Curriculum Vitae

Steven P. Schwendeman, Ph. D.

Current Position

2011 - present Ara G. Paul Professor, Department of Pharmaceutical Sciences
College of Pharmacy
The University of Michigan, Ann Arbor, MI

2011 - present Department Chair, Department of Pharmaceutical Sciences
College of Pharmacy
The University of Michigan, Ann Arbor, MI

2012 - present Advanced Materials and Drug Delivery Thrust Leader
Biointerfaces Institute, NCRC
The University of Michigan, Ann Arbor, MI

2013 - present Professor of Biomedical Engineering
College of Engineering
University of Michigan, Ann Arbor, MI

Previous Experience

2008 - 2010 Professor, Department of Pharmaceutical Sciences
College of Pharmacy
The University of Michigan, Ann Arbor, MI

2002 - 2008 Associate Professor, Department of Pharmaceutical Sciences
College of Pharmacy
The University of Michigan, Ann Arbor, MI

2007 - 2008 Visiting Scientist (sabbatical leave)
Laboratory of Philippe Le Bouteiller
Department of Immunology
INSERM 563, CHU Purpan, Toulouse, France

2000 - 2002 Assistant Professor, Department of Pharmaceutical Sciences
College of Pharmacy
The University of Michigan, Ann Arbor, MI

1995 - 2000 Assistant Professor, Division of Pharmaceutics
College of Pharmacy
The Ohio State University, Columbus, OH

Education

1983 - 1986 The University of Michigan, Ann Arbor, MI
B.S.E. with Honors in Chemical Engineering

1987 - 1992	The University of Michigan, Ann Arbor, MI Ph.D. and M.S. in Pharmaceutics, College of Pharmacy (co-thesis advisors: Robert J. Levy, M.D. and Gordon L. Amidon, Ph.D.)
1992 - 1995	Massachusetts Institute of Technology, Cambridge, MA Postdoctoral Fellow, Department of Chemical Engineering (postdoctoral advisor: Robert Langer, Sc.D.)

Honors and Awards

1984	Dean's List
1987	Warner Lambert Fellow
1988 - 1990	National Institutes of Health Pharmacological Track Training Grant Recipient
1990 - 1992	Pharmaceutical Manufacturers' Association Foundation Advanced Predoctoral Fellow
1993, 1995	Temporary Advisor to the World Health Organization Program for Vaccine Development
1993 - 1995	Individual National Research Service Award (National Institutes of Health postdoctoral fellowship)
1996 - 1998	Pharmaceutical Research and Manufacturers of America Foundation Research Starter Grant Recipient
2002	Young Investigator Research Achievement Award, Controlled Release Society
2003 - 2006	Board of Scientific Advisors, Controlled Release Society
2004 - 2007	Editor, *Pharmaceutical Research*
2003 - 2008	Member, NIH Biomaterials and Biointerfaces (BMBI) study section
2007 - present	Associate Editor of the Americas, *Journal of Controlled Release*
2010	Consumer & Diversified Products Outstanding Paper Award (with KG Desai), Controlled Release Society
2010	Member, College of CSR (Center for Scientific Review) Reviewers, NIH
2011 - present	Ara G. Paul Endowed Professorship in Pharmaceutical Sciences
2015	Fellow, American Association of Pharmaceutical Sciences
2016	Elected to College of Fellows, Controlled Release Society
2019	Awarded a University of Michigan President’s Bioscience Initiative Grant
2020	Elected to the National Academy of Inventors

Professional Societies

American Association of Pharmaceutical Scientists
Controlled Release Society
American Association for Dental Research
American Association for the Advancement of Science
Tau Beta Pi
Rho Chi (faculty advisor: 1998-2000)

Professional Service

Journal reviewer for:

Pharm. Res.
J. Pharm. Sci.
J. Controlled Release
Int. J. Pharm.
Eur. J Pharm.
Biotechniques
Biomaterials
Proceed. Natl. Acad. Sci. USA
Nature
Nat. Biotechnol.
Nat. Materials
Biotech. Bioeng.
Expert Rev. Vaccines
Tibtech
Adv. Drug Del. Rev.
Curr. Opin. Drug Del.
Biomacromolecules
J. Appl. Polym. Sci.
Adv. Functional Mater.

Journal advisory boards:

J. Pharm. Sci. (2001 – present)
Pharmaceutical Research (2004 – 2007)
J. Controlled Release (2005 – present)

Grant reviewer for:

World Health Organization (1995)
Australian Research Council (1996, 2000)
National Institutes of Health
- adhoc member of VISA, 2000-2001
- member of special emphasis panel (SSS-L), Drug Delivery and Drug Discovery, 6/03
- member of special emphasis panel (SSS-2), Drug Delivery, 7/03
- member, BMBI, 2003 - 2008
- ad hoc member, GDD, 6/09
- ad hoc member, site visit team for Purdue University Cancer Center (Cancer Center Support Grant, P30), 9/09 & 9/14
- member, special emphasis panel on “Transforming Biomedicine at the Interface of the Life and Physical Sciences”, 10/10

National Science Foundation (2001-2002)

Service to Controlled Release Society:

Abstract Reviewer
Chair and member of Young Investigator Award Committee (~10 years)
Member of Jorge Heller Best Paper Award Committee

Conference Co-organizer:

AAPS Workshop - 46th Annual Arden Conference: Pharmaceutical Development of Biologics: Fundamentals, Challenges, and Recent Advances, West Point, NY (3/11)
NanoDDS 2017, Ann Arbor, MI (9/17)
LAI 2019, Belgium (2/19)
LAI 2020, La Jolla, CA (2/20)

Patents

1. Jacobs, A. and Schwendeman, S. P., Delivery system (controlled-release of NaF from dental trays), US Patent no. 5,924,863, 1999.

2. Schwendeman, S. P. and Cui, C., Biocompatible polymeric delivery systems having functional groups attached to the surface thereof, US Patent no. 6,326,021, 2001.

3. Schwendeman, S. P., Zhu, G., Bentz, H., Hubbell, J., Jiang, W., Shenderova, A., and Kang, J., Methods for stabilizing biologically active agents encapsulated in biodegradable controlled-release polymers, US Patent no. 6,743,446, 2004.

4. Schwendeman, S. P. and Jiang, W., Polymer compositions that stabilize and control the release of formaldehyde-treated vaccine antigens, US Patent App. SN 10/417,841, April 17, 2003, withdrawn.

5. Cui, C., Schwendeman, S. P. and Stevens, V., Antigen-polymer compositions, US Patent App. SN 10/617,078, July 10, 2003.

6. Schwendeman, S. P., Zhu, G., Bentz, H., Hubbell, J., Jiang, W., Shenderova, A., and Kang, J., Methods for stabilizing biologically active agents encapsulated in biodegradable controlled-release polymers, US Patent App. SN 11/863,088, September 27, 2007.

7. Schwendeman, S. P., Kang, J. and Reinhold, S., Methods for encapsulation of biomacromolecules in polymers, US Patent no. 8,017,155, 2011.

8. Mallery, S. R., Larsen, P., Stoner, G., Schwendeman, S. and Desai, K. G., Controlled release mucoadhesive systems, WO2012068147, May 24, 2012.

9. Mallery, S. R., Larsen, P., Stoner, G., Schwendeman, S. and Desai, K. G., Controlled release mucoadhesive systems, Australian patent approved AU2011329066B2, 2017. (licensed to Serona Therapeutics)

10. Mallery, S. R., Larsen, P., Stoner, G., Schwendeman, S. and Desai, K. G., Controlled release mucoadhesive systems, Japanese Patent no. 6,415,518, 2018. (licensed to Serona Therapeutics)

11. Schwendeman, S. P. and Desai, K.G.H., Active self-healing biomaterial system, US Patent no. 10,220,001, 2019. (Optioned to Merck kGAa)

12. Schwendeman, S. P., Doty, A., Shah, R., Pisupati, K., Giles, M., Chang, R. S., and Schwendeman, A., Efficient aqueous encapsulation and controlled release of bioactive agents, US Patent no. 10,369,106, 2019. (Optioned to Merck kGAa)

13. Mallery, S. R., Larsen, P., Stoner, G., Schwendeman, S. and Desai, K. G., Controlled release mucoadhesive systems, European patent approved, EP2640368, 2020. (licensed to Serona Therapeutics)

14. Schwendeman, S. P. and Chang, R.-S., Coated implants for long-term controlled release of antibody therapeutics, PCT/US2017/030642, May 2, 2017.

15. Mallery, S. R. and Schwendeman, S. P., Chemoprevention using controlled-release formulations of anti-interleukin 6 agents, synthetic vitamin a analogues or metabolites, and estradiol metabolites, WO2017147169, August 31, 2017.

16. Tocce, E., Jordon, S. L., Desai, K. G., Schwendeman. S., Aqueous solutions of polymers, WO20180071209, March 15, 2018.

17. Lautner, G., Schwendeman, S. P. and Meyerhoff, M.E., Nitric oxide releasing plga microspheres for biomedical applications PCT/US2016/036904, June 10, 2016.

18. Lautner, G., Schwendeman, S. P. and Meyerhoff, M.E., Photolytic Generation of Nitric Oxide (NO) from Solid Phase NO Donor into Gas Phase for Inhalation Therapy, US patent application filed (optioned to NOTA Labs).

Teaching

Eng. 103 (U of M)	3 cr.	Introduction to Computer Programming (student instructor), 1986.
P'ceut. 332 (U of M)	3 cr.	Introduction to Pharmaceutics (teaching assistant), 1990.
P'ceut. 757 (U of M)	3 cr.	Transport (guest lecturer), 1992, 2001.
ICE 491 (MIT)	3 cr.	Integrated Chemical Engineering (instructor), 1993.
Pharmacy 403 (OSU)	3 cr.	Pharmaceutics 1, co-instructed annually to undergraduate professional students, 1996-1998.
Pharmacy 622 (OSU)	3 cr.	Drug Delivery 2, taught annually to graduate professional students, 1999-2000.
Pharmacy 805 (OSU)	3 cr.	Controlled Drug Delivery, taught every other year to graduate students in pharmaceutics, 1996-2000.
P'ceut. 462 (U of M)	3 cr.	Physical Pharmacy and Biopharmaceutics, co-instructed annually to graduate professional students, 2001- 2012.
P'ceut. 762 (U of M)	3 cr.	Drug Delivery Systems, co-instructed every other year to graduate students in the pharmaceutical sciences, 2001-2003.
P'ceut. 752 (U of M)	2 cr.	Controlled Drug delivery, taught every other year to graduate students in the pharmaceutical sciences, 2005-2009.
PharmSci 701 (U of M)	3 cr.	Physical Chemical Concepts of Drug Development and Delivery, co-instructed every other year to graduate students in the pharmaceutical sciences, 2011-2015.
PharmSci 703 (U of M)	3 cr.	Advanced Physical Chemical Concepts of Drug Development and Delivery, co-instructed every other year

to graduate students in the pharmaceutical sciences, 2012-2016.

PharmSci 703 (U of M) 2 cr. Mass Transfer and Chemical Kinetics, instructed every other year to graduate students in the pharmaceutical sciences, 2017-present.

PharmSci 400 (U of. M) 3 cr. Pharmaceutics of Drug Products and Biotechnology, co-taught every year to undergraduate students.

Graduate Students, Postdocs, Visiting Scientists

Ph.D. Advisor for:

Tianhong Zhou, Ph.D. granted 12/98, at FDA
Gaozhong Zhu, Ph.D. granted 9/99, at Shire
Anna Shenderova, Ph.D. granted 6/00, at University of Michigan
(co-advised with W. L. Hayton)
Juan Wang, Ph.D. granted 8/00, at MyoKardia
Wenlei Jiang, Ph. D. granted 8/01, at FDA
Chengji Cui, Ph.D. granted 12/03, at Johnson & Johnson
Guanbing Ding, Ph.D. granted 8/05, at Eiger Biopharma
David Gu, Ph.D. granted 12/08, at Jeffreys and Company
Li Zhang, Ph.D. granted 12/08, at Cidara Therapeutics
Sam Reinhold, Ph.D. granted 8/09, at Nano Pharmaceuticals
Andreas Sophocleous, Ph.D. granted 8/09, at GSK
Yajun Liu, Ph.D. granted 5/13, at FDA
Ronak Shah, Ph.D. granted 5/15, at BMS
Brittany Bailey, Ph.D. granted 12/15, at GSK
Amy Doty, Ph.D. granted 12/15, at Merck
Karthic Pisupati granted 4/16, at Eli Lilly
Rae Sung Chang granted 12/16, at University of Michigan
J. Max Mazzara, granted 4/16, at Zoetis
Kari Nieto, granted 9/17, at Ferndale Pharma Ltd.
Morgan Giles, granted 12/17, at Merck
Jia Zhou, granted 4/19, at Jannsen
Jenna Walker (current)
Jason Albert (current)
King Yeung (Justin) Hong (current)
Richard Schutzman (current)
Cameron White (current)

Masters Advisor for:

Julia Marinina, M.S. granted 12/99
Kiarri Kershaw, M.S. granted 12/04
Kellisa Hansen, M.S. granted 4/15

Postdoctoral Advisor for:

Jichao Kang, Ph.D.
Lei Li, Ph.D.
Mangesh Deshpande, Ph.D.
Ying Zhang, Ph.D.
Christian Wishke, Ph.D.

K. G. H. Desai, Ph.D.
Xiao Wu, Ph.D.
Vesna Milacic, Ph.D.
Gwangseong Cheng, Ph.D.
Hiren Patel, Ph.D.
Keiji Hirota, Ph.D.
Tinghui Li, Ph.D.
Rae Sung Chang, Ph.D.
Jie Tang, Ph.D.
Gergely Lauter, Ph.D. (current, co-advised w/Meyerhoff)
Avital Bieg, Ph.D. (current)
Nianqui Shi (current)
Raj Kumar (current)
Jing Sun (current)
Desheng Liang (current)

Assistant Research Scientists:
Ying Zhang, Ph.D.
K. G. H. Desai, Ph.D.
Jie Tang, Ph.D. (current)

Lab Manager:
Karl Olsen, B.S. (current)
Rose Ackermann, B.S. (current)

Pharm. D. Students:
Shodai Ota

Visiting Scientists:
Yanqiang Zhang, Ph.D.
Fuzheng Ren, Ph.D.
Samer Kadous, Pharm. D.
Linglin Feng, Ph.D.

Ph.D. Thesis Committee
Melanie Frangione (OSU)
Jean Weaver (OSU)
Hong Mei (OSU)
Pål Johansen (outside reviewer for ETH, Zürich, Switzerland, 1998)
Sarita Naik (U of M)
Megen Frost (U of M)
Alessandra Ennett (U of M)
Ron Kelly (U of M)
Barbara Spong (U of M)
Hiro Tsumi (U of M)
John Chung (U of M)
Jennifer Sheng (U of M)
Linh Luong (U of M)
Qinyi Yan (U of M)
Dilara Jappar (U of M)
Hee Sun Chung (U of M)
Jonathan Miller (U of M)

Xinyuan Zhang (U of M)
Kai Feng (U of M)
Lilly Roy (U of M)
Deanna Mudie (U of M)
Byumseok Koh (U of M)
Sarah Bethune (U of M)
Wenyi Cai (U of M)
Neal Huang (U of M)
Haili Ping (U of M)
Suzanne Fredenberg (Opponent for University of Lund, Sweden, 2011)
Yanhong Wen (Outside member, University of Copenhagen, 2012)
Elizabeth Brisois (U of M)
Yehua Xie (U of M)
Rui Kuai (U of M)
Bryce Chang (Georgia Tech University)
Vernon Lalone (U of M)
Alexander Benet (U of M)
Jukyung Kang (U of M)
Lukas Ochyl (U of M)
Yuchen Fan (U of M)
Alireza Hasani (U of M)

Consultantships

1994 - 1995	Osteoarthritis, Cambridge, MA
1994 - 1997	Archtek, Golden, CO
1998	Scios, Inc., Mountain View, CA
1998 - 1999	Orthogene, Sausalito, CA
2000	Baxter, Deerfield, IL
2001 - 2003	Patterson, Belknap, Webb & Tyler, New York, NY (expert witness for Takeda and Abbot (TAP))
2003 - 2004	X-Cell Medical, Inc., New York, NY
2004 - 2007	Conor Medsystems, Inc., Menlo Park, CA
2004	McKinsey and Company, New York, NY
2004	Inamed, Santa Barbara, CA
2004	Medtronic, Shoreview, MN
2006 - 2007	Nellcor Division of Tyco Healthcare, Pleasanton, CA
2006 - 2007	Patterson, Belknap, Webb & Tyler, New York, NY (expert witness for Takeda and Abbott (TAP))
2006 - 2008	Quinn & Emanuel, NY (expert witness for Connetics)
2007 - 2010	Amylin, La Jolla, CA
2007 - 2010	Alkermes, Cambridge, MA
2008	Merck, West Point, PA
2008	Kai Pharmaceuticals, South San Francisco, CA
2008	Cerenis Therapeutics, Toulouse, France
2010 - 2011	McAndrews, Held, & Malloy, Chicago, IL
2011	Takeda, Deerfield, NY
2011 - 2013	DLA Piper, LLC, NY, NY
2012 - 2013	Allergan, Irvine, CA
2013 - 2014	MedImmune, Gaithersburg, MD (scientific advisory board)
2013 - 2017	Ektapharm, LLC (co-founder), Bedford, NH

2015 - 2016	DePuy Orthopaedics, Warsaw, IN
2015 - 2016	Merck Animal Health, Rahway, NJ
2015 - present	Biological E, Hyderabad, India
2017	Amneal, Steinhausen, Switzerland

Research Support (total direct costs)

Past

Stabilizing proteins for delivery from biodegradable polymer implants, 4/95 - 3/96, $10,000, OSU Seed Grant, PI.

Surgically implanted regional cytotoxic and chemopreventive therapy, 8/95 - 7/97, $60,000, OSU Cancer Center, Co-I, PI: G. Wjientes.

Maintaining protein structure in biodegradable polymer microspheres, 1/97 - 12/98, $25,000*, PhRMA Foundation Research Starter Grant, PI.

Gift for studies with PLGA systems encapsulating BMP-2, Orthogene, $33,333.

Gift for Encapsulation studies, Novartis, $10,000.

Release profiles of candidate drugs from SC MEDDS, 9/1/99 - 12/31/99, $12,718*, iMEDD, Co-I (3% time commitment), PI: W. Hayton.

Intraocular polymer drug delivery implants, 4/95 - 5/00, $71,000*, Cleveland Clinic Foundation, PI (5%).

Evaluation of protein antigen structure in biodegradable polymer microspheres 9/1/98 - 5/31/00, $10,599*, Corixa, PI.

In vivo assessment of controlled release of IM 862, a novel angiostatic agent, OSU Comprehensive Cancer Center Seed Grant 10/1/99 - 9/30/00, $35,000, Co-I, PI: S. R. Mallery.

Responsive drug delivery systems using artificial muscle, OSU Interdisciplinary Bioengineering Seed Grant, 5/1/99 - 4/30/01, $50,000, PI. **

Responsive drug delivery using artifical muscle, Edison Biotechnology Center, 10/1/99 - 9/30/01, $100,000*, Co-PI, PI: M. Madou.**

Phase 2: Center for Industrial Sensors and Measurements, NSF, 6/1/00 - 5/31/03, $900,000, Co-PI, PI: M. Madou.**

Lesional chemotherapeutic management for oral AIDS-KS, 1 R01 DE 12183-01, 1/97 - 12/01, $748,188, NIH/NIDCR, Co-I (10%), PI: S.R. Mallery.

Structural and conformational aspects in peptide vaccines, 1 R01 AI 40302-02, 4/97 - 3/02, $686,403, NIH/NAIDS, Co-I (0%), PI: P.T.P. Kaumaya.

Time release ophthalmic drug delivery insert, NIH/NEI, 7/1/01 - 6/30/02, $1,100,000*, 1 R43EY12916-01, Co-I (10%), PI: B. Cohan.

Characterization of Novel PLGA Delivery Systems for Stabilizing Proteins, 7/1/02 - 6/30/04, $149,584*, Novartis, PI (5%).

Protein stability in polymer delivery systems, 1 R01 HL 68345-01, 2/1/01 - 1/31/06, $750,000, NIH/NHLBI, PI (20%).

Protein stability in polymer delivery systems – research supplement for underreprepresented minorities, 6/1/03 – 1/31/06, $78,493, NIH/NHLBI, PI (5% WOC).

Stability of peptides in PLGA-glucose microspheres, Novartis, 11/1/05 – 2/29/08, $220,542*, PI (5%).

Role of Oxidants & Angiogenesis in Kaposi's Sarcoma, R01 CA 095901, 4/01/03 - 3/31/08, $1,250,000, NIH/NCI, Co-I (5%), PI: S. R. Mallery.

Controlled release of a hydrophobic drug from PLGA microspheres, Merck, 12/1/06 – 12/31/08, $181,394*, PI (8%).

Self-microencapsulation without organic solvents, Upjohn/Valteich (U of M College of Pharmacy), 6/1/07 – 12/31/08, $15,000, PI (WOC).

PLGA microsphere delivery of hydrophobic drugs, 11/1/06 – 3/1/10, $181,000 *, Merck, PI (8%).

Mucoadhesive patch delivery of fenretinide and berry anthocyanins for oral cancer chemprevention, 7/1/09 – 2/28/10, $50,000, Ohio State University Comprehensive Cancer Center, Co-I (WOC), PI: Mallery.

Mucoadhesive patch delivery of fenretinide and berry anthocyanins for oral cancer chemprevention, 10/1/09 – 9/30/10, $100,000, Fanconi Anemia Research Foundation, Co-I (WOC), PI: Mallery.

Stability of proteins in polymer delivery systems, 9/1/07 – 8/31/12, R01 HL 68345, $875,000, NIH/NHLBI, PI (20%).

Stability of proteins in Polymer delivery Systems – research supplement, 7/15/09 – 6/30/12, R01 HL 68345, $297,000*, NIH/NHBLI, PI (WOC)

Self-microencapsulation in polymer delivery systems without organic solvents, 7/15/09 – 6/30/12, R21 EB 008873, $275,000, NIH/NIBIB, PI (15%)

Chemoprevention of head & neck cancer using controlled release polymers, 12/1/08 – 11/30/13, R01 CA 120609, $1,250,000, NIH/NCI, Co-I (5%), PI: Mallery.

Organic solvent-free microencapsulation of GLP-1 receptor agonists in poly(lactic-co-glycolic acid) for development of a 1-month GLP-1 injectable depot, 7/1/13 – 6/30/14, Coulter Foundation, $103,750, PI (9%).

Analytical comparison of innovator product and follow-on biologics to aid biosimilars regulatory guidelines development, 4/1/2014 – 3/31/2015, U01 FD004275-03, $127,000*, US FDA, Co-PI (2.5%).

Development of design criteria for mucoadhesive polymer excipients for use in nasal drug formulations, 9/1/11 – 12/31/16, $510,000*, Dow Chemical Company, PI (5%).

In vitro-in vivo correlations of parenteral microsphere drug products, 9/15/13 – 9/14/16, U01 FD005014, $625,000*, US FDA, PI (15%).

Evaluation of locally delivered fenretinide and black raspberries for oral cancer, 9/1/12-8/31/17, R01 CA 171329, $1,250,000, NIH/NCI, Co-I (5%), PI: Mallery.

Eradication of solid tumors using implantable drug delivery systems with controlled intratumoral disposition, 10/1/2014 – 9/30/2018, $138,600*, US – Israel Binational Science Foundation, Co-PI (WOC).

Sustained-release hormonal contraceptive administered using a microneedle patch, 1/1/17 – 12/31/18, $150,000*,***, Gates/FHI360, Co-I (5%) PI: Prausnitz

Targeted drug delivery using microneedles, 7/1/16 – 12/31/18, USAID/FHI 360, $160,000*,***, Co-I (5%) PI: Prausnitz.

Influence of raw materials, manufacturing variables, and storage conditions on release performance of long-acting release microsphere products, HHSF223201510170C A0001 BAA Contract, 10/1/15 – 9/30/19, $1,000,000*, FDA, PI (15%).

Investigation of peptide-polymer interactions in PLGA microspheres, 9/15/16-8/31/19, U01 FD005847, $500,000*, FDA, PI (10%).

Controlled Photo-release of Nitric Oxide for Antimicrobial Inhalation Therapy, 3/1/17 – 2/28/19, R21 EB 024038, NIH/NIBIB, $275,000, PI (10%)

Michigan-Pittsburgh-Wyss Resource Center: Supporting Regenerative Medicine in Dental, Oral and Craniofacial Technologies, 2/1/17 – 1/31/20, U24 DE026915, $11,698,198.00*, NIH/NIDCR, Co-I (2.5%), PI: Kohn/Giannobile

Targeted drug delivery using microneedles, 1/1/19 – 12/31/19, USAID/FHI 360, $200,000***, Co-I (5%) PI: Prausnitz.

Feasibility and comparative analysis of PLGA-drug formulations, 9/14/18-3/14/20, Merck kGaA, $144,831*, PI (5%)

Current

Secondary chemoprevention of oral cancer by locally delivered agents, 6/1/17 – 5/31/22, R01 CA 211611, $1,250,000, NIH/NCI, Co-I (5%), PI: Mallery

A biodegradable implant for contraception, 11/1/2018-10/31/2020, Gates (collaboration with Shanghai Institute of Planned Parenthood Research), $358,326*,***, Co-I (5%), PI: Feng

Influence of raw materials, manufacturing variables, and storage conditions on in vitro and in vivo performance of exenatide in PLGA microspheres, 9/26/8-9/25/22, HHSF223201810187C BAA contract, FDA, $1,106,075*, PI (15%)

Technological Innovations in Brain Cancer, 7/1/20-6/30/25, University of Michigan President Schlissel Bioscience Initiative, $14,728,537. Co-PI (5%) (with M. Castro).

Controlled Photochemical Release of Nitric Oxide for Biomedical Applications, 1/1/20-12/31/24, R01 EB028775-01, $2,075,557 * requested, (to be awarded), PI (20%).

lnjectable in-situ forming controlled release RvE1 gel for periodontal reconstruction, 7/1/19-6/30/21, GlaxoSmithKline/Intl Assoc for Dental Res, $50,000*, Co-I (WOC), PI: Bottino.

Feasibility and comparative analysis of PLGA-drug formulations-Part II, 1/1/20-6/30/21, Merck KGaA, $86,334*, PI (5%).
Contraceptive Technology Innovation Initiative (CTII) Phase 2, Gates/FHI 360, 10/1/19-6/30/20, $150,000***, Co-I (5%), PI: Prausnitz.

Michigan-Pittsburgh-Wyss Regenerative Medicine Resource Center: Advancing Dental, Oral, and Craniofacial Regeneration to Clinical Trial Initiation, NIH U24 DE29462, 4/1/20-3/31/25 (2.5%), Co-I, Co-PIs: Kohn/Giannobile.

Targeted drug delivery using microneedles –Part 3a & Part 3b, USAID/FHI 360, 10/1/19-6/30/20, $200,000***, Co-I (5%), PI: Prausnitz.

* Total costs of project
** Role of SPS on project ceased upon moving to the Univ. of Mich from Ohio State Univ.
*** Total costs to Schwendeman lab

Publications

1. Schwendeman, S. P., Amidon, G. L., Meyerhoff, M. E. and Levy, R. J., Modulated drug release using iontophoresis through heterogeneous cation-exchange membranes: membrane preparation and influence of resin cross-linkage, *Macromolecules*, **25**, 2531-2540 (1992).

2. Schwendeman, S. P., Amidon, G. L. and Levy, R. J., Determinants of the modulated release of antiarrhythmic drugs by iontophoresis through polymer membranes, *Macromolecules*, **26**, 2264-2272 (1993).

3. Schwendeman, S. P., Amidon, G. L., Labhasetwar, V. and Levy, R. J., Modulated drug release using iontophoresis through heterogeneous cation-exchange membranes II: influence of cation-exchanger content on membrane resistance and characteristic times, *J. Pharm. Sci.,* **83**, 1482-1494 (1994).

4. Chen, W., Schwendeman, S. P., Labhasetwar, V. and Levy, R. J., Techniques in cardiovascular drug delivery-surfactant derivatization, polymer implants and iontophoresis, in *Polymer Site-specific Pharmacotherapy*, Domb, A. J. (ed.), Wiley, New York, 1994, pp. 221-242.

5. Labhasetwar, V., Underwood, T., Schwendeman, S. P. and Levy, R. J., Iontophoresis for modulation of cardiac drug delivery in dogs, *Proc. Natl. Acad. Sci. USA*, **92**, 2612-2616 (1995).

6. Schwendeman, S. P., Labhasetwar, V. and Levy, R. J., Model features of a cardiac iontophoretic drug delivery implant, *Pharm. Res.,* **12**, 790-795 (1995).

7. Schwendeman, S. P., Costantino, H. R., Gupta, R. K., Siber, G. R., Klibanov, A. M. and Langer, R., Stabilization of tetanus and diphtheria toxoids against moisture-induced aggregation, *Proc. Natl. Acad. Sci. USA*, **92**, 11234-11238 (1995).

8. Labhasetwar, V., Schwendeman, S. P., Nguyen, T., Underwood, T. and Levy, R. J., Iontophoresis for modulating cardiac drug delivery of antiarrhythmic agents, in *Molecular Intervention and Local Drug Delivery in Cardiovascular Disease,* Edelman, E. R. (ed.), W. B. Saunders, Philadelphia, 1995, pp. 383-398.

9. Mooney, D., Kaufmann, P. M., Sano, K., Schwendeman, S. P., McNamara, K., Schloo, B., Vacanti, J. P. and Langer, R., Localized delivery of epidermal growth factor improves the survival of transplanted hepatocytes, *Biotech. Bioeng.*, **50**, 422-429 (1996).

10. Schwendeman, S. P., Cardamone, M., Brandon, M. R., Klibanov, A. and Langer, R., The stability of proteins and their delivery from biodegradable polymer microspheres, in *Microparticulate Systems for the Delivery of Proteins and Vaccines*, Cohen, S. and Bernstein, H. (eds.), Marcel Dekker, New York, 1996, pp. 1-49.

11. Schwendeman, S. P., Costantino, H. R., Gupta, R. K., Tobio, M., Chang, A. C., Alonso, M. J., Siber, G. R. and Langer, R., Strategies for stabilizing tetanus toxoid toward the development of a single-dose tetanus vaccine, *Dev. Biol. Stand*., **87**, 293-306 (1996).

12. Costantino, H. R., Schwendeman, S. P., Griebenow, K., Klibanov, A. M. and Langer, R., On the secondary structure and aggregation of lyophilized tetanus toxoid, *J. Pharm. Sci.*, **85**, 1290-1293 (1996).

13. Schwendeman, S. P., Costantino, H. R., Gupta, R. K. and R. Langer, Progress and challenges for peptide, protein, and vaccine delivery from implantable polymeric systems, in *Controlled Drug Delivery: Challenges and Strategies*, Park, K. (ed.), The American Chemical Society, Washington, D. C., 1997, pp. 229-267.

14. Shenderova, A., Burke, T. G. and Schwendeman, S. P., Stabilization of 10-hydroxycampothecin in poly(lactide-co-glycolide) microsphere delivery vehicles, *Pharm*. *Res*., **14**, 1406-1414 (1997).

15. Schwendeman, S. P., Tobio, M., Joworowicz, M., Alonso, M. J. and Langer, R., New strategies for the microencapsulation of tetanus vaccine, *J. Microencapsulation*, **15**, 299-318 (1998).

16. Costantino, H. R., Schwendeman, S. P., Langer, R. and Klibanov, A. M., Deterioration of lyophilized pharmaceutical proteins, *Biochemistry (Moscow)*, **63**, 357-363 (1998).

17. Zhou, T., Lewis, H., Foster, R. E. and Schwendeman, S. P., Development of a multiple-drug delivery implant for intraocular management of proliferative vitreoretinopathy, *J. Controlled Release*, **55**, 281-295 (1998).

18. Shenderova, A., Burke, T. G. and Schwendeman, S. P., An acidic microclimate in poly(lactide-co-glycolide) microspheres stabilizes camptothecins, *Pharm. Res.*, **16**, 241-248 (1999).

19. Cook, V. L., Bertone, A. L., Kowalski, J. J., Schwendeman, S. P., Ruggles, A. J. and Weisbrode, S. E., Biodegradable drug delivery systems for gentamicin release and treatment of synovial membrane infection, *Vet. Surg*., **28**, 233-241 (1999).

20. Wang, J. and Schwendeman, S. P., Mechanisms of solvent evaporation encapsulation processes: predicting evaporation rate, *J. Pharm. Sci.*, **10**, 1090-1099 (1999).

21. Tobio M, Schwendeman S. P., Guo, Y., McIver, J., Langer, R. and Alonso, M. J., Improved immunogenicity of a core-coated tetanus toxoid delivery vehicle, *Vaccine*, **18**, 618-622 (1999).

22. Zhu, G., Mallery, S. R. and Schwendeman, S. P., Stabilization of proteins encapsulated in injectable poly(lactide-co-glycolide), *Nat. Biotechnol.*, **18**, 52-57 (2000).

23. Zhu, G. and Schwendeman, S. P., Stabilization of proteins encapsulated in cylindrical poly(lactide-co-glycolide) implants: mechanism of stabilization by basic additives, *Pharm*. *Res*., **17**, 350-356 (2000).

24. Schwendeman, S. P., Shenderova, A., Zhu, G. and Jiang, W., Stability of encapsulated substances in poly(lactide-co-glycolide) delivery systems, in *Handbook of Pharmaceutical Controlled Release Technology*, D. Wise (ed.), Dekker (New York), 2000.

25. Marinina, J., Shenderova, A., Mallery, S. R. and Schwendeman, S. P., Stabilization of vinca alkaloids encapsulated in poly(lactide-co-glycolide) microspheres, *Pharm*. *Res*., **17**, 677-683 (2000).

26. Jiang, W. and Schwendeman, S. P., Formaldehyde-mediated aggregation of formalinized antigens: comparison of untreated and formalinized model protein antigens, *Biotech. Bioeng.*,**70**, 507-517 (2000).

27. Mallery, S. R., Pei, P., Kang, J., Zhu, G., Ness, G. M. and Schwendeman S. P., Sustained angiogenesis enables in vivo transplantation of mucocutaneous derived AIDS-related Kaposi's sarcoma cells in murine hosts, *Carcinogenesis*, **21**, 1647-1653 (2000).

28. Mallery, S. R., Pei, P., Kang, J., Ness, G. M., Ortiz, R., Touhalisky, J. E. and Schwendeman, S. P., Controlled-release of doxorubicin from poly(lactide-co-glycolide) microspheres significantly enhances cytotoxicity against cultured AIDS-related Kaposi's sarcoma cells, *Anticancer Res*., **20**, 2817-2825 (2000).

29. Frangione-Beebe, M., Albrecht, B., Dakappagari, N., Rose, R. T., Brooks, C. L., Schwendeman, S. P., Lairmore, M. D. and Kaumaya, P. T. P., Enhanced immunogenicity of a conformational epitope of human T-lympotropic virus type 1 using a novel chimeric peptide, *Vaccine*, **19**, 1068-1081 (2000).

30. Jiang, W. and Schwendeman, S. P., Stabilization and controlled release of bovine serum albumin encapsulated in poly(lactide) and poly(ethylene-glycol) microsphere blends, *Pharm. Res.*, **18**, 878-885 (2001).

31. Frangione-Beebe, M., Rose, R. T., Kaumaya, P. T. P. and Schwendeman, S. P., Microencapsulation of a synthetic peptide epitope for HTLV-1 in biodegradable poly(D, L-lactide-co-glycolide) microspheres using a novel encapsulation technique, *J. Microencapsulation*, **18**, 663-677 (2001).

32. Jiang, W. and Schwendeman, S. P., Stabilization of a model formalinized protein antigen encapsulated in PLGA-based microspheres, *J. Pharm. Sci.*, **90**, 1558-1569 (2001).

33. Cui, C. and Schwendeman, S. P., Surface-entrapment of polylysine in poly(lactide-co-glycolide) microparticles, *Macromolecules*, **34**, 8426-8433 (2001).

34. Kang, J. and Schwendeman, S. P., Comparison of the effects of $Mg(OH)_2$ and sucrose on the stability of bovine serum albumin encapsulated in poly(D,L-lactide-co-glycolide) implants, *Biomaterials*, **23**, 239-245 (2002).

35. Schwendeman, S. P., Recent advances in the stabilization of proteins encapsulated in injectable PLGA delivery systems, *Crit. Rev. Ther. Drug Carr. Sys*., **19**, 73-98 (2002).

36. Schwendeman, S. P, Lewis, H., Zhou, T. and Kamei, M., Intraocular controlled release: engineering biodegradable polymer drug delivery implants against proliferative vitreoretinopathy, in *Frontiers of Ocular Pharmacology and Therapeutics*, P. N. Patil and V. N. Puri (eds.), Allied Publishers PVT Ltd., New Delhi, India, pp. 131-140, 2002.

37. Wang, J., Wang, B. M. and Schwendeman, S. P., Characterization of the initial burst release of a model peptide from poly(D,L-lactide-co-glycolide) microspheres, *J. Controlled Release*, **82**, 289-307 (2002).

38. Kang, J. and Schwendeman, S. P., Determination of diffusion coefficient of a small hydrophobic probe in poly(lactide-co-glycolide) microparticles by laser scanning confocal microscopy, *Macromolecules*, **36**, 1324-1330 (2003).

39. Schwendeman, S. P., Protein drug delivery, in *McGraw-Hill 2003 Yearbook of Science & Technology*, McGraw-Hill, New York, pp. 347-349, 2003.

40. Wang, J., Wang, B. M. and Schwendeman, S. P., Mechanistic evaluation of the glucose-induced reduction in initial burst release of octreotide acetate from poly(D,L-lactide-*co*-glycolide) microspheres, *Biomaterials*, **25**, 1919-1927 (2004).

41. Ding, A. G. and Schwendeman, S. P., Determination of the water-soluble acid distribution in poly(lactide-co-glycolide), *J. Pharm. Sci*., **93**, 322-331 (2004).

42. Jiang, W., Costantino, H. R. and Schwendeman, S. P., Stabilization of lyophilized proteins encapsulated in controlled-release polymers: overview and cases studies including formaldehyde-treated vaccine antigens, in Lyophilization of Biopharmaceuticals, H. R. Costantino and M. J. Pikal (eds.), AAPS Press, Arlington, VA, pp. 483-518, 2004.

43. Shenderova, A., Ding, A. G. and Schwendeman, S. P., Potentiometric method for determination of microclimate pH in poly(lactic-co-glycolic acid) films, *Macromolecules*, **37**, 10052-10058 (2004).

44. Li, L. and Schwendeman, S. P., Mapping neutral microclimate pH in PLGA microspheres, *J. Controlled Release*, **101**, 163-173 (2005).

45. Kang, J. and Schwendeman, S. P., Improving the stability of PLGA-encapsulated proteins, in *Polymeric Drug Delivery Systems*, G. S. Kwon (ed.), Marcel Dekker, New York, 2005.

46. Jiang, W., Deshpande, M., Gupta, R. K. and Schwendeman, S. P., Biodegradable poly(lactic-co-glycolic acid) microparticulates for injectable controlled antigen delivery, *Adv. Drug Del. Rev.*, **57**, 391-410 (2005).

47. Ding, A. G., Shenderova, A. and Schwendeman, S. P., Prediction of microclimate pH in poly(lactic-co-glycolic acid) films, *J. Am. Chem. Soc.*, **128**, 5384-5390 (2006).

48. Estey, T., Kang, J., Schwendeman, S. P. and Carpenter, J. F., BSA Degradation under acidic conditions: a model for protein stability during release from PLGA delivery systems, *J. Pharm. Sci*., **95**, 1626-1639 (2006).

49. Pei, P., Horan, M. P., Hille, R., Herman, C. F., Schwendeman, S. P. and Mallery, S. R., Reduced nonprotein thiols inhibit activation and function of MMP-9, *Free Radical Biol. Med.*, **41**, 1315-1324 (2006).

50. Cui, C., Stevens, V. C. and Schwendeman, S. P., Injectable polymer microspheres enhance immunogenicity of a contraceptive peptide vaccine, *Vaccine*, **25**, 500-509 (2007).

51. Kang, J. and Schwendeman, S. P., Pore closing and opening in biodegradable polymers and their effect on the controlled release of proteins, *Mol. Pharm.*, **4**, 104-118 (2007).

52. Zhong, Y., Ding, A., Zhang, L., Shenderova, A., Zhu, G., Pei, P., Chen, R., Mallery, S. R., Mooney, D. J. and Schwendeman, S. P., Rescue of SCID murine ischemic hindlimbs with pH-modified rhbFGF/poly(D,L-lactic-co-glycolic acid) implants, *J. Controlled Release*, **122**, 331-337 (2007).

53. Cui, C. and Schwendeman, S. P., One-step surface modification of poly(lactide-co-glycolide) microparticles with heparin, *Pharm. Res.*, **24**, 2381-2393 (2007).

54. Desai, K-G. H., Mallery, S. R. and Schwendeman, S. P., Formulation and characterization of injectable poly(D,L-lactide-co-glycolide) implants loaded with N-acetylcysteine, a MMP inhibitor, *Pharm. Res.*, **25**, 586-597 (2008).

55. Desai, K-G. H., Mallery, S. R. and Schwendeman, S. P., Enhanced 2-methoxyestradiol release from poly(D,L-lactide-co-glycolide) implants, *Eur. J. Pharm. Biopharm*., **70**, 187-198 (2008).

56. Kang, J., Lambert, O., Ausborn, M. and Schwendeman, S. P., Stability of proteins encapsulated in injectable and biodegradable poly(lactide-co-glycolide)-glucose millicylinders, *Int. J. Pharm*., **357**, 235-243 (2008).

57. Jiang, W. and Schwendeman, S. P., Stabilization of tetanus toxoid encapsulated in PLGA microspheres, *Mol*. *Pharm.*, **5**, 808-817 (2008).

58. Ding, A. G. and Schwendeman, S. P., Acidic microclimate pH distribution in PLGA microspheres monitored by laser confocal scanning microscopy, *Pharm. Res*., **25**, 2041-2052 (2008).

59. Wischke, C. and Schwendeman, S. P., Principles of encapsulating hydrophobic drugs in PLA/PLGA microparticles, *Int J. Pharm.*, **364**, 298-327 (2008).

60. Zhang, L. and Schwendeman, S. P., Injectable biodegradable polymer depots for minimally invasive delivery of peptides and proteins, *Adv. Exp. Med. Biol.* **611**, 611-613 (2009).

61. Sophocleous, A, Zhang, Y. and Schwendeman, S. P., A new class of inhibitors for peptide sorption and acylation in PLGA*, J. Controlled Release*, **137**, 179-184 (2009).

62. Zhang, Y., Sophocleous, A. and Schwendeman, S. P. Inhibition of peptide acylation in PLGA microspheres with water-soluble divalent cationic salts, *Pharm. Res*., **26**, 1986-1994 (2009).

63. Desai, K. G. H., Olsen, K. F., Mallery, S. R., Stoner, G. D., and Schwendeman, S. P., Formulation and in vitro-in vivo evaluation of black raspberry extract-loaded PLGA/PLA injectable millicylindrical implants for sustained delivery of chemopreventive anthocyanins, *Pharm. Res*., **27**, 628-643 (2010).

64. Wischke, C., Zhang, Y., Mittal, S, and Schwendeman, S. P., Development of PLGA-based injectable delivery systems for hydrophobic fenretinide, *Pharm. Res*., **27**, 2063-2074 (2010).

65. Desai, K. G. H., Mallery, S. R., Holpuch, A. S. and Schwendeman, S. P., Development and in vitro-in vivo evaluation of fenretinide-loaded oral mucoadhesive patches for site-specific chemoprevention in oral cancer, *Pharm. Res*., **28**, 2599-2609 (2011).

66. Holpuch, A. S., Desai, K. G. H., Schwendeman, S. P. and Mallery, S. R., Optimizing therapeutic efficacy of chemopreventive agents: a critical review of delivery strategies in oral cancer chemoprevention clinical trials, *J. Carcinog*., **10**, 23 (2011).

67. Wischke, C. and Schwendeman, S. P., Degradable polymeric carriers for parenteral controlled drug delivery, in *Fundamentals of Drug Delivery*. J. Siepmann, R. Siegel and M. Rathbone (eds), Springer, NY, pp. 171-228, 2012.

68. Milacic, V., Bailey, B., O'Hagan, D. and Schwendeman, S. P., Injectable delivery systems for vaccine antigens, in *Long Acting Implants and Injections*, J. Wright and D. Burgess (eds), Springer, NY, pp. 429-458, 2012.

69. Wu, X., Desai, K. G., Mallery, S. R., Holpuch, A. S., Phelps, M. P. and Schwendeman, S. P., Mucoadhesive fenretinide patches for site-specific chemoprevention of oral cancer: enhancement of oral mucosal permeation of fenretinide by co-incorporation of propylene glycol and menthol, *Mol. Pharm.*, **9**, 937-945 (2012).

70. Holpuch, A. S., Phelps, M. P., Desai, K. G., Chen, W., Koutras, G. M., Han, B., Warner, B. M., Pei, P., Seghi, G. A., Tong, M., Border, M. B., Fields, H. W., Stoner, G. D., Larsen, P. E., Liu, Z., Schwendeman, S. P., Mallery, S. R., Evaluation of a mucoadhesive fenretinide patch for local intraoral delivery: A strategy to re-introduce denretinide for oral cancer chemoprevention, *Carcinogenesis*, **33**, 1098-1105 (2012).

71. Liu, Y. and Schwendeman, S. P., Mapping microclimate pH distribution inside protein-encapsulated PLGA microspheres using confocal laser scanning microscopy, *Mol. Pharm.*, **9**, 1342-1350 (2012).

72. Zhang, Y. and Schwendeman, S. P., Minimizing acylation of peptides in PLGA microspheres, *J. Controlled Release*, **162**, 119-126 (2012).

73. Liu, Y., Ghassemi, A. H., Hennink, W. E. and Schwendeman, S. P., The microclimate pH in poly(D,L-lactide-co-hydroxymethyl glycolide) microspheres during biodegradation, *Biomaterials*, **33**, 7584-7593 (2012).

74. Yin, K.-J., Olsen, K., Hamblin, M., Zhang, J., Schwendeman, S. P. and Chen, Y. E., Vascular endothelial cell-specific microRNA-15a inhibits angiogenesis in hindlimb ischemia, *J. Biol. Chem.*, **32**, 27055-27064 (2012).

75. Reinhold, S. E., Desai, K.-G. H., Zhang, L., Olsen, K. F. and Schwendeman, S. P. Self-healing microencapsulation of biomacromolecules without organic solvents, *Angew. Chem. Int. Ed.*, **51**, 10800-10803 (2012).

76. Desai, K.-G. H. and Schwendeman, Active self-healing encapsulation of vaccine antigens in PLGA microspheres, *J. Controlled Release*, **165**, 62-74 (2013).

77. Desai, K.-G. H., Kadous, S., Gupta, R. K. and Schwendeman, S. P., Gamma irradiation of active self-healing PLGA microspheres for efficient aqueous encapsulation of vaccine antigens, *Pharm. Res*., **30**, 1768-1778 (2013).

78. Mazzara, J. M., Thouless, M. D. and Schwendeman, S. P., Healing kinetics of microneedle-formed pores in PLGA films, *J. Controlled Release*, **171**, 172-177 (2013).

79. Sophocleous, A. M., Desai, K.-G. H., Mazzara, J. M., Tong, L., Cheng, J.-X., Olsen, K. F. and Schwendeman, S. P., The nature of peptide interactions with acid end-group PLGAs and facile aqueous-based microencapsulation of therapeutic peptides, *J. Controlled Release*, **172**, 662-670 (2013).

80. Reinhold, S. E. and Schwendeman, S. P., Effect of polymer porosity on aqueous self-healing encapsulation of proteins in PLGA microspheres, *Macromol. Biosci*., **13**, 1700-1710 (2013).

81. Milacic, V. and Schwendeman, S. P., Lysozyme release and polymer erosion behavior of injectable implants prepared from PLGA-PEG block copolymers and PLGA/PLGA-PEG blends, *Pharm. Res*., **31**, 436-448 (2014).

82. Schwendeman, S. P., Shah, R., Bailey, B. and Schwendeman, A. S., Injectable controlled-release depots for large molecules, *J. Controlled Release*, **190**, 240-253 (2014).

83. Shah, R. B. and Schwendeman, S. P., A biomimetic approach to active self-microencapsulation of proteins in PLGA, *J. Controlled Release*, **196**, 60-70 (2014).

84. Huang, J., Mazzara, J. M., Schwendeman, S. P., Thouless, M.D., Self-healing of pores in PLGAs, *J. Controlled Release*, **206**, 20-29 (2015).

85. Han, B. B., Li, S., Tong, M., Holpuch, A. S., Spinney, R., Wang, D., Bordner, M. B., Liu, Z., Sarode, S., Pei, P., Schwendeman, S. P. and Mallery, S. R., Fenretinide perturbs focal adhesion kinase in premalignant and malignant human oral keratinocytes. Fenretinide's chemopreventive mechanisms include ECM interactions, *Cancer Prev. Res*., **8**, 419-430 (2015).

86. Hansen, K, Kim, G., Desai, K.-G., Patel, H., Olsen, K., Curis-Fisk, J., Tocce, E., Jordan, S. and Schwendeman, S. P., Feasibility investigation of cellulose polymers for mucoadhesive nasal drug delivery applications, *Mol. Pharm.*, **12**, 2732-2741 (2015).

87. Lautner, G., Meyerhoff, M. E. and Schwendeman, S. P., Biodegradable poly(lactic-co-glycolic acid) microspheres loaded with S-nitroso-N-acetyl-D-penicillamine for controlled nitric oxide delivery, *J. Controlled Release*, **225**, 133-139 (2016).

88. Chiang, B., Kim, Y. C., Doty, A. C., Grossniklaus, H.E., Schwendeman, S. P. and Prausnitz, M. R., Sustained reduction of intraocular pressure by supraciliary delivery of brimonidine-loaded poly(lactic acid) microspheres for the treatment of glaucoma, *J. Controlled Releas*e, **228**, 48-57 (2016).

89. Zhang, Y., Wischke, C., Mittal, S., Amitava, M. and Schwendeman, S. P., Design of controlled PLGA microspheres for hydrophobic fenretinide, *Mol. Pharm.*, **13**, 2622-2630 (2016).

90. Tee, B. C., Desai, K. G. H., Kennedy, K. S., Sonnichsen, B., Kim, D.-G., Fields, H. W., Mallery, S. R., Schwendeman, S. P. and Sun, Z, Reconstructing jaw defects with MSCs and PLGA-encapsulated growth factors, *Am. J. Trans. Res*., **8**, 2693-2704 (2016).

91. Doty, A. C., Hirota, K., Olsen, K. F., Sakamoto, N., Wang, Y., Choi, S., Qu, W., Schwendeman, A. S. and Schwendeman, S. P., Validation of a cage implant for assessing in vivo performance of long-acting release microspheres, *Biomaterials*, **109**, 88-96 (2016).

92. Hirota, K., Doty, A. C., Ackermann, R., Zhou, J., Olsen, K. F., Feng, M. R., Wang, Y., Choi, S., Qu, W., Schwendeman, A. S. and Schwendeman, S. P., Characterizing release mechanisms of leuprolide acetate-loaded PLGA microspheres for IVIVC development I: in vitro evaluation, *J. Controlled Release*, **244**, 302-313 (2016).

93. Doty, A. C., Zhang, Y., Weinstein, D. G., Wang, Y., Choi, S., Qu, W., Mittal, S. and Schwendeman, S. P., Mechanistic analysis of triamcinolone acetonide release from PLGA microspheres as a function of varying in vitro release conditions, *Eur. J. Pharm. Biopharm*., **113**, 24-33 (2017).

94. Mallery, S. R., Wang, D., Santiago, B., Pei, P., Schwendeman, S. P., Nieto, K., Spinney, R., Tong, M., Koutras, G., Han, B., Holpuch, A. and Lang, J., Benefits of multifaceted chemopreventives in the suppression of the oral squamous cell carcinoma (OSCC) Tumorigenic phenotype, *Cancer Prev. Res*., **10**, 76-88 (2017).

95. Bailey, B. A., Ochyl, L. J., Schwendeman, S. P. and Moon, J. J., Towards a single-dose vaccination strategy with self-encapsulating PLGA microspheres, *Adv. Healthc. Mater*., **6**, 1601418 (2017).

96. Doty, A. C., Weinstein, D. G., Hirota, K., Olsen, K. F., Ackermann, R., Wang, Y., Choi, S. and Schwendeman, S. P., Mechanisms of *in vivo* release of triamcinolone acetonide from PLGA microspheres *J. Controlled Release*, **256**, 19-25 (2017).

97. Pisupati, K., Tian, Y., Okbazghi, S., Benet, A., Ackermann, R., Ford, M., Saveliev, S., Hosfield, C. M., Urh, M., Carson, E., Becker, C., Tolbert, T.J., Schwendeman, S.P., Ruotolo, B.T. and Schwendeman, A., A multidimensional analytical comparison of Remicade and the biosimilar Remsima, *Anal. Chem.,* **89**, 4838-4846 (2017).

98. Mitragotri, S., Lammers, T., Bae, Y. H., Schwendeman, S., De Smedt, S., Leroux, C., Peer, D., Kwon, I. C., Harashima, H., Kikuchi, Al, Oh, Y.-K., Torchilin, V., Hennink, W., Hanes, J. and Park, K., Drug delivery research for the future: expanding the nano horizons and beyond, *J. Controlled Release*, **246**, 183 (2017). (*Commentary*)

99. Pisupati, K., Benet, A., Tian, Y., Okbazghi, S., Kang, J., Ford, M., Saveliev, S., Sen, K., Carlson, E., Tolbert, T. J., Ruotolo, B. T., Schwendeman, S. P. and Schwendeman, A., Biosimilarity under stress: a forced degradation study of Remicade® and Remsima™, *MAbs*, **9**, 1197-1209 (2017).

100. Bailey, B., Desai, K.-G., Ochyl, L., Ciotti, S., Moon, J. and Schwendeman, S. P., Self-Encapsulating poly(Lactic-co-Glycolic Acid) (PLGA) microspheres for intranasal vaccine delivery, *Mol. Pharm*., **14**, 3228-3237 (2017).

101. Nieto, K., Pei, P., Wang, D., Mallery, S. R. and Schwendeman, S. P., In vivo controlled release of fenretinide from long-acting release depots for chemoprevention of oral squamous cell carcinoma recurrence, *Int. J. Pharm*., 538, 48-56 (2018).

102. Moon, J. J., Schwendeman, S. P. and Schwendeman, A., Guest editorial title: nanomedicine: past, present, and future, *Adv. Drug Del. Rev*., **130**, 1-2 (2018).

103. Kang, J., Pisupati, K., Benet, A., Ruotolo, B. T., Schwendeman, S. P. and Schwendeman, A., Inflixamab biosimilars in the age of personalized medicine, *TIBTECH*, 36, 987-992 (2018).

104. Popilski, H., Esther, A., Schwendeman, S., Domb, A. and Stepensky, D., Efficacy of paclitaxel/dexamethasone intra-tumoral delivery in treating orthotopic mouse breast cancer, *J. Control. Rel*., **279**, 1-7 (2018).

105. Yu, M., Benjamin, M. M., Srinivasan, S., Morin, E. E., Shishatskaya, E. I., Schwendeman, S. P. and Schwendeman, A., Battle of GLP-1 delivery technologies, *Adv. Drug Del. Rev*., **130**, 113-130 (2018).

106. Moon, J. J., Hennink, W. E., Schwendeman, S. P. and Schwendeman, A., NanoDDS2017: The 15th International Nanomedicine & Drug Delivery Symposium, *J. Control. Rel*., **282**, 1-2 (2018).

107. Zhou, J., Hirota, K., Ackermann, R., Walker, J., Wang, Y., Choi, S., Schwendeman, A. and Schwendeman, S. P. Reverse Engineering the 1-month Lupron Depot®**,** *AAPS J.*, **20**, 105 (2018).

108. Mazzara, J. M., Ochyl, L. J., Hong, J. K. Y., Moon, J. J., Prausnitz, M. R., Schwendeman, S. P., Self-healing encapsulation and controlled release of vaccine antigens from PLGA microparticles delivered by microneedle patches, *Bioeng. Trans. Med*., **4**, 116-128 (2019).

109. Li, W., Terry, R. N., Tang, J., Feng, M. R., Schwendeman, S. P. and Prausnitz, M. R., Rapidly separable microneedle patch for sustained release of contraceptive hormone, *Nat. BME*, **3**, 220-229 (2019).

110. Lautner, G., Stringer, B., Brisbois, E. J., Meyerhoff, M. E. and Schwendeman, S. P., Controlled light-induced gas phase nitric oxide release from S-nitrosothiol-doped silicone rubber films, *Nitric Oxide*, **86**, 31-37 (2019).

111. Li. W., Tang, J., Terry, R. N., Li, S., Brunie, A., Callahan, R. L., Noel, R. K., Rodriquez, C. A., Schwendeman, S. P. and Prausnitz, M. R., Long-acting reversible contraception of effervescent microneedle patch, *Sci. Adv*., **5**, eaaw8145 (2019).

112. Yu, M., Yuan, W., Li, D., Schwendeman, A. and Schwendeman, S. P., Predicting drug release kinetics from nanocarriers inside dialysis bags, *J. Control. Release*, **315**, 23-30 (2019).

113. Schwendeman, S. P., A local combination therapy to inhibit GBM recurrence, *J. Control. Release*, **309**, 339-340 (2019). (*Commentary*)

114. Schwendeman, S. P., Moving RNA interference beyond the liver, *J. Control. Release*, **313**, 161-162, 2019. (*Commentary*)

115. Schwendeman, S. P., Revisiting the nano option for overcoming antibiotic resistance, *J. Control. Release*, **316**, 418-419 (2019). (*Commentary*)

116. Mallery, S. R., Wang, D., Santiago, B., Pei, P., Bissonette, C., Jayawardena, J., A. and Schwendeman, S. P., Spinney, R. and Lang, Fenretinide, tocilizumab, and reparixin provide multifaceted disruption of oral squamous cell carcinoma stem cell properties: implications for tertiary chemoprevention, J., *Mol. Cancer Ther*., **18**, 2308-2320 (2019).

117. Lautner, G., Lautner-Csorba, O., Stringer, B., Meyerhoff, M. E. and Schwendeman, S. P., Feedback-controlled photolytic gas phase nitric oxide delivery from S-nitrosothiol-doped silicone rubber films, *J. Control. Release*, **318**, 264-269 (2020).

118. Kang, J., Kim, S. Y., Vallejo, D., Hageman, T. S., White, D. R., Benet, A., Coghlan, J., Sen, K. I., Ford, M., Saveliev, S., Tolbert, T. J., Weis, D. D., Schwendeman, S. P., Ruotolo, B., T. and Schwendeman, A., Multifaceted assessment of rituximab biosimilarity: the impact of glycan microheterogeneity on Fc function, *Eur. J. Pharm. Biopharm*., **146**, 111-124 (2020).

119. Kang, J., Kim, S. Y., Vallego, D., Hageman, T. S., White, D. R., Benet, A., Coghlan, J., Sen, K. I., Ford, M., Saveliev, S., Tolbert, T. J., Weis, D. D., Schwendeman, S. P., Ruotolo, B. T. and Schwendeman A., Multifaceted assessment of rituximab biosimilarity: the impact of glycan microheterogeneity on Fc function, *Eur. J. Pharm. Biopharm*., **146**, 111-124 (2020).

120. Shi, N., Zhou, J., Walker, J., Li, L., Hong, K.-Y., Olsen, K. F., Tang, J., Ackermann, R., Wang, Y., Qin, B., Schwendeman, A. and Schwendeman, S. P., Microencapsulation of luteinizing hormone-releasing hormone agonist in pol(lactic-co-glycolic acid) microspheres by spray drying, *J. Control. Release*, **321**, 756-772 (2020).

121. Zhou, J., Walker, J., Ackermann, R., Olsen, K., Hong, J., Wang, Y. and Schwendeman, S. P., Effect of manufacturing variables and raw materials on composition-equivalent PLGA microspheres for 1-month controlled release of leuprolide, *Molec. Pharm*., in press.

122. Nieto, K., Mallery, S. R. anad Schwendeman, S. P., Microencapsulation of amorphous solid dispersions of fenretinide enhances drug solubility and release from PLGA in vitro and in vivo, *Int. J. Pharm*., in press.

123. Giles, M. B., Hong, J. K. Y., Li, T., Beig, A., Schwendeman, A. and Schwendeman, S. P., Efficient aqueous remote loading of peptide in poly(lactic-co-glycolic acid), submitted.

124. Scheiner, K. C., Maas-Bakker, R. F., van Steenbergen, Schwendeman, S. P., Hennink, W. E. and Kok, R., Post-loading of proangiogenic growth factors in PLGA microspheres, submitted.

125. Hong, J. K. Y. and Schwendeman, S. P., Characterization of octreotide-PLGA binding by isothermal titration calorimetry, submitted.

126. Beig, A., Feng, L., Walker, J., Ackermann, R., Hong, J. K. Y., Li, T., Wang, Y., Qin, B. and Schwendeman, S. P., Physical-chemical characterization of Sandostatin LAR, submitted.

127. Chang, R. S., Walker, J., Kadiyala, P., Jamison, J., Schwendeman, A., Antonetti, D., Castro, M. G. and Schwendeman, S. P., Local controlled release of monoclonal antibodies for macular degeneration and glioblastoma treatment, submitted.

Conference Proceedings

1. Schwendeman, S. P., Amidon, G. L., Meyerhoff, M. E. and Levy, R. J., Characterization of the iontophoretic transport through heterogeneous cation-exchange membranes, *Pharm. Res.*, **7**, S-171 (1990).
2. Schwendeman, S. P., Levy, R. J., Murphy, H. A. and Amidon, G. L., Influence of the silicone rubber matrix on the iontophoretic transport through heterogeneous cation-exchange membranes, *Pharm. Res.*, **8**, S-141 (1991).
3. Schwendeman, S. P., Amidon, G. L. and Levy, R. J., Modulatable drug release using iontophoresis through heterogeneous cation-exchange membranes, *Pharm. Res.*, **8**, S-141 (1991).
4. Schwendeman, S. P., Amidon, G. L., Labhasetwar, V. and Levy, R. J., Modulated release of d-sotalol using iontophoresis through heterogeneous cation-exchange membranes, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.,* **19**, 165-166 (1992).
5. Schwendeman, S. P., Amidon, G. L. and Levy, R. J., Modulated release of antiarrhythmics by iontophoresis through polymer membranes, *Pharm. Res.*, **9**, S-169 (1992).
6. Schwendeman, S. P., Labhasetwar, V. and Levy, R. J., Controlled release drug delivery implants for cardiac arrhythmias: iontophoretic modulation, *Proceed. Cardiovas. Sci. Technol. Conf.*, 195 (1992).
7. Labhasetwar, V., Schwendeman, S. P., Underwood, T., Gallagher, M., Nguyen, T., Langberg, J., and Levy, R. J., Epicardial iontophoretic delivery of antiarrhythmic agents, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.*, **20**, 476-477 (1993).
8. Schwendeman, S. P., Gupta, R. K., Costantino, H. R., Siber, G. R. and Langer, R., Stability of tetanus vaccine for encapsulation in bioerodible polymer microspheres, *Pharm. Res.*, **10,** S-220 (1993).

9. Schwendeman, S. P., Lee, J. H., Gupta, R. K., Costantino, H. R., Siber, G. R., and Langer, R., Inhibition of moisture-induced aggregation of tetanus toxoid by protecting thiol groups, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.*, **21**, 54-55 (1994).
10. Schwendeman, S. P., Costantino, H. R., Gupta, R. K., Siber, G. R. and Langer, R., Mechanisms of moisture-induced aggregation of tetanus toxoid, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.*, **22**, 41-42 (1995).
11. Schwendeman, S. P., Gupta, R. K., Siber, G. R. and Langer, R., Pathways of inactivation of tetanus toxoid in the presence of PLA 2000, *Pharm. Res.*, **12**, S-80 (1995).
12. Cardamone, M., Schwendeman, S., Langer, R. and Brandon, M., Protein engineering of tetanus toxoid from first principles: enhanced stabilization through the removal of labile peptide bonds, *Proceedings of the Twentieth Annual Lorne Conf. on Protein Structure and Function*, Feb. 4-9, 1995, p. 254.
13. Tobio, M., Schwendeman, S., Alonso, M. J. and Langer, R., Development of new strategies for the microencapsulation of tetanus vaccine*, Proceedings of the 1st Spanish-Portuguese Conf. on Controlled Drug Delivery*, Santiago de Compostela, Sept. 25-27, 1995, p. 49.
14. Shenderova, A., Burke, T. G. and Schwendeman, S. P., Biodegradable polymer microspheres stabilize the active form of 10-hydroxycamptothecin, *Proc. Am. Assoc. Cancer Res.*, **36**, 303 (1996).
15. Foster, R. E., Schwendeman, S. P., Zhou, T., Jaworowicz, M., Buckner, P. and Lewis, H., Multidrug biodegradable polymer implant in the porcine PVR model, *Invest. Ophthalmol. Vis. Sci.*, **37,** S196 (1996).
16. Schwendeman, S. P. and Schwendeman, D. W., Integrated nonsteady-state Nernst-Planck equations describe iontophoretic drug transport through ion-exchange membranes, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.,* **23**, 125-126 (1996).
17. Alonso, M. J., Villamayor, B., Tobio, M., Schwendeman, S. P., Gupta, R. K., Siber, G. and Langer R., Innovative approaches for the stabilization and controlled release of tetanus vaccine from polyester microspheres, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.,* **23**, 825-826 (1996).
18. Shenderova, A., Burke, T. G. and Schwendeman, S. P., Characterization of the microclimate in PLGA microspheres with a camptothecin probe, *Pharm. Res*., **9**, S-254 (1996).
19. Cook, V. L., Bertone, A. L., Kowalski, J. J., Schwendeman, S. P., Ruggles, A. J. and Weisbrode, S. E., Biodegradable drug delivery systems for gentamicin release and the elimination of synovial membrane infection, *J. Vet. Surg*., **25**, 419 (1996).
20. Schwendeman, S. P., Stability of protein antigens in biodegradable polymer microspheres*, Proceedings of the 1997 Colorado Biopharmaceutical Delivery Conference*, Breckenridge, CO.
21. Shenderova, A., Burke, T. G., Giovanella, B., and Schwendeman, S. P., Characterization of controlled release formulations of camptothecins composed of polylactide-co-glycolide (PLGA) microspheres, *Proc. Am. Assoc. Cancer Res.*, **38**, 260 (1997).
22. Frangione, M. J., Schwendeman, S. P., Kaumaya, P. T. P., Delivery of peptide epitopes for HTLV-1 using biodegradable microspheres, *Proceedings of the 15th American Peptide Symposium*, Nashville, TN, June 14-19 (1997).
23. Randall, M., Schwendeman, S., Hrkach, J. and Kaumaya, P. T. P., Adjuvant free induction of CD4+ and CD8+ responses by covalent linkage of HTLV-1 peptides to biodegradable microspheres, *Proceedings of the 15th American Peptide Symposium*, Nashville, TN, June 14-19 (1997).

24. Zhou, T., Foster, R. E., Lewis, H. and Schwendeman, S. P., A multi-drug controlled-release implant for intraocular treatment of proliferative vitreoretinopathy, *Proceed. Intern. Symp. Control. Rel. Bioact. Mater.*, **24**, 625-626 (1997).
25. Shenderova, A., Burke, T. G. and Schwendeman, S. P., Mechanisms of stabilization of camptothecins in PLGA microspheres, *Pharm. Res.*, **14**, S-46 (1997).
26. Frangione, M., Kaumaya, P. T. P. and Schwendeman, S. P., Development of a novel technique for the encapsulation of peptide vaccines in biodegradable polymer microspheres, *Pharm. Res.*, **14**, S-314 (1997).
27. Zhou, T. and Schwendeman, S. P., Characterization of triamcinolone release kinetics from millicylindrical poly(lactide-co-glycolide) (PLGA) 50/50 implantable devices, *Pharm. Res.*, **14**, S-152 (1997).
28. Wang, J. and Schwendeman, S. P., Quantitative evaluation of organic solvent removal during solvent evaporation encapsulation processes, *Pharm. Res.*, **14**, S-324 (1997).
29. Zhu, G., Mallery, S. R., Clark, Y. M., Shenderova, A. and Schwendeman, S. P., Stabilization of proteins encapsulated in injectable poly(lactide-co-glycolide) delivery vehicles, *J. Dent. Res.*, **77** (Special Issue A), 170 (1998).
30. Zhu, G. and Schwendeman, S. P., Stabilization of bovine serum albumin encapsulated in injectable poly(lactide-co-glycolide) millicylinders, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **25**, 267-268 (1998).
31. Wang, J. and Schwendeman, S. P., Mechanisms of solvent evaporation encapsulating processess: predicting solvent evaporation rate, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **25**, 246-247 (1998).
32. Shenderova, A., Burke, T. G., and Schwendeman, S. P., Evidence for an acidic microclimate in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater*., **25**, 265-266 (1998).
33. Zhou, T., Motohiro, K., Foster, R. E., Lewis, H. and Schwendeman, S. P., Optimization and in vivo evaluation of multi-drug biodegradable implants for proliferative vitreoretinopathy, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **25**, 156-157 (1998).
34. Wang, J. and Schwendeman, S. P., Characterization of microsphere hardening rate during encapsulation by the solvent evaporation method, *PharmSci*, **1**, #2225 (1998).
35. Zhu, G., Mallery, S. R. and Schwendeman, S. P., Controlled release of basic fibroblast growth factor form cylindrical poly(lactide-co-glycolide) implants, *PharmSci*, **1**, #2316 (1998).
36. Song, S., Zheng, J. H., Mallery, S. R., Schwendeman, S. P., Au, J. L.-S. and Wientjes, M. G., Distribution of doxorubicin after regional administration to the tongue, *PharmSci*, **1**, #4223 (1998).
37. Zhu, G. and Schwendeman, S. P., Stabilization of bovine serum albumin in injectable cylindrical poly(lactide-co-glycolide) implants, *PharmSci*, **1**, #1363 (1998).
38. Wang, J., Wang, B. M. and Schwendeman, S. P., A reproducible method to determine the surface area of the liquid-air interface in a stirred vessel, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5402 (1999).
39. Cui, C. and Schwendeman, S. P., Biodegradable microspheres with surface conjugatable groups, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5213 (1999).
40. Ortiz, R., Schwendeman, S. P. and Wientjes, M. G., Encapsulation and stability of doxorubicin free base in poly(lactide-co-glycolide) microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5915 (1999).
41. Zhu, G. and Schwendeman, S. P., Influence of basic salts on stability and release of proteins in injectable poly(lactide-co-glycolide) delivery systems, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #6446 (1999).

42. Jiang, W. and Schwendeman, S. P., Inhibiting formaldehyde-mediated aggregation of a model formalinized antigen, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5403 (1999).
43. Shenderova, A., Madou, M. J., Yao, S. and Schwendeman, S. P., Potentiometric and impedence measurements of PLGA coated microelectrodes, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5919 (1999).
44. Marinina, J., Mallery, S. R., Wientjes, M. G. and Schwendeman, S. P., Stabilization of vincristine in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **26**, #5914 (1999).
45. Frangione, M., Rose, T., Schwendeman, S. P., Stevens, V. C. and Kaumaya, P. T. P., Delivery of peptide epitopes for HTLV-1 using biodegradable microspheres, *Proc. Am. Pept. Symp.*, 17th, 799-800 (1999).
46. Lewis, H., Kamei, M., Kaiser, P. K., Zhou, T. and Schwendeman, S. P., *Invest. Ophth. Vis. Sci.*, **40**, S974 (1999).
47. Zhu, G. and Schwendeman, S. P., Stability and controlled release of enzymes encapsulated in injectable poly(lactide-co-glycolide) cylindrical implants, *PharmSci*, **2**, #2226 (1999).
48. Zhu, G. and Schwendeman, S. P., Stability and controlled release of proteins encapsulated in poly(lactide-co-glycolide) microspheres, *PharmSci*, **2**, #2228 (1999).
49. Shenderova, A. and Schwendeman, S. P., Techniques for microclimate pH measurement in PLGA delivery devices, *PharmSci*, **2**, #2241 (1999).
50. Jiang, W. and Schwendeman, S. P., Stabilization of formalinized bovine serum albumin (f-BSA) in poly(lactide-co-glycolide) microspheres, *PharmSci*, **2**, #3752 (1999).
51. Jiang, W. and Schwendeman, S. P., Development of poly(lactide-co-glycolide)/poly(lactide) microspheres for protein antigen delivery by using an anhydrous encapsulation method, *PharmSci*, **2**, #2243 (1999).
52. Cui, C. and Schwendeman, S. P., Biodegradable microspheres with surface conjugatable groups, *PharmSci*, **2**, #3150 (1999).
53. Mallery, S. R., Pei, P., Zhu, G., Ness, G. M. and Schwendeman, S. P., Basic fibroblast growth factor (bFGF) induced angiogenesis facilitates tumorigenecity, *J. Dent. Res*., **79** (Special Issue A), 51 (2000).
54. Shenderova, A., Zhu, G. and Schwendeman, S. P., Correlation of measured microclimate pH with the stability of BSA encapsulated in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **27**, #0413 (2000).
55. Jiang, W. and Schwendeman, S. P., Stabilization of formalinized protein antigens encapsulated in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **27**, #6415 (2000).
56. Kang, J. and Schwendeman, S. P., Encapsulation of doxorubicin hydrochloride in PLGA microspheres by a w/o/w emulsion-solvent evaporation method, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **27**, #8139 (2000).
57. Zhu, G. and Schwendeman, S. P., Stabilization of proteins encapsulated in PLGA microspheres by adjusting polymer microclimate pH, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **27**, #8040 (2000).
58. Cui, C. and Schwendeman, S. P., Surface-entrapment of polylysine in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.*, **27**, #6414 (2000).
59. Kang, J. and Schwendeman, S. P., Controlled release of recombinant human endostatin from magnesium hydroxide neutralized injectable PLGA implants, *PharmSci*, **3**, #4084 (2000).
60. Kang, J. and Schwendeman, S. P., Comparison of the effects of magnesium hydroxide and sucrose on the release of proteins from injectable PLGA implants, *PharmSci*, **3**, #4086 (2000).

61. Cui, C. and Schwendeman, S. P., Elevated alpha-helix content promotes surface-entrapment of native polylysine in poly(lactide-co-glycolide) microspheres, *PharmSci*, **3**, #2543 (2000).
62. Jiang, W. and Schwendeman, S. P., Stabilization and controlled release of a model protein antigen from a poly(lactide) and poly(ethylene glycol) blend, *PharmSci*, **3**, #4081 (2000).
63. Wang, J., Wang, B. M. and Schwendeman, S. P., Characterization of the initial burst drug release from poly(D,L-lactide-co-glycolide) microspheres I: multiphasic release behavior uncovered by continuous monitoring, *PharmSci*, **3**, #2149 (2000).
64. Wang, J., Wang, B. M. and Schwendeman, S. P., Characterization of the initial burst drug release from poly(D,L-lactide-co-glycolide) microspheres II: alterations in surface permeability implicated in cessation of burst release, *PharmSci*, **3**, #2150 (2000).
65. Schwendeman, S. P., Stabilization of vaccine antigens encapsulated in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **28**, #320 (2001).
66. Jiang, W. and Schwendeman, S. P., Mechanisms of histidine inhibition of tetanus toxoid aggregation, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **28**, #7029 (2001).
67. Jiang, W. and Schwendeman, S. P., Effect of excipients on the structure, antigenicity and aggregation of tetanus toxoid, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **28**, #7030 (2001).
68. Cui., C., Stevens, V. C., and Schwendeman, S. P., Enhanced imuunogenecity of a synthetic human chorionic gonadotropin peptide antigen from encapsulated & surface-conjugated PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **29**, #674 (2002).
69. Kang, J. and Schwendeman, S. P., Determination of diffusion coefficient in PLGA microspheres by laser scanning confocal microscopy, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **29**, #149 (2002).
70. Jiang, W. and Schwendeman, S. P., Stabilization of tetanus toxoid encapsulated in PLGA microspheres, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **29**, #142 (2002).
71. Estey, T. B., Krishnan, S., Schwendeman, S. P., and Carpenter, J. F., Physical and chemical factors affecting BSA Stability: Understanding degradation with poly(lactide-co-glycolide) microspheres, *PharmSci*, **4**, #2042 (2002).
72. Kang, J. and Schwendeman, S. P., Predicting the release of small fluorescent dyes from PLGA microspheres, *PharmSci*, **4**, #4174 (2002).
73. Cui, C. and Schwendeman, S. P., Stability of a synthetic human chorionic gonadotropin (hCG) antigen in PLGA microspheres, *PharmSci*, **4**, #4185 (2002).
74. Ding, A. G. and Schwendeman, S. P., Microclimate pH inside PLGA films and a possible relationship with water-soluble acids, *PharmSci*, **4**, #5140 (2002).
75. Cui, C., Kershaw, K. and Schwendeman, S. P., Surface-entrapment of heparin in PLGA, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **30**, #400 (2003).
76. Ding, A. G. and Schwendeman, S. P., Predicting acidic microclimate pH in thin poly(lactide-co-glycolide) 50/50 films., *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **30**, #50 (2003).
77. Lai, L. and Schwendeman, S. P., Minimization of soluble aggregation of bovine serum albumin in base-neutralized PLGA millicylinders, *PharmSci*, **5**, #3123 (2003).
78. Li, L. and Schwendeman, S. P., Quantitative determination of base-neutralized microclimate pH in PLGA microspheres, *PharmSci*, **5**, #1216 (2003).
79. Ding, A. G. and Schwendeman, S. P., Origin of the acidic microclimate pH inside PLGA films, *PharmSci*, **5**, #1192 (2003).

80. Schwendeman, S. P., Beyond peptide delivery: meeting the challenges to control the release of proteins, *Proceedings of the Eighth European Symposium on Controlled Drug Delivery*, Noordwijk aan Zee, The Netherlands (2004).
81. Estey, T. Schwendeman, S. P., Carpenter, J. F., Development of stable protein formulations for controlled-release from PLGA delivery systems, *Proceedings from the 2nd Pharmaceutical Sciences World Congress*, Kyoto, Japan, #P1E-IV-044 (2004).
82. Kang, J. and Schwendeman, S. P., Dynamics of the transition between open and isolated pores in PLGA and its effect on the controlled release of Proteins, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **31**, #32 (2004).
83. Ding, A. G. and Schwendeman, S. P., Spatial distribution of the acidic microclimate pH in thin PLGA films monitored by confocal laser scanning microscopy, *AAPS Journal*, **6**, #1209 (2004).
84. Zhong, Y., Ding, A. G., Zhu, G., Pei, P., Chen, R., Mallery, S. R., Mooney, D. J. and Schwendeman, S. P., Stabilization of basic fibroblast growth factor encapsulated in injectable PLGA implants enhances angiogenesis in vivo, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **32**, #51 (2005).
85. Zhong, Y., Zhang, L., Shenderova, A., Zhu, G., Pei, P., Chen, R., Mallery, S. R., Mooney, D. J. and Schwendeman, S. P., Overcoming barriers to protein delivery with minimally invasive controlled release depots, *Proceedings of the 13th International Symposium on Recent Advances in Drug delivery Systems: "Overcoming long-standing barriers*," Salt Lake City, UT, pp. 36-37 (2007).
86. Schwendeman, S. P., Injectable biodegradable polymer depots for minimally invasive delivery of peptides and proteins, *Biopolymers*, **88** (4), 528 (2007).
87. Zhong, Y., Zhang, L., Shenderova, A., Zhu, G., Pei, P., Chen, R., Mallery, S. R., Mooney, D. J. and Schwendeman, S. P., Rescue of murine ischemic hindlimbs with controlled-release rhbFGF, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **34**, #231 (2007).
88. Desai, K. G., Mallery, S. R. and Schwendeman, S. P., Controlled release of N-acetylcysteine from injectable poly(D,L-lactide-co-glycolide) implants for AIDS-associated Kaposi's Sarcoma, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **34**, #147 (2007).
89. Gu, X. and Schwendeman, Novel doxorubicin-detergent complexes for improved stealth polymeric nanoparticle delivery, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **34**, #823 (2007).
90. Reinhold, S. E. and Schwendeman, S. P., Self-microencapsulation in biodegradable polymers: a new paradigm to prepare protein controlled release polymers, *Proceed. Int'l. Symp. Control. Rel. Bioact. Mater.,* **34**, #232 (2007).
91. Zhang, L. and Schwendeman, S. P., Stabilization of recombinant human VEGF with albumin for VEGF controlled release devices, *AAPS Journal*, **9**, #1257 (2007).
92. Sophocleous, A., Zhang, Y. and Schwendeman, S. P., A new class of inhibitors of peptide sorption and acylation in PLGA, *AAPS Journal*., **10**, #4026 (2008).
93. Reinhold, S. and Schwendeman, S. P., A new method of preparing protein controlled release polymers, *AAPS Journal*, **10**, #6212 (2008).
94. Zhang, L. and Schwendeman, S. P., Controlled release of angiogenic growth factors from poly(lactide-co-glycolide) implants for therapeutic angiogenesis, *AAPS Journal*, **10**, #6219 (2008).
95. Zhang, Y., Sophocleous, A. and Schwendeman, S. P., Inhibition of peptide acylation in PLGA microspheres with water-soluble divalent cationic salts, *AAPS Journal*, **11**, #4079 (2009).
96. Desai, K. G. H., Mallery, S. R. and Schwendeman, S. P., Development of biodegradable injectable implants for site-specific sustained release of black raspberry anthocyanins, *AAPS Journal*, **11**, #4286 (2009).

97. Devineni, D., Schwendeman, S. P. and Carpenter, J., Development of freeze-dried formulations for protein delivery by PLGA microspheres and millicylinders, AAPS National Biotechnology Conference, #2025 (2010).
98. Shah, R. and Schwendeman, S., Exploring a biomimetic approach for the delivery of growth factors, AAPS National Biotechnology Conference, #2009 (2010).
99. Holpuch, A. S., Desai, K. G., Phelps, M. P., Han, B., Schwendeman, S. P., Mallery, S. R., Evaluation of a fenretinide mucoadhesive patch for local intraoral delivery, *J. Dent. Res*., **90**, #146204 (2011).
100. Milacic, V. and Schwendeman, S. P., Protein release behavior of injectable implants prepared from PLGA-PEG block copolymers and PLGA/PLGA-PEG blends, CRS Meeting, #830 (2011).
101. Desai, K.-G., Sophocleous, A. M., Mazzara, J. M., Tong, L., Cheng, J., Olsen, K. F. and Schwendeman, S. P., Leuprolide sorption to PLGA-COOH provides controlled in vitro-in vivo peptide release: a new and facile approach to prepare low-cost injectable depots, CRS Meeting, #253 (2011).
102. Liu, Y. and Schwendeman, S., Mapping microclimate pH inside protein-encapsulated PLGA microspheres using confocal laser scanning microscopy, AAPS Meeting, #1184 (2011).
103. Desai, K. G. H. and Schwendeman, S. P. Aqueous-based microencapsulation of tetanus toxoid in PLGA microspheres: a new and facile approach for controlled release of vaccine antigens, AAPS National Biotechnology Conference, #2006 (2012).
104. Mazzara, J. M., Self-healing kinetics of microneedle-formed holes in PLGA films, CRS Meeting, #204 (2012).
105. Shah, R. and Schwendeman, S. P., A biomimetic approach to active self-healing microencapsulation of proteins in PLGA, AAPS Meeting, #3143 (2012)
106. Liu, Y., Ghassemi, A., Hennink, W. and Schwendeman, S. P., Investigation of the pH distribution kinetics in degrading microspheres in hydrophilic poly(D,L-lactide-co-hydroxymethyl glycolide) and PLGA by confocal laser scanning microscopy, AAPS Meeting, #2008 (2012).
107. Bailey, B. and Schwendeman, Desai, K. G. and Schwendeman, S. P., Self-healing microencapsulation of vaccine antigens in small PLGA microspheres, AAPS Meeting, #4219 (2012).
108. Schwendeman, S. P., Desai, K. H. and Mazzara, J. M., Aqueous microencapsulation of large molecules in PLGAs, CRS Meeting, #9 (2013).
109. Chiang, B., Kim, Y. C., Doty, A. C., Schwendeman, S. P. and Prausnitz, M. R., Sustained-release brimonidine particles delivered into the suprachoroidal space using microneedles, International Conference on Microneedles, Invited Presentation (2014). [Recognized as one of the top 3 abstracts]
110. Doty, A. C., Choi, S., Qu, W., Lionberger, R., Feng, M. R., Schwendeman, A. S., and Schwendeman, S. P., Cage Implant system to evaluate mechanism of in vivo PLGA microsphere release for IVIVC development, AAPS Meeting, #3259 (2014).
111. Pisupati, K. and Schwendeman, S., Moisture-induced aggregation of zinc-human growth hormone complexes, AAPS Meeting, #4177 (2014).
112. Doty, A. C., Hirota, K., Olsen, K. F., Ackermann, R., Feng, R., Qu, W., Wang, Y., Choi, S., Schwendeman, A. and Schwendeman, S. P., A cage implant system for assessing in vivo controlled release performance of long-acting release PLGA depots, The National Institute for Pharmaceutical Training and Education (NIPTE) Research Conference: Pharmaceutical Critical Path Manufacturing, April 2015, Rockville, MD (Poster—won second place award).
113. Lautner, G., Schwendeman, S. P. and Meyerhoff, M. E., Nitric oxide releasing PLGA microspheres for biomedical applications, Biotech, Biomaterials and Biomedical TechConnect Briefs 2015, Materials for Drug & Gene Delivery Chapter 1, pp. 5 – 8.

114. Pisupati, K., Benet, A., Ackermann, R., Tian, Y., Ford, M., Saveliev, S., Carlson, E., Becker, C., Ruotolo, B., Schwendeman, S. and Schwendeman, A., Assessing biosimilarity of infliximab products using forced degradation, Colorado Protein Stability Conference, #19, Breckridge, CO (2015).
115. Giles, M.B., Doty, A.C. and Schwendeman, S.P., Aqueous remote loading of cationic peptides in PLGA microspheres, CRS Meeting, #69 (2015).
116. Chang, R. S. and Schwendeman, S. P., Injectable PLGA implants for controlled release of bevacizumab, CRS Meeting, #112 (2015).
117. Nieto, K., Mallery, S. and Schwendeman, S. P., Development of local controlled-release fenretinide as a chemopreventive therapy for oral squamous cell carcinoma (OSCC), CRS Meeting, #299 (2015).
118. Mazzara, J. M., Prausnitz, M. R. and Schwendeman, S. P., Self-encapsulating PLGA microparticles for controlled release vaccination via microneedles, AAPS Meeting, #1626 (2015).
119. Hirota, K., Doty, A., Ackermann, R., Olsen, K., Feng, M., Wang, Y., Choi, S., Qu, W., Schwendeman, A. and Schwendeman, S., Characterizing release mechanisms of leuprolide-loaded PLGA microparticles for IVIVC development, AAPS Meeting, #4193 (2015).
120. Pisupati, K., Benet, A., Ackermann, R., Tian, Y., Ford, M., Saveliev, S., Carlson, E., Becker, C., Ruotolo, B., Schwendeman, S. and Schwendeman, A., Comprehensive characterization of remicade and its biosimilar—remsima using mass spectrometry, AAPS Meeting, #2679 (2015).
121. Hansen, K., Kim, G., Desai, K.-G. H., Patel, H., Olsen, K. F., Curtis-Fisk, J., Tocce, E., Jordan, S. and Schwendeman, S. P., Feasbility investigation of cellulose polymers for mucoadhesion nasal drug delivery applications, AAPS Meeting, #6082 (2015).
122. Doty, A. C., Hirota, K., Olsen, K., Ackermann, R., Feng, R., Qu, W., Wang, Y., Choi, S., Schwendeman, A. and Schwendeman, S. P., A cage implant system for assessing in vivo controlled release performance of long-acting release PLGA depots, AAPS Meeting, #1290 (2015).
123. Nieto, K., Mallery, S. and Schwendeman, S. P., Characterizing drug release from PLGA in situ forming implants for delivery of chemopreventives for oral squamous cell carcinoma: hydrophobic fenretinide and hydrophilic black raspberry extract, AAPS Meeting, #6116 (2015).
124. Stepensky, D., Popilski, H., Abtew, E., Schwendeman, S. and Domb, A., Potential positive effect of dexamethasone as penetration enhancer on effectiveness of intratumoral drug delivery systems, CRS Meeting, #549 (2016).
125. Hirota, K., Zhou, J., Ackermann, R., Wang, Y., Choi, S., Schwendeman, A. and Schwendeman, S. P., Reverse engineering of the one-month Lupron depot, AAPS Meeting, 13M0330 (2016).
126. Nieto, K., Schwendeman, S. and Mallery, S. R., In vivo controlled release of fenretinide from PLGA millicylinders for local oral cancer chemoprevention, AAPS Meeting, 32R1100 (2016).
127. Chang, R. S. and Schwendeman, S. P., Coated PLGA implants for stabilization and controlled release of bevacizumab, CRS Meeting, P-513 (2017).
128. Benet, A., Pisupati, K., Tian, Y., Okbazghi, S., Kang, J., Ford, M., Saveliev, S., Carlson, E., Tolbert, T., Ruotolo, B., Schwendeman, S. and Schwendeman, A., Biosimilarity under stress: a forced degradation study of remicade and remsima, AAPS Meeting, M4023 (2017).
129. Zhou, J., Hirota, K., Feng, M. R., Doty, A. C., Olsen, K. F., Ackermann, R., Wang, Y., Choi, S. and Schwendeman, S. P., In vitro-in vivo correlation of leuprolide acetate-loaded PLGA microspheres, AAPS Meeting, M6006 (2017).

Invited Lectures

1. Iontophoretic drug delivery through polymer membranes, Dow Corning, Midland, Michigan (2/92).

2. Slow-release systems for tetanus vaccine, Meeting of the Programme for Vaccine Development, The World Health Organization, Geneva, Switzerland (3/93).

3. Study on stabilizing tetanus toxoid for encapsulation in polylactic/glycolic acid microspheres, Meeting of the Working Group on Single-dose Tetanus Vaccines (WHO Global Programme for Vaccines and Immunization), The Food and Drug Administration, Bethesda, Maryland (2/95).

4. Development of clinically useful controlled release implants, Proctor & Gamble, Cincinnati, Ohio (2/96).

5. Development of clinically useful controlled release implants, Mitsubishi Kasei Corp., Kashima, Japan (7/96).

6. Development of clinically useful controlled release implants, Suntory Limited, Gunma, Japan (7/96).

7. Stability of protein antigens in biodegradable polymer microspheres, Colorado Biopharmaceutical Delivery Conference, Breckenridge, CO (7/97).

8. Stability of proteins in injectable PLGA delivery systems, Scios, Inc., Mountain View, CA (5/98).

9. Stability of proteins in injectable PLGA delivery systems, Alkermes, Inc., Boston, MA (7/98).

10. Stability of proteins in injectable PLGA delivery systems, ETH Zürich, Zürich. Switzerland (7/98).

11. Effect of microclimate and formulation on protein stability in injectable PLGA devices, Biopharm Conference East and West, Framingham, MA (East) and San Franciso, CA (West) (6/99).

12. Stabilization of proteins encapsulated in PLGA delivery systems, Baxter, Deerfield, IL (11/00).

13. Stabilization of proteins encapsulated in PLGA delivery systems, Novartis, Basel, Switzerland (11/00).

14. Stability of protein antigens encapsulated in PLGA microspheres, 28th International Symposium on Controlled Release of Bioactive Materials, San Diego, CA (6/01).

15. Stabilization of proteins encapsulated in PLGA delivery systems, Allergan, Irvine, CA (6/01).

16. New trends in PLGA microspheres, PARTICLES 2002, Orlando, FL (4/02).

17. New trends in PLGA microspheres, Shanghai Pharmaceutical Association, Shanghai, China (5/02).

18. New trends in PLGA microspheres, Secondary Military Medical University and Chinese Pharmaceutical Association, Shanghai, China (5/02).

19. Stability of proteins encapsulated in PLGA delivery systems, AAPS Conference on Advances in Pharmaceutical Processing, Parsippany, NJ (6/03).

20. Microclimate pH in poly(lactic-co-glycolic acid) and its effect on the stability of encapsulated proteins, Polymers for Advanced Technologies, ACS Division of Polymer Chemistry, Ft. Lauderdale, FL (9/03).

21. Beyond peptide delivery: meeting the challenges to control the release of biomacromolecules, Johnson & Johnson, Somerville, NJ (10/03).

22. Stabilization of proteins encapsulated in d,l-PLGA star polymer: characterization and potential solutions to stability and release issues, Novartis, Basel, Switzerland (10/03).

23. Beyond peptide delivery: meeting the challenges to control the release of biomacromolecules, University of Nebraska Health Sciences Center, Omaha, NE (12/03).

24. Beyond peptide delivery: meeting the challenges to control the release of proteins, Eighth European Symposium on Controlled Drug Delivery, Noordwijk aan Zee, The Netherlands (4/04).

25. Beyond peptide delivery: meeting the challenges to control the release of proteins, Conor Medsystems, Menlo Park, CA (5/04).

26. Beyond peptide delivery: meeting the challenges to control the release of proteins, The International Workshop on Pharmaceutics, Hangzhou, China (5/04).

27. Improving the stability of PLGA-encapsulated proteins, 31st International Symposium on Controlled Release of Bioactive Materials, Honolulu, HI (6/04).

28. Protein stability in poly(lactic-co-glycolic acid) delivery systems, 18th Symposium of the Protein Society, San Diego, CA (8/04).

29. Stabilization of proteins encapsulated in PLGA delivery systems, AAPS Annual Meeting and Exposition, Baltimore, MD (11/04).

30. New Trends in poly(lactic-co-glycolic acid) systems for delivery of biomacromolecules**,** AAPS Annual Meeting and Exposition, Baltimore, MD (11/04).

31. Beyond peptide delivery: meeting the challenges to control the release of proteins, Medtronic, Minneapolis, MN (11/04).

32. Formulation challenges to protein and peptide delivery from polymers, 32nd International Symposium on Controlled Release of Bioactive Materials, Miami, FL (6/05).

33. Stability of proteins encapsulated in poly(lactic-co-glycolic acid delivery systems), Sociedade Brasileira de Bioquimica e biologia Molecular (SBBq) XXXIV Annual Meeting, Águas de Lindóia, Sp, Brazil (7/05).

34. Beyond peptide delivery: meeting the challenges to control the release of proteins, Pfizer, Groton, CN (7/05).

35. Improving the stability of PLGA-encapsulated growth factors, 2005 Biomedical Engineering Society (BMES) Meeting, Baltimore, MD (9/05).

36. Beyond peptide delivery: meeting the challenges to control the release of proteins, Conor Medsystems, Menlo Park, CA (9/05).

37. Beyond peptide delivery: meeting the challenges to control the release of proteins, U.S. Government's Science and Technical Expert Partnership (STEP) workshop entitled "Novel BioDelivery Technologies," The Mitre Corp., McLean, VA (3/06).

38. Beyond peptide delivery: meeting the challenges to control the release of proteins, Merck, West Point, PA (7/06).

39. Protein stability in PLGA, Short Course for the Controlled Release Society, Vienna, Austria (7/06).

40. Overcoming barriers to protein delivery with minimally invasive controlled release depots, 13th international symposium on recent advances in drug delivery systems, Salt Lake City, Utah (2/07).

41. Beyond peptide delivery: meeting the challenges to control the release of proteins, INSERM U563, Toulouse, France (3/07).

42. Beyond peptide delivery: meeting the challenges to control the release of proteins, CNRS, Toulouse, France (3/07).

43. Injectable biodegradable polymer depots for delivery of peptides and proteins, Amylin, La Jolla, CA (4/07).

44. Injectable biodegradable polymer depots for minimally invasive delivery of peptides and proteins, 20th American Peptide Society Symposium, Montreal, Canada (6/07).

45. Beyond peptide delivery: meeting the challenges to control the release of proteins, Genentech, South San Francisco, CA (7/07).

46. Stabilization and controlled release of proteins from poly(lactic-co-glycolic acid), ETH Zürich, Zürich, Switzerland (7/07).

47. New developments in poly(lactic-co-glycolic acid) delivery systems for peptides and proteins, University of Utrecht, Utrecht, Netherlands (4/08).

48. Overcoming barriers to development of injectable peptide and protein delivery depots, 2nd LTS Academy Meeting, West Caldwell, NJ (5/08).

49. Beyond peptide delivery: improving the controlled release of proteins, KIST and Korea University, Seoul, Korea (9/08).

50. Beyond peptide delivery: improving the controlled release of proteins, 2008 Korean Controlled Release Society Meeting, Jeju Island, Korea (9/08).

51. Rescue of murine ischemic hindlimbs with bFGF/VEGF delivery from pH-modified PLGA implants, 3rd International Conference on Tissue Engineering (Aegean Conferences), Rhodes, Greece (9/08).

52. Beyond peptide delivery: improving the controlled release of proteins, Wayne State University, Detroit, MI (3/09).

53. Poly(lactic-co-glycolic acid) delivery systems for peptides and proteins, Univ. of Colorado Health Sciences Center, Denver, CO (4/09).

54. Self-microencapsulation of large molecules without organic solvents, Purdue University, West Lafayette, IN (10/09).

55. Self-microencapsulation of large molecules without organic solvents, University of Nebraska Health Sciences Center, Omaha, NE (10/09).

56. Self-microencapsulation of large molecules without organic solvents, Wayne State University, Detroit, MI (12/09).

57. Shifting paradigms of controlled peptide and protein delivery, University of Pennsylvania, Philadelphia, PA (3/10).

58. Shifting paradigms of controlled peptide and protein delivery, Purdue University, West Lafayette, IN (4/10).

59. Advances in PLGA microsphere antigen delivery, Adjuvant 2010, Trinidad, Cuba (5/10).

60. Self-healing microencapsulation of large molecules without organic solvents, Genentech, South San Francisco, CA (7/10).

61. Injectable biodegradable polymer depots for minimally invasive delivery of peptides and proteins, Novo Nordisk, Copenhagen, Denmark (3/11).

62. Microsphere drug delivery systems for biologics—key challenges in drug loading and sustained release, AAPS Workshop - 46th Annual Arden Conference: Pharmaceutical Development of Biologics: Fundamentals, Challenges, and Recent Advances, West Point, NY (3/11)

63. New injectable depots for controlled release of peptides and proteins, School of Pharmacy and Pharmaceutical Sciences, University of California at San Diego, San Diego, CA (4/11).

64. Self-microencapsulation of large molecules without organic solvents, 38th Annual Meeting and Exposition of the Controlled Release Society, National Harbor, MD (8/11).

65. New approaches for polymer delivery of vaccine antigens and therapeutic large molecules, Takeda, Deerfield, IL (8/11).

66. Microencapsulation of biomacromolecules in PLGA without organic solvents, Department of Pharmaceutical Chemistry, University of Kansas, Lawrence, KS (9/11).

67. Microencapsulation of biomacromolecules in PLGA without organic solvents, Department of Pharmaceutics and Pharmaceutical Chemistry, University of Utah, Salt Lake City, UT (1/12).

68. Development of design criteria for mucoadhesive polymer excipients for use in nasal drug formulations, Dow Chemical Co., Midland, MI (2/12).

69. Microencapsulation of biomacromolecules in PLGA without organic solvents, The 6th International Symposium on Intelligent Drug Delivery System, Seoul, South Korea (3/12).

69. Controlled release from PLGA: 1.5 day Short Course (6 lectures), Allergan, Irvine, CA (4/12).

70. Microencapsulation of biomacromolecules in PLGA without organic solvents, Dept. of Chemical Engineering, Northwestern University, Evanston, IL (5/12).

71. Microencapsulation of biomacromolecules in PLGA without organic solvents, Dept. of Pharmacy, University of Copenhagen, Copenhagen, Denmark (5/12).

72. Aqueous-based microencapsulation of biomacromolelcules in PLGA, School of Pharmacy, Shanghai Jiao Tong University, Shanghai, China (10/12).

73. Aqueous-based microencapsulation of biomacromolelcules in PLGA, School of Pharmacy, East China University Science and Technology, Shanghai, China (10/12).

74. Aqueous-based microencapsulation of biomacromolelcules in PLGA, School of Pharmacy, Shanghai Second Medical University, Shanghai, China (10/12).

75. Aqueous-based microencapsulation of large molecules in PLGA, School of Pharmacy, Texas Tech University, Amarillo, TX (10/12).

76. Novel approaches to extend the duration of action of peptides and proteins, Endocrine Division, University of Michigan Medical School, Ann Arbor, MI (3/13).

77. Microencapsulation of biomacromolecules in PLGA without organic solvents, WE-Heraeus Seminar Series, Advanced Functional Polymers, Bad-Honnef, Germany (5/13).

78. Microencapsulation of biomacromolecules in PLGA without organic solvents, Dept. of Bioeng., Imperial College of London, London, UK (5/13).

79. Long-term controlled drug delivery: past and future perspectives, Keynote Lecture/39th International Aldosterone Congress, San Francisco, CA (6/13).

80. Aqueous microencapsulation of large molecules in PLGAs, 40th Annual Meeting and Exposition of the Controlled Release Society, Honolulu, HI (7/13).

81. Porous Healing PLGA Particles for Large Molecule Delivery, 10th International Conference and Workshop on Biological Barriers, Swaarbruecken, Germany (2/14).

82. Basic concepts in development of PLGA dosage forms, Modified Release Symposium, Amgen, Thousand Oaks, CA (3/14).

83. Microencapsulation of large molecules in PLGA without organic solvents, Modified Release Symposium, Amgen, Thousand Oaks, CA (3/14).

84. Microencapsulation of large molecules in PLGA without organic solvents, University of Wisconsin School of Pharmacy, Madison, WI (4/14).

85. Physical-chemical factors relevant for PLGA delivery of large molecules, Monash School of Pharmacy, Melbourne, Australia (4/14).

86. Microencapsulation of large molecules in PLGA without organic solvents, University of Queensland Dept of Chemistry, Brisbane, Australia (4/14).

87. Advanced controlled release platforms and their application to deliver anticancer drugs, Translational Oncology Program Seminar Series, University of Michigan, Ann Arbor, MI (8/14).

88. Aqueous microencapsulation of peptides and proteins in PLGA, CRS Nordic Chapter, Helsinki, Finland (8/14).

89. Microencapsulation of large molecules in PLGA without organic solvents, University of Tennessee at Memphis Department of Pharmaceutical Sciences, Memphis, TN (3/15).

90. Controlled release of large molecules from PLGA. University of Michigan School of Dentistry, Ann Arbor, MI (3/15).

91. Drug delivery to the eye, B-EYE Biointerfaces Institute/Ophthalmology Challenge, University of Michigan, Ann Arbor, MI (3/15).

92. A cage implant system for assessing in vivo performance of long-acting release PLGA depots, The 9th International Symposium on Intelligent DDS at KIST, Seoul, Korea (4/15).

93. Long-term controlled drug delivery: past and future perspectives, Distinguished Lecture Series, College of Dentistry, The Ohio State University, Columbus, OH (10/15).

94. Case study on development of PLGA microsphere-based leuprolide depot and current research, Dr. Reddy's, Hyderabad, India (2/16).

95. Basic concepts of PLGA dosage forms; Long-acting injectables; Leuprolide case study; Long-acting release depots – current research, Biological E Limited, Hyderabad, India (2/16).

96. Mechanistic evaluation of in vitro and in vivo release from PLGA microspheres

employing a cage model, 14th European Symposium on Controlled Drug Delivery, Egmund Aan Zee, Netherlands (4/16).

97. Current progress in PLGA systems, International Summer School on Regenerative Medicine, Tel Aviv, Israel (6/16).

98. Structural comparison of Remicade® and its biosimilar Remsima™ under stressed and unstressed conditions, CPPR Freeze Drying of Pharmaceuticals & Biologicals Conference, Breckinridge, Colorado (7/16).

99. New trends in PLGA controlled drug delivery, 4th Congress on Innovation in Drug Delivery Site-Specific Drug Delivery, Antibes, France (9/16).

100. Mechanistic evaluation of *in vitro* and *in vivo* release from PLGA microspheres employing a cage model, Plenary Speaker, China Pharmaceutical Conference, Nanjing, China (11/16).

101. PLGA controlled release of peptides and proteins, Fudan University College of Pharmacy, Shanghai, China (11/16).

102. Poly(lactic-co-glycolic acid) in injectable long-acting release depots, USP FDA Workshop on Standards for Pharmaceutical Products, United States Pharmacopeia, Rockville, MD (2/17).

103. GSK-CRS Long-Acting Injectables and Implantables Conference, Philadelphia, PA (4/17).

104. Controlled release of large molecules from PLGA depots, University of Uppsala, Uppsala, Sweden (5/17).

105. Controlled release of large molecules from PLGA depots, Plenary Speaker, 2017 UKICRS Workshop & Symposium, University of Strathclyde, Glasgow, Scotland (5/17).

106. 2-day training workshop on PLGA controlled drug delivery (8 lectures), Merck kGAa/Millipore-Sigma, Bedford, MA (6/17).

107. Mechanisms of release from PLGA microspheres, FDA: Demonstrating Equivalence of Generic Complex Drug Substances and Formulations, Silver Spring, MD (10/17).

108. PLGA-bevacizumab implants for long-acting anti-VEGF efficacy in rabbit retinal vascular leakage model, CRS Asia (9/18).

109. Overcoming top drug delivery challenges with poly(lactic-co-glycolic acid) long-acting release depots, Merck, Darmstadt, Germany (11/18).

110. New paradigms for PLGA drug delivery, China Pharmaceutical University School of Pharmacy, Nanjing, China (11/18).

111. New paradigms for PLGA drug delivery, Shanghai Institute of Planned Parenthood Research, Shanghai, China (11/18).

112. New paradigms for PLGA drug delivery, Chinese Pharmaceutical Conference,

Guangzhou, China (11/18).

113. New paradigms for PLGA drug delivery, Fudan University College of Pharmacy, Shanghai, China (12/18).

114. New paradigms for PLGA drug delivery, West China School of Pharmacy, Sichuan University, Chengdu, China (12/18).

115. Stability of peptides and proteins in PLGA depots, Long-acting injectables and implantables conference 2019, Leuven/Beerse, Belgium (2/19).

116. Development of novel PLGA controlled release depots, University of Kentucky Department of Pharmaceutical sciences, Lexington, KY (9/19).

117. A cage Implant to study drug release from microspheres in vivo, Long-acting injectables and implantables conference 2020, La Jolla, CA (2/20).

Conference Presentations

1. Schwendeman, S. P., Amidon, G. L., Meyerhoff, M. E. and Levy, R. J., Characterization of the iontophoretic transport through heterogeneous cation-exchange membranes, AAPS Fifth Annual Meeting and Exposition, Las Vegas, NV (11/90).

2. Schwendeman, S. P., Levy, R. J., Murphy. H. A. and Amidon, G.L., Influence of the silicone rubber matrix on the iontophoretic transport through heterogeneous cation-exchange membranes, AAPS Sixth Annual Meeting and Exposition, Washington, DC (11/91).

3. Schwendeman, S. P., Amidon, G. L. and Levy, R. J., Modulatable drug release using iontophoresis through heterogeneous cation-exchange membranes, AAPS Sixth Annual Meeting and Exposition, Washington, DC (11/91).

4. Schwendeman, S. P., Amidon, G. L., Labhasetwar, V. and Levy, R. J., Modulated release of d-sotalol using iontophoresis through heterogeneous cation-exchange membranes, 19th International Symposium on Controlled Release of Bioactive Materials, Orlando, FL (6/92).

5. Schwendeman, S. P., Amidon, G. L. and Levy, Modulated release of antiarrhythmics by iontophoresis through polymer membranes, AAPS Seventh Annual Meeting and Exposition, San Antonio, TX (11/92).

6. Schwendeman, S. P., Gupta, R. K., Costantino, H. R., Siber, G. R. and Langer, R., Stability of tetanus vaccine for encapsulation in bioerodible polymer microspheres, AAPS Eighth Annual Meeting and Exposition, Orlando, FL (11/93).

7. Schwendeman, S. P., Lee, J. H., Gupta, R. K., Costantino, H. R., Siber, G. R., and Langer, R., Inhibition of moisture-induced aggregation of tetanus toxoid by protecting thiol groups, 21st International Symposium on Controlled Release of Bioactive Materials, Nice, France (7/94).

8. Schwendeman, S. P., Costantino, H. R., Gupta, R. K., Tobio, M., Chang, A., Alonso, M. J., Siber, G. R. and Langer, R., Strategies for stabilizing tetanus toxoid for the development of a single-dose tetanus vaccine, Progress on the Stability of Vaccines, WHO Headquarters, Geneva, Switzerland (5/95).

9. Schwendeman, S. P., Costantino, H. R., Gupta, R. K., Siber, G. R. and Langer, R., Mechanisms of moisture-induced aggregation of tetanus toxoid, 22nd International Symposium on Controlled Release of Bioactive Materials, Seattle, WA (7/95).

10. Schwendeman, S. P., Gupta, R. K., Siber, G. R. and Langer, R., Pathways of inactivation of tetanus toxoid in the presence of polylactide 2000, AAPS Tenth Annual Meeting and Exposition, Miami, FL (11/95).

11. Schwendeman, S. P. and Schwendeman, D. W., Integrated nonsteady-state Nernst-Planck equations describe iontophoretic drug transport through ion-exchange membranes, 23rd International Symposium on Controlled Release of Bioactive Materials, Kyoto, Japan (7/96).

12. Shenderova, A., Burke, T. G. and Schwendeman, S. P., Characterization of the microclimate in PLGA microspheres with a camptothecin probe, AAPS Eleventh Meeting and Exposition, Seattle, WA (10/96).

13. Zhu, G., Mallery, S. R., Clark, Y. M., Shenderova, A. and Schwendeman, S. P., Stabilization of proteins encapsulated in injectable poly(lactide-co-glycolide) delivery vehicles, 27th Annual Meeting of the AADR, Minneapolis, MN (3/98).

14. Wang, J. and Schwendeman, S. P., Mechanisms of solvent evaporation encapsulating processess: predicting solvent evaporation rate, 25th International Symposium on Controlled Release of Bioactive Materials, Las Vegas, NV (6/98).

15. Zhu, G., Mallery, S. R., Clark, Y. M., Shenderova, A. and Schwendeman, S. P., Stabilization of proteins encapsulated in injectable poly(lactide-co-glycolide) delivery vehicles, Gordon Research Conference on Orthopedics and Bioengineering, Proctor Academy, NH (7/98).

16. Zhu, G. and Schwendeman, S. P., Stabilization of proteins encapsulated in PLGA microspheres by adjusting polymer microclimate pH, 27th International Symposium on Controlled Release of Bioactive Materials, Paris, France (7/00).

17. Jiang, W. and Schwendeman, S. P., Effect of excipients on the structure, antigenicity and aggregation of tetanus toxoid, 28th International Symposium on Controlled Release of Bioactive Materials, San Diego, CA (6/01).

18. Jiang, W. and Schwendeman, S. P., Mechanisms of histidine inhibition of tetanus toxoid aggregation, 28th International Symposium on Controlled Release of Bioactive Materials, San Diego, CA (6/01).

19. Cui, C., Stevens, V. S. and Schwendeman, S. P., Enhanced immunogenicity of a synthetic human chorionic gonadotropin peptide antigen from encapsulated & surface-conjugated PLGA microspheres, 29th International Symposium on Controlled Release of Bioactive Materials, Seoul, Korea (7/02).

20. Kang, J. and Schwendeman, S. P., Determination of diffusion coefficient in PLGA microspheres by laser scanning confocal microscopy, 29th International Symposium on Controlled Release of Bioactive Materials, Seoul, Korea (7/02).

21. Jiang, W. and Schwendeman, S. P., Stabilization of tetanus toxoid encapsulated in PLGA microspheres, 29th International Symposium on Controlled Release of Bioactive Materials, Seoul, Korea (7/02).

22. Cui, C. and Schwendeman, S. P., Stability of a synthetic human chorionic gonadotropin (hCG) antigen in PLGA microspheres, AAPS Annual Meeting and Exposition, Toronto, Canada (11/02).

23. Cui, C., Kershaw, K. and Schwendeman, S. P., Surface-entrapment of heparin in PLGA, 30th International Symposium on Controlled Release of Bioactive Materials, Glasgow, Scotland (7/03).

24. Ding, A. G. and Schwendeman, S. P., Predicting acidic microclimate pH in thin poly(lactide-co-glycolide) 50/50 films., 30th International Symposium on Controlled Release of Bioactive Materials, Glasgow, Scotland (7/03).

25. Lai, L. and Schwendeman, S. P., Optimization of stability and release of bovine serum albumin encapsulated in base-neutralized PLGA millicylinders, AAPS Annual Meeting and Exposition, Salt Lake City, UT (11/03).

26. Kang, J. and Schwendeman, S. P., Dynamics of the transition between open and isolated pores in PLGA and its effect on the controlled release of Proteins, 31st International Symposium on Controlled Release of Bioactive Materials, Honolulu, HI (6/04).

27. Zhong, Y., Ding, A. G., Zhu, G., Pei, P., Chen, R., Mallery, S. R., Mooney, D. J. and Schwendeman, S. P., Stabilization of basic fibroblast growth factor encapsulated in injectable PLGA implants enhances angiogenesis in vivo, 32nd International Symposium on Controlled Release of Bioactive Materials, Miami, FL (6/05).

28. Zhang, L. and Schwendeman, S. P., Controlled release of angiogenic growth factors from poly(lactide-co-glycolide) implants for therapeutic angiogenesis AAPS Annual Meeting and Exposition, Atlanta, GA (11/08).

29. Aqueous remote loading of protein therapeutics in PLGA microspheres, 5th FIP Pharmaceutical Sciences World Congress, Melbourne, Australia (4/14).

30. Importance of Regulatory Research Funding for Long Acting Release (LAR) Drug Products, FDA Public Forum, FDA, Silver Spring, MD (5/14).

31. Importance of Mechanistic Research Funding for Long Acting Release (LAR) Drug Products, FDA Public Forum, FDA, Silver Spring, MD (6/15).

32. PLGA-bevacizumab implants for long-acting anti-VEGF efficacy in a rabbit retinal vascular leakage model, ACS Conference, New Orleans (3/18).