Minneapolis, MN, June 8-10, 2006.

105. Deamidation in a lyophilized protein formulation and structural characterization by solid state hydrogen/deuterium exchange. Yunsong Li, Todd D. Williams, Richard L. Schowen and Elizabeth M. Topp, 6th Globalization of Pharmaceutics Education Network (GPEN) Meeting, Lawrence, KS, October 25-27, 2006.

106. Engineering peptides to promote stabilizing interactions in the solid state. S. Sinha, S. Thompson, K. Camarda, E. Topp, 6th Globalization of Pharmaceutics Education Network (GPEN) Meeting, Lawrence, KS, October 25-27, 2006.

107. Preparation and properties of novel methacrylate-based dentin adhesives with esterase resistance, J.G. Park, Q. Ye, E.L.Kostoryz**,** X. Yao, E. M. Topp**,** Y. Wang and P. Spencer. Society for Biomaterials 2007 Annual Meeting, Chicago, IL, April 18-21, 2007.

108. Comparison of top-up (intact protein) and bottom-up techniques for the quantitation of glycosylation in recombinant IgG molecules. Sandipan Sinha, Gary Pipes, Elizabeth Topp, Pavel V. Bondarenko, Michael Treuheit and Himanshu S. Gadgil. American Society for Mass Spectrometry 2007 Annual Meeting, Indianapolis, IN, June 4-7, 2007.

109. MS method to report disulfide scrambling due to gamma irradiation. Sheng-Xue Xie, Todd D. Williams, Dru Willey and Elizabeth M. Topp. American Society for Mass Spectrometry 2007 Annual Meeting, Indianapolis, IN, June 4-7, 2007.

110. Characterizing protein structure in amorphous solids using hydrogen/deuterium exchange with mass spectrometry. Yunsong Li, Todd D. Williams and Elizabeth M. Topp. American Chemical Society 233rd National Meeting, Boston, MA, August 19-23, 2007.

111. Analysis of protein-excipient interactions in amorphous solids by hydrogen/deuterium exchange with mass spectrometry. Sandipan-Sinha, Yunsong Li, Todd Williams and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Annual Meeting, San Diego, CA, November 11-15, 2007.

112. Simulation studies of stabilizing polymers within peptide drug formulations. J. D. Ashley, S. M. Thompson, E.M. Topp, and K. V. Camarda. American Institute of Chemical Engineers Annual Meeting, Salt Lake City, UT, November 4-9, 2007.

113. Comparison of top-up (intact protein) and bottom-up techniques for the quantitation of glycosylation in recombinant IgG molecules. Sandipan Sinha, Gary Pipes, Elizabeth Topp, Pavel V. Bondarenko, Michael Treuheit and Himanshu S. Gadgil. American Association of Pharmaceutical Scientists Annual Meeting, San Diego, CA, November 11-15, 2007.

114. Analysis of protein-excipient interactions in amorphous solids by hydrogen/deuterium exchange with mass spectrometry. Sandipan Sinha, Todd D. Williams and Elizabeth M. Topp. Colorado Protein Stability Conference, Breckenridge, CO, July 18-21, 2007. Recipient of the Timasheff prize for best graduate student poster presentation.

115. Excipient design for protein drug formulation by molecular dynamics simulation and computational molecular design. S.M. Shulda, J. Ashley, Y. Li, E.M. Topp and K.V. Camarda. European Symposium on Computer Aided Process Engineering, Lyon, France, June 1-4, 2008 (accepted).

116. Synthesis and evaluation of a new dimethacrylate monomer for improved dental restoratives. J.G. Park, Q. Ye, E. M. Topp, E.L.Kostoryz, C. Lee, X. Yao**,** and P. Spencer. Midwest Regional Meeting of the American Chemical Society, Kansas City, MO, November 7-9, 2007.

117. Analysis of protein-excipient interactions in amorphous solids by hydrogen/deuterium exchange with mass spectrometry. Sandipan Sinha, Yunsong Li, Todd Williams and Elizabeth M. Topp. Midwest Regional Meeting of the American Chemical Society, Kansas City, MO, November 7-9, 2007.

118. Enzymatic degradation of dentin adhesives containing new urethane-linked trimethacrylate monomer. J.G. Park, Q. Ye, H. Davis, N. Davydova, E. Topp, E.L. Kostoryz, X. Yao, C.H. Lee, Y. Wang and P. Spencer. American Association of Dental Research Annual Meeting, Dallas, TX, April 2-5, 2008.

119. Synthesis and characterization of new methacrylate monomers for dentin adhesives. P. Spencer, J.G. Park, Q. Ye, E. Topp, X. Yao, C.H. Lee, E.L. Kostoryz, A. Misra and Y. Wang. American Association of Dental Research Annual Meeting, Dallas, TX, April 2-5, 2008.

120. Effect of secondary structure on deamidation of the Fc portion of a recombinant monoclonal antibody IgG. S. Sinha, L. Zhang, T.D. Williams, R. Ionescu, J. Vlasak and E.M. Topp. American Society for Mass Spectrometry Annual Meeting, Denver, CO, June 1-5, 2008.

121. Uniting experimental stability studies with molecular simulation for rational excipient design. S. Shulda, E.M. Topp and K.V. Camarda. Abbott Grand Opening Celebration, Abbott Park, IL, June 12-13, 2008.

122. Controlled release of GAD-BPI peptides and its effect on immune response in an NOD mouse model. H. Zhao, J.S. Murray, T.J. Siahaan and E.M. Topp. Abbott Grand Opening Celebration, Abbott Park, IL, June 12-13, 2008.

123. Effect of water on photopolymerization and properties of dentin adhesives with branched methacrylate. P. Spencer, Q. Ye, J.G. Park, A. Misra, E.M. Topp, E.L. Kostoryz and Y. Wang. Society for Biomaterials 2008 Symposium- Translation Biomaterials Research, Atlanta, GA, September 11-13, 2008.

124. Correlation between photo-polymerization behavior and picrostructure of heterogeneous model dentin adhesive, Q. Ye, P. Spencer, J.G. Park, A. Misra, E.M. Topp, Y. Wang, Society for Biomaterials 2008 Symposium- Translation Biomaterials Research, Atlanta, GA, September 11-13, 2008.

125. Controlled release of GAD-BPI peptides and its effect on immune response in an NOD mouse model. H. Zhao, J.S. Murray, T.J. Siahaan and E.M. Topp. Department of Pharmaceutical Chemistry Retreat, University of Kansas, Lawrence, KS, October 16-17, 2008.

126. Thermomechanical behavior, biodegradation and ester linkages in novel dentin adhesives, J.G. Park, Q. Ye, E.M. Topp, A. Misra, P. Spencer, IADR/AADR/CADR 87th General Session and Exhibition, Miami, FL, April 1-4, 2009.

127. Effect of photoinitiators on dynamic mechanical properties of dentin adhesives, J.G. Park, Q. Ye, E.M. Topp, A. Misra, P. Spencer, IADR/AADR/CADR 87th General Session and Exhibition, Miami, FL, April 1-4, 2009.

128. Water absorption and thermal-mechanical properties of model dentin adhesives, Q. Ye, J.G. Park, E.M. Topp, A. Misra, P. Spencer, IADR/AADR/CADR 87th General Session and Exhibition, Miami, FL, April 1-4, 2009.

129. Water absorption and wetting properties of dentin adhesives with a urethane-based branched methacrylate, P. Spencer, Q. Ye, J.G. Park, E.M. Topp, X. Yao, E. Nalvarte, Y. Wang, B.S. Bohaty, A. Misra, Society For Biomaterials Annual Meeting, San Antonio, TX, April 22-25, 2009.

130. Thiol/disulfide interchange: the effect of freezing and drying on the product distribution. M. Thing, S. Duan, J.S. Laurence, E.M. Topp. Pharmaceutics Graduate Students Research Meeting (PGSRM), Purdue University, West Lafayette, IN, June 25-27, 2009.

131. Thiol/disulfide interchange: the effect of freezing and drying on the product distribution. M. Thing, S. Duan, J.S. Laurence, E.M. Topp. Colorado Protein Stability Conference, Breckenridge, CO, July 16-18, 2009.

132. Prediction of aggregation potential for protein/excipient systems, Thomas S. Reynolds, Anthony Pokphanh, E. M. Topp and Kyle V. Camarda. American Institute of Chemical Engineers Annual Meeting, Nashville, TN, November 8-13, 2009.

133. Peptide fragmentation patterns by CID and ETD in ESI-MS, A. Sophocleus and E.M. Topp, American Chemical Society Midwest Regional Meeting, Iowa City, IA, October 21-24, 2009.

134. Aggregation prediction in therapeutic protein formulations for excipient design. Brock C. Roughton, Anthony I. Pokphanh, T. Steele Reynolds, J. Laurence, E.M. Topp and K.V. Camarada. Missouri Regional Life Sciences Summit, Kansas City, MO, March 8-9, 2010.

135. Hydrogen-deuterium exchange study of myoglobin in solution and solid states. Andreas Sophocleous and Elizabeth M. Topp, AAPS National Biotechnology Conference, San Francisco, CA, May 16-19, 2010.

136. Stabilization of human IgGs by immobilization on Protein G agarose beads. Jun Zhang and Elizabeth M. Topp. 2010 Workshop on Protein Aggregation and Immunogenicity, Breckenridge, CO, July 20-22, 2010.

137. Stabilization of human IgGs by immobilization on Protein G agarose beads. Jun Zhang and Elizabeth M. Topp. Eighth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 14, 2010.

138. Use of aggregation prediction in the design of protein formulations. Brock C. Roughton, Anthony I. Pokphanh, T. Steele Reynolds, Jennifer Laurence, Elizabeth M. Topp, and Kyle.V. Camarda. American Institute of Chemical Engineers Annual Meeting, Salt Lake City, UT, November 7-12, 2010.

139. Stabilization of human IgGs immobilized onto protein G agarose beads via affinity interaction. Jun Zhang and Elizabeth M. Topp. American Association of Pharmaceutical Scientists Annual Meeting, New Orleans, LA, November 14-18, 2010.

140. Hydrogen-deuterium exchange study of myoglobin in solution and solid states. Andreas Sophocleous and Elizabeth M. Topp, Biophysical Society Meeting, Baltimore, MD, March, 2011.

141. Characterization of disulfide bond scrambling in human growth hormone induced by thermal stress, freeze-thaw cycling, agitation and lyophilization. Jun Zhang, Andreas Sophocleous and Elizabeth M. Topp. American Chemical Society National Meeting, Anaheim, CA, March 27-31, 2011.

142. Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. Saradha Chandresekhar and Elizabeth M. Topp. Pharmaceutics Graduate Students Research Meeting, Madison, WI, June 23-25, 2011.

143. Lyophilization-induced aggregation of model proteins. Esben Bertelsen and Elizabeth M. Topp. Pharmaceutics Graduate Students Research Meeting, Madison, WI, June 23-25, 2011.

144. Aggregation and stabilization of lyophilized proteins by excipients. Lavanya K. Iyer and Elizabeth M. Topp, Pharmaceutics Graduate Students Research Meeting, Madison, WI, June 23-25, 2011.

145. Lyophilization-induced aggregation: A survey of structural properties of model proteins. Esben Bertelsen and Elizabeth M. Topp, Colorado Protein Stability Conference, Breckenridge, CO, July 19-21, 2011.

146. Investigation of deuterium uptake kinetics in lyophilized myoglobin powders. Andreas Sophocleous and Elizabeth M. Topp, Gordon Research Conference, Biological Molecules in the Gas Phase and in Solution, Andover, NH, July 31-August 5, 2011.

147. Thiol disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. Saradha Chandrasekhar, Andreas Sophocleous and Elizabeth M. Topp, Ninth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 20, 2011.

148. Aggregation and stabilization of lyophilized proteins by excipients. Lavanya K. Iyer and Elizabeth M. Topp, Ninth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 20, 2011.

149. Optimizing protein-excipient interactions for the development of aggregation-reducing formulations. Brock C. Roughton, Anthony I. Pokphanh, Elizabeth M. Topp and Kyle V. Camarda, Symposium on Process Systems Engineering (PSE2012), Singapore, July 15-19, 2012.

150. Analyzing subvisible protein aggregates in biologics. Jainik P. Panchal and Elizabeth M. Topp, Pharmaceutics Graduate Students Research Meeting, Omaha, NE, June 6-8, 2012.

151. Collaborative evaluation of dynamic light scattering for detection of aggregates in biologics. B. Abraham, M. Anderson, N. Eller, W. Jong, D. Scott, J. Panchal, E. Topp and E. Marszal, OBRR's Second Annual Science Poster Day, Center for Biologics Evaluation and Research, U.S. Food and Drug Administration, Bethesda, MD, September 10, 2012.

152. Analyzing subvisible protein aggregates in biologics. Jainik P. Panchal and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

153. Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. Saradha Chandrasekhar, Andreas Sophocleous and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

154. Protein aggregation in lyophilized solids: Protein structural descriptors as predictors of aggregation propensity. Lavanya Iyer, Brock Roughton, Esben Bertelsen, Kyle Camarda and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

155. Localized hydration and dynamics in lyophilized myoglobin by HDX-MS. Andreas Sophocleous and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

156. Design of excipients to prevent IgG aggregation: An approach based on the naturally occurring binding partners. Balakrishnan S. Moorthy and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

157. Effect of temperature on thiol-disulfide exchange in peptides derived from human growth hormone. Daniel Epling, Saradha Chandrasekhar, Andreas Sophocleous and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

158. Prediction of aggregation in lyophilized formulations as a function of protein and excipient structure. Brock C. Roughton, Lavanya K. Iyer, Kyle V. Camarda and Elizabeth M. Topp, Tenth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, October 11, 2012.

159. Analyzing subvisible protein aggregates in biologics. Jainik P. Panchal, Christine Martha Anderson and Elizabeth M. Topp, American Association of Pharmaceutical Scientists Annual Meeting, Chicago, IL, October 14-18, 2012 (Abstract 2637).

160. Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. Saradha Chandrasekhar, Andreas Sophocleous and Elizabeth M. Topp, American

Association of Pharmaceutical Scientists Annual Meeting, Chicago, IL, October 14-18, 2012 (Abstract 761).

161. Protein aggregation in lyophilized solids: Protein structural descriptors as predictors of aggregation propensity. Lavanya Iyer, Brock Roughton, Esben Bertelsen, Kyle Camarda and Elizabeth M. Topp, American Association of Pharmaceutical Scientists Annual Meeting, Chicago, IL, October 14-18, 2012 (Abstract 737).

162. Localized hydration and dynamics in lyophilized myoglobin by HDX-MS. Andreas Sophocleous and Elizabeth M. Topp, American Association of Pharmaceutical Scientists Annual Meeting, Chicago, IL, October 14-18, 2012 (Abstract 2379).

163. Design of excipients to prevent IgG aggregation: An approach based on the naturally occurring binding partners. Balakrishnan S. Moorthy and Elizabeth M. Topp, American Association of Pharmaceutical Scientists Annual Meeting, Chicago, IL, October 14-18, 2012 (Abstract 3387).

164. Prediction of protein loss following lyophilization as a function of excipient choice. Brock C. Roughton, Elizabeth M. Topp and Kyle V. Camarda. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 20-22, 2013. (Abstract ID: NBC-13-0361).

165. Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. S. Chandrasekhar, A. Sophocleous and E.M. Topp. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 20-22, 2013. (Abstract ID: NBC-13-0254).

166. Photolytic labeling with mass spectrometric analysis to probe protein-matrix interactions in lyophilized solids. L.K. Iyer and E.M. Topp, American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 20-22, 2013. (Abstract ID: NBC-13-0300). Also presented in podium form by L. Iyer, as one of four participants in the AAPS Graduate Student Symposium sponsored by Eli Lilly & Company.

167. Analyzing subvisible protein aggregates using dynamic light scattering (DLS) and resonant mass measurement (DMM). J.P. Panchal and E.M. Topp, American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 20-22, 2013. (Abstract ID: NBC-13-0299).

168. Development and comparison of computer-aided methods for the optimal design of lyophilized protein formulations. B.C. Roughton, E.M. Topp and K.V. Camarda, American Institute of Chemical Engineers Annual Meeting, San Francisco, CA, November 3-8, 2013.

169. Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone. S. Chandrasekhar, A. Sophocleous and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, San Antonio, TX, November 10-14, 2013. (Abstract 910).

170. Development of a cell-based assay for the immunogenic potential of pharmaceutical protein aggregates. E. Moussa and E.M. Topp. American Association of Pharmaceutical Scientists National Meeting, San Antonio, TX, November 10-14, 2013. (Abstract 3370).

171. Therapeutic protein aggregation at interfacial surfaces. Bo Xie, Shenbaga M. Balakrishnan and Elizabeth M. Topp. Eleventh Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, March 7, 2014.

172. Predicting protein aggregation in lyophilized solids using amide hydrogen/deuterium exchange mass spectrometry. B.S. Moorthy, S.G. Schultz, S.G. Kim and E.M. Topp. Eleventh Annual

Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, March 7, 2014.

173. Development of a cell-based assay for the immunogenic potential of pharmaceutical protein aggregates. E.M. Moussa and E.M. Topp. Eleventh Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, March 7, 2014.

174. Thiol-disulfide exchange in peptides derived from human growth hormone during lyophilization and storage. Saradha Chandrasekhar and Elizabeth M. Topp. Eleventh Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, March 7, 2014.

175. Thiol-disulfide exchange in peptides derived from human growth hormone during lyophilization and storage. S. Chandrasekhar and E.M. Topp. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 19-21, 2014.

176. Probing molecular interactions in glucagon fibrillation using hydrogen/deuterium exchange and mass spectrometry. B. S. Moorthy and E. M. Topp. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 19-21, 2014.

177. Photolytic crosslinking-mass spectrometry to probe molecular Interactions in lyophilized solids. L.K. Iyer and E.M. Topp. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 19-21, 2014.

178. Monitoring aggregation of alpha 1 proteinase inhibitor (A1PI) using hydrogen/deuterium exchange mass spectrometry (HDX-MS). J. Panchal and E.M. Topp. American Association of Pharmaceutical Scientists National Biotechnology Conference, San Diego, CA, May 19-21, 2014.

179. Predicting protein stability in lyophilized powders using amide hydrogen/deuterium exchange with mass spectrometric analysis (HDX-MS). B.S. Moorthy, S. Schultz, S. Kim and E. M. Topp. 2014 Annual Meeting of the Midwest Chapter of the International Society for Lyophilization – Freeze Drying (ISLFD), Chicago, IL, April 10, 2014.

180. Effect of lyophilization on thiol-disulfide exchange kinetics in tryptic peptides derived from human growth hormone. S. Chandrasekhar and E. M. Topp. 2014 Annual Meeting of the Midwest Chapter of the International Society for Lyophilization – Freeze Drying (ISLFD), Chicago, IL, April 10, 2014.

181. Photolytic labeling-mass spectrometry to probe molecular interactions in lyophilized solids. L.K. Iyer and E. M. Topp. 2014 Annual Meeting of the Midwest Chapter of the International Society for Lyophilization – Freeze Drying (ISLFD), Chicago, IL, April 10, 2014.

182. Monitoring aggregation of alpha1-proteinase inhibitor (A1PI) using hydrogen/deuterium exchange mass spectrometry (HDX-MS). Jainik P. Panchal, Joseph Kotarek, Ewa Marszal and Elizabeth M. Topp. Workshop on Protein Aggregation and Immunogenicity, Breckenridge, CO, July 15-17, 2014.

183. Photolytic crosslinking- mass spectrometry to probe the environment of lyophilized proteins. Lavanya K. Iyer and Elizabeth M. Topp. Workshop on Protein Aggregation and Immunogenicity, Breckenridge, CO, July 15-17, 2014.

184. Photolytic crosslinking mass spectrometry to probe the environment of lyophilized proteins. Lavanya K. Iyer and Elizabeth M. Topp. Indiana/Ohio Discussion Group of the American Association of Pharmaceutical Scientists Dinner Meeting, Indianapolis, IN, August 7, 2014.

185. Monitoring aggregation of alpha-1 proteinase inhibitor using hydrogen deuterium exchange mass spectrometry (HDX-MS). Jainik P. Panchal, Joseph Kotarek, Ewa Marszal and Elizabeth M. Topp.

Indiana/Ohio Discussion Group of the American Association of Pharmaceutical Scientists Dinner Meeting, Indianapolis, IN, August 7, 2014.

186. Predicting protein aggregation in lyophilized solids using amide hydrogen/deuterium exchange mass spectrometry. Moorthy BS, Schultz SG, Kim SG and Topp EM. Indiana/Ohio Discussion Group of the American Association of Pharmaceutical Scientists Dinner Meeting, Indianapolis, IN, August 7, 2014.

187. Thiol-disulfide exchange in peptides derived from human growth hormone during lyophilization and storage in the solid-state. Saradha Chandrasekhar and Elizabeth M. Topp. Indiana/Ohio Discussion Group of the American Association of Pharmaceutical Scientists Dinner Meeting, Indianapolis, IN, August 7, 2014.

188. Early stages in glucagon fibrillation. Hamed T. Ghomi, Balakrishnan S. Moorthy, Lavanya K. Iyer, Markus A. Lill and Elizabeth Topp. Indiana/Ohio Discussion Group of the American Association of Pharmaceutical Scientists Dinner Meeting, Indianapolis, IN, August 7, 2014.

189. Computational modelling of amyloid β-fibrils. Hamed Tabatabaei Ghomi, Elizabeth Topp and Markus A. Lill, Biophysical Society Annual Meeting, Baltimore, MD, February 7-11, 2015.

190. Sub-visible aggregates in IgG formulations stimulate innate response in PBMC and monocytes, Ehab Moussa, Joseph Kotarek, Janice S. Blum, Ewa Marszal and Elizabeth M. Topp, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

191. Monitoring changes in aggregate morphology of alpha 1-proteinase inhibitor using hydrogen deuterium exchange mass spectrometry, Jainik Panchal, Ewa Marszal, Joseph Kotarek, Elizabeth Topp, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

192. Thiol-disulfide exchange in peptides derived from human growth hormone during lyophilization and storage in the solid-state. Saradha Chandrasekhar and Elizabeth M. Topp, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

193. Photolytic crosslinking to study molecular interactions in lyophilized solids, Lavanya Iyer and Elizabeth Topp, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

194. A computational method to model amyloid β-fibrils. Hamed Tabatabaei Ghomi, Shenbaga Moorthy Balakrishnan, Elizabeth Topp and Markus A. Lill, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

195. Structural transitions and interactions in the early stages of human glucagon amyloid fibrillation. Balakrishnan S. Moorthy, Hamed Tabatabaei Ghomi, Markus A. Lill and Elizabeth M. Topp, Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

196. N-terminal pyroglutamate formation in model peptides. Anshul Mishra, Saradha Chandrasekhar, Sajal M. Patel and Elizabeth M. Topp. Twelfth Annual Garnet E. Peck Symposium in Industrial Pharmacy, Purdue University, West Lafayette, IN, February 25-27, 2015.

197. Identification of reactive cells and proteins from plasma in response to biosimilars. Yi Li, Jainik Panchal, Lake Paul, Jeffrey E. Wooliff and Kari Clase. Experimental Biology 2015, Boston, MA, March 28-April 1, 2015.

198. Sub-visible particles of intravenous immunoglobulin (IGIV) induce innate immune response in PBMC, primary monocytes and THP-1 cells. Ehab Moussa, Joseph Kotarek, Ewa Marszal, Janice Blum and Elizabeth Topp. 2015 ORSI Science Symposium, U.S. Food and Drug Administration, Rockville, MD, April 27, 2015.

199. Analyzing subvisible protein aggregates in biologics. Jainik Panchal, Ewa Marzsal, Joseph Kotarek and Elizabeth Topp. 2015 ORSI Science Symposium, U.S. Food and Drug Administration, Rockville, MD, April 27, 2015.

200. Monitoring changes in aggregate morphology of alpha-1-proteinase inhibitor (A1PI) using hydrogen/deuterium exchange mass spectrometry (HDX-MS) and covalent label mass spectrometry (CL-MS). Jainik Panchal, Ewa Marzsal, Joseph Kotarek and Elizabeth Topp. 2015 ORSI Science Symposium, U.S. Food and Drug Administration, Rockville, MD, April 27, 2015.

201. Sub-visible intravenous immunoglobulin (IVIG) aggregates induce innate immune response in peripheral blood mononuclear cells (PBMC), primary monocytes and THP-1 cells. E. Moussa, J. Kotarek, E. Marszal, J. Blum and E.M. Topp. AAPS National Biotechnology Conference, San Francisco, CA, June 8-10, 2015. (accepted)

202. Monitoring changes in aggregate morphology of alpha-1-proteinase inhibitor (A1PI) using hydrogen/deuterium exchange mass spectrometry. J. Panchal, J. Kotarek, E. Marszal and E.M. Topp. AAPS National Biotechnology Conference, San Francisco, CA, June 8-10, 2015. (accepted)

Sources of funding

(1) Current

a. Source of support: National Institutes of Health, R01GM085293, "Protein aggregation in amorphous solids"
b. Percentage of time: 0.96 months as PI
c. Date of project period: 03/01/2013 to 02/28/17
d. Total costs: $1, 477, 749
e. Brief description: Mechanisms of covalent and non-covalent protein aggregation in amorphous solids; inhibition of aggregation.

a. Source of support: U.S. Food and Drug Administration, HHSF223201310233C, "Subvisible protein aggregates in biologics: Analytical methods and monocyte/macrophage response"
b. Percentage of time: 3% as PI
c. Date of project period: 09/30/13 to 09/29/15
d. Total costs: $459,000
e. Brief description: Evaluation of analytical methods for aggregates and pre-aggregates in biologics and determinants of monocyte/macrophage response.

a. Source of support: AbbVie, Inc., "Development and validation of analytical methods for detection and quantitation of surfactant proteins in Survanta®"
b. Percentage of time: 5% as PI
c. Date of project period: 02/19/14 to 09/30/2015
d. Total costs: $190,574
e. Brief description: Development of analytical methods for proteins in Survanta®

a. Source of support: Baxter Healthcare Corp., "Solid-state and solution-state H-D exchange methodology"
b. Percentage of time: none listed, PI
c. Date of project period: 06/20/14 to 06/19/15
d. Total costs: $9,900
e. Brief description: Development and transfer of H-D exchange methods

a. Source of support: Center for Pharmaceutical Processing Research (CPPR, with MedImmune), "Pyroglutamate formation during lyophilization and storage"
b. Percentage of time: none listed, PI
c. Date of project period: 08/01/14 to 07/31/15
d. Total costs: $45,000
e. Brief description: Mechanisms of pyroglutamate formation in solids; methods of inhibition

a. Source of support: Pfizer, Inc., "Biotherapeutic aggregation and immunogenicity"
b. Percentage of time: none listed
c. Date of project period: 12/22/2014 to 12/21/18
d. Total costs: $75,000
e. Brief description: Support of graduate student internships and supply of monoclonal antibody to study therapeutic protein aggregation and immune response *in vitro*.

(2) Pending

a. Source of support: National Institutes of Standards and Technology (NIST AMTech), "Lyophilization technology consortium for advanced manufacturing of food, pharmaceuticals and biotech products"
b. Percentage of time: 0.60 months as PI
c. Date of project period: 06/01/2015 to 05/31/17
d. Total costs: $450,000
e. Brief description: Development of a national consortium on lyophilization and technology roadmapping.

(3) Completed (past three years)

a. Source of support: NIPTE, "Analytical methods for subvisible protein aggregates in biologics"
b. Percentage of time: 3% as PI
c. Date of project period: 03/01/2012 to 02/28/2013
d. Total costs: $99,999
e. Brief description: Compare dynamic light scattering and microflow imaging for detecting protein aggregates in α_1-proteinase inhibitor products.

a. Source of support: National Institutes of Health, R01GM085293, "Protein aggregation in amorphous solids"
b. Percentage of time: 18% as PI
c. Date of project period: 03/01/09 to 02/28/13; NCE to 02/28/14
d. Total direct costs: $207,500 (Year 1)
e. Brief description: Mechanisms of covalent and non-covalent protein aggregation in amorphous solids.

a. Source of support: Abbott Laboratories, "Purdue-Abbott collaboration on pharmaceutical freeze-drying"
b. Percentage of time: 2.5% as Co-PI; Aleena Alexeenko, PI
c. Date of project period: 12/05/2011 to 09/30/2012
d. Total costs: $77,000
e. Brief description: Collaborative studies on freeze-dryer design and product quality

a. Source of support: Pharmaceutical Research and Manufacturers Association Foundation, "Hydrogen-deuterium exchange-mass spectrometry analysis of lyophilized protein formulations as a predictive tool for aggregation propensity", post-doctoral fellowship for A. Sophocleous
b. Percentage of time: None (Sponsor); PI: A. Sophocleous
c. Date of project period: 01/01/2010 to 12/31/2011
d. Total direct costs: $80,000
e. Brief description: Funds to support postdoctoral research and training for Andreas Sophocleous.

a. Source of support: National Institutes of Health, " Im/miscible adhesive/dentin interfaces: structure/mechanics", 2 R01 DE014392-06A1
b. Percentage of time: Consultant; PI Paulette Spencer
c. Date of project period: 05/01/08 to 04/30/12
d. Total direct costs: $250,000 (Year 2)
e. Brief description: Design and evaluation of new esterase-resistant and water compatible dental adhesives

a. Source of support: Purdue Research Foundation, "Thiol-disulfide exchange and disulfide scrambling in peptides derived from human growth hormone"
b. Percentage of time: none listed
c. Date of project period: 06/01/13 to 05/31/14
d. Total costs: $16,065
e. Brief description: Partial support for graduate student, Saradha Chandrasekhar.

a. Source of support: Purdue University, College of Pharmacy Lilly Seed Grant Program, "Optimizing lyophilization for biologics: Process modeling and product quality"
b. Percentage of time: PI; percent time not specified
c. Date of project period: 06/01/2013 to 05/31/2014
d. Total costs: $96,192
e. Brief description: Collaborative studies on freeze-dryer design and product quality.