

## Cory J Berkland

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Department of Chemical and Petroleum Engineering

Department of Pharmaceutical Chemistry

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### Education

- PhD. Chemical and Biomolecular Engineering, University of Illinois, Urbana, IL May 2003
- **Research:** Fabrication of micro/nanostructures from biodegradable polymers; advanced fabrication techniques, thermodynamics of polymer/drug phase behavior and drug partitioning.
- M.S. Chemical Engineering, University of Illinois, Urbana, IL May 2001
- **Research:** Drug encapsulation/enhanced delivery via precision polymer particle fabrication techniques.
- B.S. Chemical Engineering, Iowa State University, Ames, IA December 1998
- **Research:** Protein crystallization.

### Awards

- Genencor Outstanding Consumer & Diversified Products Paper Award, Controlled Release Society, Honolulu, HI 2004
- Best Presentation, Chemical and Biomolecular Engineering Symposium, Urbana, IL 2003
- Graduate College Travel Award, Urbana, IL 2003
- Highlights of Student Posters Award, Controlled Release Society, Seoul, Korea 2002
- Whitaker Award, American Chemical Society, Particles annual meeting, Orlando, FL 2002
- Featured Technology, University of Illinois Technology Showcase, Urbana, IL 2001
- Best Poster, Cell and Molecular Biology Training Grant Symposium, Urbana, IL 2001
- Graduate College Travel Award, Urbana, IL 2000
- Cell and Molecular Biology Training Grant, National Institute of Health, Urbana, IL 1999-2000
- Dorothy and Maurice Clark Scholarship, Ames, IA 1997-1998
- Transfer Student Scholarship, Ames, IA 1996-1997

### Research Experience

- Director of Research and Development**, AriSphere, Inc, Champaign, IL 2002-2004
- Director and head researcher for improved precision particle fabrication (PPF) technology. Related projects include; a new formulation for >50-day non-steroidal anti-inflammatory drug release *in vivo*, scaled-up production of low temperature casting of microspheres, and development of improved peptide delivery system.
- Postdoctoral Research Associate**, University of Illinois, Urbana, IL 2003-2004
- Advisor: Daniel W. Pack and Kevin (Kyekyoon) Kim
- Studied phenomena of phase separation in ternary (polymer I, polymer II, solvent) systems. Tested the effect of various fabrication schemes on the partitioning of drug in a polymer system. Worked toward producing one-shot vaccinations. Development of projects and advising of several graduate students. Techniques include; GPC, XPS, FTIR.

**Graduate Research Assistant**, University of Illinois, Urbana, IL 1999-2003  
 Advisor: Daniel W. Pack and Kevin (Kyekyoon) Kim

- Developed precision particle fabrication technology (patented) for enhanced performance of microsphere-based drug delivery. The invention produces uniform (monodisperse) microspheres and microcapsules comprising biodegradable polymers encapsulating small molecule therapeutics, proteins, or DNA either distributed throughout the polymer matrix or localized to a polymer, oil, or aqueous core. Organized and advised projects of six undergraduate researchers. Techniques include; UV/VIS, HPLC, SEM, Confocal microscopy, fluorescent labeling of polymers/proteins, gel electrophoresis, column chromatography, protein purification.

**Undergraduate Research Assistant**, Iowa State University, Ames 1996-1998  
 Advisor: Charles Glatz

- Studied the crystallization of lysozyme using pressure as a probe to determine structural factors that promote or hinder crystallization. Techniques include; cell culture, dialysis of cellular products, centrifugation, ultrafiltration, HPLC.

### **Teaching Experience**

Chemical Engineering/Pharmaceutical Chemistry Fall 2005  
 CPE/PHCH 715 Drug Delivery  
 Coordinated and taught a new graduate-level course in drug delivery principles.

Chemical Engineering Spring 2004  
 CPE 732 Advanced Transport Phenomena II  
 Coordinated and taught the mass transport course to graduate students.

Biochemical Engineering: Teaching Assistant. Spring 2001  
 Lead discussion section for the course. Lectured occasionally during semester. Assisted students with homework assignments and explained material during office hours. Helped maintain web interface for class.

Transport Phenomena: Teaching Assistant. Fall 2000  
 Regular office hours for helping students with homework and questions. Helped design semester project.

### **Publications**

EJ. Pollauf, C. Berkland, K. Kim, and D.W. Pack (2005) "In vitro degradation of polyanhydride/polyester core-shell double-wall microspheres" *International Journal of Pharmaceutics*, 301(1-2):294-303

C. Raman, C. Berkland, K. Kim, and D.W. Pack (2005) "Modeling small-molecule release from PLG microspheres: effects of polymer degradation and nonuniform drug distribution" *Journal of Controlled Release*, 103(1):149-158

C. Berkland, K. Kim, and D.W. Pack (2004) "Controlling double-walled microcapsule shell thickness offers modulated piroxicam release" *Journal of Biomedical Materials Research 70A(4)*:576-584

C. Berkland, K. Kim, and D.W. Pack (2004) "Uniform double-walled polymer microspheres of controllable shell thickness" *Journal of Controlled Release*, 96(1):101-111

C. Berkland, K. Kim, and D.W. Pack (2004) "Controlling Surface Nano-Structure using Flow-Limited Field-Injection Electrostatic Spraying (FFESS) of Poly-(D,L-lactide-co-glycolide)." *Biomaterials*, 25(25):5649-58

C. Berkland, M.J. Kipper, B. Narasimhan, K. Kim, and D.W. Pack (2004) "Microsphere Size, Precipitation Kinetics, and Drug Distribution Control Drug Release from Biodegradable Polyanhydride Microspheres." *Journal of Controlled Release*, 94(1):129-141

C. Berkland, K. Kim, and D.W. Pack (2004) "Precision polymer microparticles for controlled-release drug delivery." *ACS Symposium Series*, 879:197-213

C. Berkland, K. Kim, and D.W. Pack (2003) "PLG microsphere size controls drug release rate through several competing factors." *Pharmaceutical Research*, 20(7):1055-1062

C. Berkland, M. King, A. Cox, K. Kim, and D.W. Pack (2002) "Precise control of PLG microsphere size provides enhanced control of drug release rate." *Journal of Controlled Release*, 82(1):137-147

C. Berkland, K. Kim, and D.W. Pack (2001) "Fabrication of PLG microspheres with precisely controlled and monodisperse size distributions." *Journal of Controlled Release*, 73(1):59-74

### **Patents**

K. Kim, D.W. Pack, C. Berkland, "Microparticles." filed August 15, 2001, U.S. Patent #6,669,961

### **Presentations**

C. Berkland "What do Chemical Engineers do?" Presented to high school girls visiting the School of Engineering, February 4, 2006

C. Berkland "Precision Particle Fabrication Technology" Southwest Research Institute, San Antonio, Texas, January 11, 2006

C. Berkland "Designing Particulate Vaccine Delivery Systems" Mannkind Corporation, Valencia, California, January 24, 2006

C. Berkland "Engineering Therapeutic Particles" guest lecturer in senior Biochemical Engineering course at Vanderbilt University, Nashville, Tennessee, November 7, 2005 (invited)

M. Arnold and C. Berkland "Monodisperse Powders for Controlled Release Inhalation Therapy" Presented at American Institute of Chemical Engineers annual meeting, Cincinnati, OH, November 2, 2005

C. Berkland "API Particle Engineering" 47th Annual International Industrial Pharmaceutical Research & Development Conference: Emerging Practices for Advancing Drug Development, Merrimac, Wisconsin, June 7, 2005 (invited)

C. Berkland "Engineering micro- and nanoparticles for enhanced drug delivery performance" University of Kansas, Department of Chemistry, Lawrence, Kansas, March 7, 2005 (invited)

C. Berkland, K. Kim, and D.W. Pack "Pulsatile release of macromolecules from aqueous core PLG microcapsules" American Institute of Chemical Engineers annual meeting, San Francisco, California, November 9, 2004

C. Berkland, E. Pollauf, N. Varde, K. Kim, and D.W. Pack "Monodisperse microcapsules of controlled shell thickness and composition" American Institute of Chemical Engineers annual meeting, San Francisco, California, November 9, 2004

C. Berkland "Improvements in Delivery Strategies Using Particulate Technologies to Treat Infectious Diseases" 3<sup>rd</sup> Annual Great Plains Infectious Disease Meeting, Lawrence, Kansas, September 18, 2004 (Invited)

C. Berkland "Designing materials to enhance drug delivery performance" University of Kansas, Department of Pharmaceutical Chemistry, Lawrence, Kansas, September 7, 2004

C. Berkland, E. Pollauf, K. Kim, and D.W. Pack "Control of Drug Delivery from Core-Shell Microparticles" American Institute of Chemical Engineers annual meeting, San Francisco, California, November 19, 2003

C. Berkland, E. Pollauf, K. Kim, and D.W. Pack "Visual Tracking of Protein Release from Uniform PLG Microspheres" American Institute of Chemical Engineers annual meeting, San Francisco, California, November 19, 2003

C. Berkland, K. Kim, and D.W. Pack "Uniform biodegradable polymer microparticles for improved drug delivery" Chemical and Biomolecular Engineering Biannual Symposium, Urbana-Champaign, Illinois, April 1, 2003

C. Berkland, K. Kim, and D.W. Pack "Precision fabrication of polymer-based drug delivery devices for enhanced control of drug release kinetics" Cell and Molecular Biology Training Grant Symposium, Urbana-Champaign, Illinois, October, 25, 2002 (selected)

C. Berkland, K. Kim, and D.W. Pack "Modeling drug release from uniform PLG microspheres" American Institute of Chemical Engineers annual meeting, Indianapolis, Indiana, November 8, 2002

C. Berkland, M. King, A. Cox, K. Kim, and D.W. Pack "Modulation of release profiles through microsphere size control" Controlled Release Society annual meeting Highlights of Student Posters Session, Seoul, Korea, July 20, 2002 (selected)

C. Berkland, K. Kim, and D.W. Pack "Controlled electrohydrodynamic spraying to produce precision micro- and nanostructures" Particles 2002, Orlando, Florida, April 22, 2002

C. Berkland, K. Kim, and D.W. Pack "Fabrication of Polymer Microshells with Controlled Core Diameter and Shell Thickness" American Institute of Chemical Engineers annual meeting, Reno, Nevada, November 7, 2001

C. Berkland, K. Kim, and D.W. Pack "Novel Techniques for Controlling Size of Micro- and Nano-Particles Used in Drug Delivery" Cell and Molecular Biology Training Grant meeting, Urbana-Champaign, Illinois, March 15, 2000 (invited)

## **Posters**

C. Berkland, E. J. Pollauf, K. Kim, and D.W. Pack "Modulating protein release from monodisperse aqueous-core microcapsules with a defined PLG shell" Presented at the Controlled Release Society annual meeting, Honolulu, HI, June 13, 2004

C. Berkland, E. J. Pollauf, N.K. Varde, K. Kim, and D.W. Pack "Uniform polymer, oil, or aqueous core microcapsules of controlled biodegradable shell thickness" Presented at the American Association of Pharmaceutical Scientists: Drug Delivery meeting, Philadelphia, PA, June 7, 2004

C. Berkland, K. Kim, and D.W. Pack "Controlled release from uniform two polymer microcapsules" Presented at the Controlled Release Society annual meeting, Glasgow, United Kingdom, July 21, 2003

C. Berkland, M. King, A. Cox, K. Kim, and D.W. Pack "Modulation of release profiles through microsphere size control" Presented at the Controlled Release Society annual meeting, Seoul, Korea, July 20, 2002

C. Berkland, K. Kim, and D.W. Pack "Improved techniques for the production of precision micro and nanoparticles" Presented at Particles 2002, Orlando, Florida, April 22, 2002

C. Berkland, K. Kim, and D.W. Pack "Fabrication of Polymer Microshells with Controlled Core Diameter and Shell Thickness" Presented at Cell and Molecular Biology Training Grant meeting, Urbana-Champaign, Illinois, November 17, 2001

C. Berkland, K. Kim, and D.W. Pack "Novel Techniques for Controlling Size of Micro- and Nano-Particles Used in Drug Delivery" Presented at Cell and Molecular Biology Training Grant meeting, Urbana-Champaign, Illinois, November 4, 2000

C. Berkland, K. Kim, and D.W. Pack "Biodegradable Polymer Nanoshells for Drug Delivery: The pursuit of an artificial virus" Presented at Cell and Molecular Biology Training Grant meeting, Urbana-Champaign, Illinois, October 30, 1999

### **Professional Activities**

Member: AICHE, AAPS, ACS, Controlled Release Society, Omega Chi Epsilon, Tau Beta Pi

Lawrence High School Pre-Engineering Curriculum Advisory Committee

Ad hoc reviewer for: Biomaterials, Journal of Controlled Release, Expert Opinion in Drug Delivery, Journal of Pharmaceutical Science, Chemical Engineering Communications

Session Chair/co-Chair: AICHE annual meeting 2005

Abstract reviewer: CRS annual meeting 2005

### **Current Funding**

FND39400	Berkland (PI)	01/01/05– 12/31/06
PhRMA Foundation		\$60,000

Particle Design for Improved Delivery and Controlled Release of Inhalable Pharmaceuticals. Biodegradable polymer microspheres may be useful to control the release of drugs in the lung. Solid and porous biodegradable polymer microspheres are investigated for their properties as dry powders for inhalation therapy.

5-2005-1286	Berkland (PI)	01/01/06 – 12/31/06
Juvenile Diabetes Research Foundation		\$110,000

ICAM-1 Targeted Nanoparticles for In Vivo, VEGF-Induced Angiogenesis  
Nanoparticles targeting ICAM-1 are investigated in an in vivo diabetic rat model to deliver VEGF to sites of injury. MRI studies are used to determine formation of new blood vessels at various sites over time.

0630269N	Berkland (PI)	01/01/06 – 12/31/09
American Heart Association-National		\$260,000

Self Assembled Molecular Complexes for the Stabilization and Controlled Release of Angiogenic Growth Factors

Nanoparticles formed by electrostatically driven self-assembly are investigated for their ability to bind, stabilize, encapsulate and controllably release angiogenic growth factors, VEGF and FGF-2.

5-2006-280                                      Berkland (PI)                                      03/01/06 – 02/28/06  
Juvenile Diabetes Research Foundation                                      \$105,000  
Templated Islets for Enhancing Insulin Production  
Poly(DL-lactide-co-glycolide) microspheres of a defined diameter are tested for the ability to bind insulin-producing beta-cells. Binding these cells to the surface of microspheres may improve the insulin production/cell and facilitate local delivery of drugs to the islet.

5 P20 RR015563                                      Georg (PI)                                      07/01/05 – 06/30/10  
NIH (COBRE) Sub Project – 2 years                                      \$125,000 (PI)  
Center for Cancer Experimental Therapeutics (Project Title- Cancer-Targeted Biodegradable Nanoparticles Encapsulating MRI Contrast-Enhancing Agents and Paclitaxel for Traceable, Localized Chemotherapy)  
Peptides derived from the binding domain of ICAM-1 and LFA-1 are attached to poly(DL-lactide-co-glycolide) nanoparticles to specifically target ICAM-1. The mechanism of nanoparticle adhesion and internalization by activated Caco2 cells as mediated by these peptides is studied.

NA    Lunte (PI)                                      07/01/05 to 06/30/07  
HBC, J.R. and Inez Jay Award                                      \$40,000  
Real world interfaces for microscale separation-based sensors  
A microfluidic platform for sensing biologicals is designed with a fast response valve for sampling biological fluids for on-chip electrophoresis separations.  
Role: Co-I – 5%  
Overlap: None