**Ángel E. Mercado-Pagán**
Department of Orthopedic Surgery
Stanford University School of Medicine
Edwards Research Center, Room 163
angelm1@stanford.edu
http://med.stanford.edu/profiles/Angel_Mercado-Pagan/

EDUCATION

2010 Ph.D. Chemical Engineering University of South Carolina, Columbia, SC
2006 B.S. Chemical Engineering University of Puerto Rico-Mayagüez Campus, Mayagüez, PR

HONORS

2010 Chemical Engineering Excellence in Research Award, USC
2007 Alfred P. Sloan Foundation Fellowship
2006 SEAGEP Scholarship
2006 Swearingen Fellow, USC
2005 NSF-Research Experience for Undergraduates, Osaka, Japan
2004-2005 Chemical Engineering Honors College Award

REFEREED PUBLICATIONS

Sungwoo Kim, Yunqing Kang, Ángel E. Mercado-Pagán, William J. Maloney, Yunzhi Peter Yang. Development and characterization of photo-cross-linkable chitosan-lactide hydrogels for growth factor delivery. *J. Biomed. Mater. Res. B Appl. Biomater.* **2014** (in press).

Angel E. Mercado, Xiaoming Yang, Xuezhong He, and Esmaiel Jabbari. Effect of Grafting BMP2 Derived Peptide to Nanoparticles on Osteogenic and Vasculogenic Expression of Stromal Cells. *J. Tissue Eng. Regen. Med.* **2014**; 8(1): 15-28.

Ángel E. Mercado-Pagán, Yunqing Kang, Dai Fei Elmer Ker, Sangwon Park, Jeffrey Yao, Julius Bishop, Yunzhi Yang. Synthesis and characterization of novel elastomeric poly(D,L-lactide urethane) maleate composites for bone tissue engineering. *Eur. Polym. J.* **2013**; 49(10): 3337-3349.

Hyun-Pil Lim; Ángel E. Mercado-Pagán; Kwi-Dug Yun; Seong-Soo Kang; Taek-Hue Choi; Julius Bishop; Jeong-Tae Koh; William Maloney; Kwang-Min Lee; Yunzhi Yang; Sang-Won Park. The effect of rhBMP-2 and PRP delivery by biodegradable β-tricalcium phosphate scaffolds on new bone formation in a non-through rabbit cranial defect model. *J. Mater. Sci. Mater. Med.* **2013**; 24(8): 1895-1903.

Angel E. Mercado; Esmaiel Jabbari. The Effect of Encapsulation or Grafting on Release Kinetics of Recombinant Human Bone Morphogenetic Protein-2 from Self-Assembled Poly(lactide-co-glycolide ethylene oxide fumarate) Nanoparticles*, Microsc. Res. Techniq*. **2010**; 73(9): 824-833.

Mercado A.E.; Ma J.; He X.; Jabbari E. Release characteristics and osteogenic activity of recombinant human bone morphogenetic protein-2 grafted to novel self-assembled poly(lactide-co-glycolide fumarate) nanoparticles, *J. Control. Release* **2009**; 140(2): 148-156.

Mercado A.E.; He X.; Xu W.; Jabbari E. The release characteristics of a model protein from self-assembled succinimide-terminated poly(lactide-co-glycolide ethylene oxide fumarate) nanoparticles. *Nanotechnology* **2008***;* 19(32): 325609 (12pp).

He X.; Ma J.; Mercado A. E.; Xu W.; Jabbari E. Cytotoxicity of Paclitaxel in Biodegradable Self-Assembled Core-Shell Poly(Lactide-Co-Glycolide Ethylene Oxide Fumarate) Nanoparticles. *Pharm. Res.* **2008**; 25(7):1552-1562.

REFEREED PROCEEDINGS PREPRINTS

Esmaiel Jabbari, Angel E. Mercado, Junyu Ma, and Xuezhong He. Effect of BMP-2 Derived Peptide Grafted to Nanoparticles on Differentiation of Stromal Cells. *Mater. Res. Symp. Proc.* 2012 1417: mrsf11-1417-kk06-34 (6 pages).

A.E. Mercado, J. Ma, E. Jabbari, Sustained Release of rhBMP-2 Grafted to Self-Assembled Nanoparticles Enhances the Expression of Osteogenic Markers of Mesenchymal Stem Cells. *Trans. Annu. Meet. Orthop. Res. Soc.* Abstract #1217 (2010).

A.E. Mercado; E. Jabbari. Synthesis and Release Characteristics of rhBMP-2 protein grafted to a novel self-assembled poly(lactide-co-glycolide fumarate) nanoparticles. *Polym. Prepr. (Am. Chem. Soc., Div. Polym. Chem.)*, #1299140 (2009).

Ángel E. Mercado-Pagán and Esmaiel Jabbari. Synthesis and Characterization of Peptidomimetic Self-Assembled Biodegradable Nanoparticles, in Molecular Biomimetics and Materials Design, edited by J. Harding, J. Evans, J. Elliott, R. Latour (*Mater. Res. Soc. Symp. Proc.* Volume 1238E, Warrendale, PA, 2009), paper# UU05-04.

A.E. Mercado and E. Jabbari, Peptide-induced self-assembly of synthetic poly(lactide fumarate) macromer*, Trans. Soc. Biomaterials*, p. 118 (2009).

J. Ma, A.E. Mercado, X. He, E. Jabbari, Release characteristics and osteogenic activity of rhBMP-2 conjugated to self-assembled nanoparticles, *Trans. Soc. Biomaterials*, p. 100 (2009).

A.E. Mercado, X. He, E. Jabbari, Sustained in situ delivery of rhBMP-2 by conjugation to novel biodegradable nanoparticles, *Trans. Soc. Biomaterials*, p. 276 (2008).

X. He, A.E. Mercado, J. Ma, W. Xu, E. Jabbari, Biodegradable self-assembled nanoparticles for targeted delivery of Paclitaxel to tumor cells, *Trans. Soc. Biomaterials*, p. 152 (2008).

X. He, J. Ma, A.E. Mercado, W. Xu, E. Jabbari, Cytotoxicity of Paclitaxel in biodegradable self-assembled core-shell PLGEOF nanoparticles, *CRS Transactions*, Abstract # 622 (2008).

A.E. Mercado, X. He, E. Jabbari, Release characteristics of rhBMP-2 from self-assembled biodegradable PLEOF nanoparticles, *CRS Transactions*, Abstract #324 (2008).

J. Ma, W. Xu, X. He, A. Mercado, E. Jabbari, Morphology of rat bone marrow stromal cells on aligned electrospun biodegradable fibers, *Trans. Soc. Biomaterials*, p. 2660 (2008).

A.S. Sarvestani, A. Mercado, E. Jabbari, Quantification of membrane adhesion on ligand gradient substrates, *Trans. Soc. Biomaterials*, p. 2661 (2008).

A. Mercado, X. He, J. Ma, W. Xu, E. Jabbari, Biodegradable self-assembled nanoparticles for targeted delivery of paclitaxel to tumor cells. *Trans. Soc. Biomaterials*, p. 2662 (2008).

PODIUM PRESENTATIONS

Uptake of Fluorescently-Labeled Peptidomimetic Nanoparticles by Tumor Cells. Angel Mercado and Esmaiel Jabbari. 2010 AIChE Annual Meeting, Salt Lake City, UT. November 2010.

Tumor Suppression Characteristics of Doxorubicin Encapsulated in Novel Peptidomimetic Nanoparticles. Angel Mercado and Esmaiel Jabbari. 2010 AIChE Annual Meeting, Salt Lake City, UT. November 2010.

Conjugation of rhBMP-2 Derived Peptide to Self-Assembled Nanoparticles Enhances Osteogenic Differentiation of Mesenchymal Stem Cells. Angel Mercado and Esmaiel Jabbari. 2010 AIChE Annual Meeting, Salt Lake City, UT. November 2010.

Sustained release of rhBMP-2 grafted to biodegradable nanoparticles enhances osteogenic expression of marrow stromal cells. A Mercado, J Ma, E Jabbari. 37th Controlled Release Society Annual Meeting and Exposition. Portland, OR. July 2010.

Sustained Release of Stromal Derived Factor-1 Enhances Migration of Marrow Stromal Cells. Junyu Ma, Xuezhong He, Angel Mercado, Esmaiel Jabbari. 37th Controlled Release Society Annual Meeting and Exposition. Portland, OR. July 2010.

Self-assembled peptide-conjugated polymer nanoparticles for tumor targeting. Angel Mercado and Esmaiel Jabbari. 2009 AIChE Annual Meeting, Nashville, TN. November 2009.

Release characteristics and osteogenic activity of rhBMP-2 grafted to resorbable nanoparticles. Angel Mercado, Junyu Ma, Esmaiel Jabbari. 2009 AIChE Annual Meeting, Nashville, TN. November 2009.

Synthesis and release characteristics of rhBMP-2 protein grafted to novel self-assembled poly(lactide-co-glycolide fumarate) nanoparticles. Angel E. Mercado and Esmaiel Jabbari. The 238th ACS National Meeting, Washington, DC. August 2009.

Biodegradable Scar-Inhibiting Implants for Guided Spinal Cord Regeneration. Angel E. Mercado. SCAS Annual Meeting. Columbia, SC. April 2009.

Release Characteristics of rhBMP-2 Conjugated to Self-Assembled Biodegradable Nanoparticles. Mercado A. E.; Ma J.; Jabbari E. 2008 AIChE Annual Meeting, Philadelphia, PA. November 2008.

Biodegradable Nanoparticles Conjugated with αvβ3 Integrin-Binding Ligand for Targeted Tumor Delivery. Mercado A. E.; He X.; Jabbari E. 2008 AIChE Annual Meeting, Philadelphia, PA. November 2008.

Biodegradable Self-Assembled Nanoparticles for Targeted Delivery of Paclitaxel to Tumor Cells. Mercado A. E.; Xu W.; He X.; Ma J.; Jabbari E. 8th World Biomaterials Congress, Amsterdam, the Netherlands. June 2008.

Release Behavior of Paclitaxel from Self-Assembled Degradable Nanoparticles. He X.; Mercado A. E.; Jabbari E. 2007 AIChE Annual Meeting, Salt Lake City, UT. November 2007.

Effect of an Unsaturated Amphiphilic Macromer on Electrospining of Random and Aligned PLGA Fibers. Xu W.; He X.; Sarvestani A. S.; Mercado A. E.; Jabbari E. 2007 AIChE Annual Meeting, Salt Lake City, UT. November 2007.

POSTER PRESENTATIONS

"Development and characterization of a novel weight-bearing biodegradable bone void filler" Angel Mercado-Pagan, Yunqing Kang, Elmer Ker, Sangwon Park, Yunzhi Yang. ORS 2013 Annual Meeting, San Antonio, TX. January 2013.

"HUVEC-derived Extracellular Matrix (ECM) enhances the osteogenic differentiation of Mesenchymal Stem Cells in β-TCP Scaffold" Yunqing Kang, Angel E. Mercado-Pagan, Sungwoo Kim, Yunzhi Yang. Bio-X Interdisciplinary Initiatives Symposium, Stanford. CA. February 2012.

"Uptake and Migration of Tumor Cells in Response to Hybrid Polymer-Peptide Self-Assembled Nanoparticles" H. Ardalani, A. E. Mercado, J. Ma, X. He, E. Jabbari. Society For Biomaterials Annual Meeting and Exposition, Orlando, FL. April 2011.

"rhBMP-2 Protein Grafted to Resorbable Nanoparticles Enhances Osteogenic Expression of Stromal Cells" Ángel E. Mercado-Pagán, Junyu Ma, Esmaiel Jabbari. TERMIS North America 2010 Annual Conference, Orlando, FL. December 2010.

"Effect of Osteopontin-Derived Pepide on Vasculogenic Differentiation of Bone Marrow Stromal Cells" Junyu Ma, Angel Mercado, Esmaiel Jabbari. 2010 Society For Biomaterials Annual Meeting and Exposition, Seattle, WA. April 2010.

"Migration of Marrow Stromal Cells in Response to Sustained Release of Stromal-Derived Factor-1α from Poly(lactide ethylene oxide fumarate) Hydrogels" Xuezhong He, Angel Mercado, Esmaiel Jabbari. 2010 Society For Biomaterials Annual Meeting and Exposition, Seattle, WA. April 2010.

"Sustained Release of rhBMP-2 Grafted to Self-Assembled Nanoparticles Enhances the Expression of Osteogenic Markers of Mesenchymal Stem Cells" Angel Mercado, Junyu Ma, Esmaiel Jabbari. 56th Annual Meeting of the Orthopaedic Research Society, New Orleans, LA. March 2010.

"Release Characteristics of rhBMP-2 from Self-Assembled Biodegradable PLEOF Nanoparticles" A Mercado, X He, E Jabbari. 35th Controlled Release Society Annual Meeting and Exposition. New York City, NY. July 2008.

"Cytotoxicity of Paclitaxel in Biodegradable Self- Assembled Core-Shell PLGEOF Nanoparticles" X He, J Ma, A Mercado, W Xu, E Jabbari. 35th Controlled Release Society Annual Meeting and Exposition. New York City, NY. July 2008.

"Quantification of Membrane Adhesion on Ligand Gradient Substrates" Sarvestani A. S.; Mercado A. E.; Jabbari E. 8th World Biomaterials Congress, Amsterdam, the Netherlands. May 2008.

"Morphology of Rat Bone Marrow Stromal Cells on Aligned Electrospun Biodegradable Fibers" Xu W.; He X.; Ma J.; Mercado A. E.; Jabbari E. 8th World Biomaterials Congress, Amsterdam, the Netherlands. May 2008.

"Release Behavior of Paclitaxel from Self-Assembled Degradable Nanoparticles" He X.; Mercado A. E.; Jabbari E. 3rd Annual SEAGEP Conference, Gainesville, FL. May 2008.

"Release Behavior of Paclitaxel from Self-Assembled Degradable Nanoparticles" He X.; Mercado A. E.; Jabbari E. 2007 INBRE Research Symposium, Charleston, SC. January 2008.

"Liposome Imprinting Gel for Observation of Heterogeneous Surface of Membrane" University of Osaka, Osaka, Japan (大阪大学) ○ (正)Hiroshi Umakoshi, Angel Mercado Pagan, (学)Bui Thi Huong, (学)Kien Xuan Ngo, (学)Le Quoc Tuan, (正)Toshinori Shimanouchi, (正)Ryoichi Kuboi. Technical Committee Meeting on Separations (分離技術会 年会), Japan. June 2006.

## RESEARCH EXPERIENCE

August 2011 – Present: Postdoctoral Research
"Development of Elastomeric Devices for Bone and Vascular Tissue Engineering"
PI: Yunzhi Peter Yang
Stanford University
School of Medicine, Department of Orthopedic Surgery

- Developed new elastomeric materials for load-bearing applications in bone-tissue engineering
- Fabricated new vascular grafts for improving vascularization, angiogenesis and anastomosis of bone tissue engineering scaffolds
- Characterized mechanical, chemical, *in vitro* and *in vivo* properties of new elastomeric devices
- Implemented novel methods for scaffold and graft fabrication and elastomer synthesis

August 2010 – August 2011: Postdoctoral Research
"Development and characterization of Peptidomimetic Nanoparticles for Tissue Engineering Applications"
PI: Esmaiel Jabbari, PhD
University of South Carolina
Department of Chemical Engineering

- Developed hybrid nanoparticles with self-assembly and grafting functionalities
- Studied the different uptake properties and agent delivery profiles of functionalized nanoparticles
- Synthesized and characterized peptide sequences with biological activity and self-assembly properties
- Developed and implemented methods for characterization of the nanoparticles *in vitro* and *in vivo*.

August 2006 – August 2010: Research Assistant, Graduate Research
"Functional Self-Assembled Poly(L-lactide) Nanoparticles for Targeted Delivery of Bioactive Materials"
Advisor: Esmaiel Jabbari, PhD
University of South Carolina
Department of Chemical Engineering

- Studied the properties of different amphiphilic polymers for the synthesis of nanoparticles
- Synthesized nanoparticles by different solvent techniques
- Characterized nanoparticles by release behavior and physical and chemical properties
- Implemented the particles in 3D scaffolds for the study of release behavior inside marrow stromal cells
- Implemented chemical variations to polymers to introduce functionality
- Devised simple encapsulation methods for model proteins in nanoparticles
- Studied techniques for culture, differentiation, and analysis of marrow stromal cells
- Developed self-assembled nanoparticles for the selective delivery of active antitumor agents
- Conjugated and encapsulated rhBMP-2 in NPs for differentiation of bone marrow stromal cells
- Studied methods for synthesis of complex organic molecules, such as macromers and peptides

January 2006 – May 2006: Undergraduate Research
"Characterization of Membrane Bilayer Fluidity in Liposome Cell Models by FRAP Analysis"
Advisor: Madeline Torres-Lugo, PhD
University of Puerto Rico
Department of Chemical Engineering

- Implemented knowledge of liposome synthesis to create liposomes with fluorescent markers
- Studied FRAP analysis for surface of liposomes

August 2005 – December 2005: Research Experience for Undergraduates
"Characterization of Liposome Structure and Domains by Surface Imprinting on Hydrogel-Based Polymeric Matrix"
Advisors: Ryoichi Kuboi, PhD; Hiroshi Umakoshi, PhD; Esmaiel Jabbari, PhD; Madeline Torres-Lugo, PhD
University of Osaka, University of South Carolina, University of Puerto Rico
Department of Chemical Science and Engineering (Osaka), Department of Chemical Engineering

- Studied techniques for the development and characterization of liposomes
- Applied hydrogel synthesis knowledge to create polymer matrices capable of imprinting the surface of the liposomes for recognition

- Applied SEM and AFM techniques to characterize the hydrogels
- Studied release behavior of entrapped species in the liposomes attached to the hydrogel
- Analyzed possible uses for the hydrogel-liposome systems

August 2004 – May 2005: Undergraduate Research
"Development of Hydrogels for the Creation of Biosensor Devices"
Advisor: Madeline Torres-Lugo, PhD
University of Puerto Rico
Department of Chemical Engineering

- Studied molecularly imprinted polymer (MIP) technology
- Synthesized MIP hydrogels by UV polymerization
- Studied the release behavior of fluorescent probes from MIPs in solution to characterize their behavior in models of biological systems

RESEARCH FUNDING

Type: External (PI: Yunzhi Peter Yang)
Agency: NIH Research Supplement to Promote Diversity in Health Related Research
Title: R01 project "Microengineered osteons for bone tissue engineering" 3R01AR057837 – 02W1
Date: 04/01/2012-06/30/2014

Type: External (PI: Esmaiel Jabbari)
Agency: National Science Foundation Graduate Supplement
Title: Engineering Bone Formation in Multi-Functional Nanocomposite Scaffolds
Date: August 5, 2009 Amount: $40,590 Duration: 1 year

TEACHING AND ADMINISTRATIVE EXPERIENCE

Aug 2011 – Present: Lab Inventory and Purchasing Coordinator, Undergraduate Mentor
PI: Yunzhi Peter Yang
Stanford University
School of Medicine, Department of Orthopedic Surgery
Stanford, CA

Aug 2006 – July 2011: Teaching Assistant
University of South Carolina
Department of Chemical Engineering
Columbia, SC

Aug 2008 – July 2011: Undergraduate Laboratory Coordinator
PI: Esmaiel Jabbari
University of South Carolina
Department of Chemical Engineering
Columbia, SC

- 4 students awarded Magellan Scholarship for Undergraduate Research, USC
- 2 presentation awards (1st place) in Discovery Day at USC
- 1 student selected for REU Experience in University of Florida
- 1 student selected for SURF grant for undergraduates, USC
- 1 undergraduate student admitted to graduate studies at Duke University