

Andrea J. Vernengo

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EDUCATION AND RESEARCH

2014 - Current Rowan University Glassboro, NJ
Associate Professor, Departments of Chemical Engineering and Biomedical Engineering (joint)

2013 – Current Cooper University Hospital Camden, NJ
Affiliated Faculty, Department of Orthopaedics

2009-2014 Rowan University Glassboro, NJ
Assistant Professor, Department of Chemical Engineering

2009 Drexel University College of Medicine Philadelphia, PA
Post-Doctoral Research Associate, Spinal Cord Research Center
Mentor: Dr. Itzhak Fischer

2007-2009 Synthes Biomaterials West Chester, PA
Scientist, Bone Substitutes R&D

2003-2007 Drexel University Philadelphia, PA
Ph.D., Department of Chemical and Biological Engineering
Mentor: Dr. Anthony Lowman

1998-2003 Drexel University Philadelphia, PA
B.S., Chemical Engineering, Cum Laude

EXTERNALLY SPONSORED FUNDING:

- NJ Health Foundation, Inc., *Injectable Scaffolds with Bioadhesive Properties for the Regeneration of the Annulus Fibrosus and Nucleus Pulposus of the Intervertebral Disc*, \$34,986, 06/01/16-05/31/17, **PI – awarded.**
- NIH R15 National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)/ National Institute of Biomedical Imaging and Bioengineering (NIBIB), *Development of Self-Assembling Biomimetic Hydrogels with Adhesive Properties for Intervertebral Disc Tissue Engineering*, \$315,933, 09/16/2013-09/16/2017, **PI – awarded.**
- NSF TUES, *Enhancing the STEM Curriculum Through a Multidisciplinary Approach that Integrates Biology and Engineering*, \$199,790, 10/01/2013-10/01/2017, **PI – awarded.**
- New Jersey Commission on Spinal Cord Research, *Using Bioengineered Scaffold Loaded with Neurotrophins to Enhance Functional Recovery after Locomotor Training in Spinal Cord Injury Animals*, \$198,437, 07/01/2014- 07/01/2016, **co-PI – awarded.**
- NIH R25, *Bioengineering Team-Based Projects and Summer Immersion to Improve Design Expertise*, \$200,000, 07/01/2013-07/01/2018, **senior personnel- awarded.**

- NSF TUES, *Organ-izing the Curriculum - Enhancing Student Understanding of Core Engineering Concepts through Biomedical Activities*, \$200,000, 07/01/2012-07-01/2015, **co-PI-awarded**.
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AWARDS AND HONORS

- *Outstanding Faculty of the Year Award*, American Institute of Chemical Engineers, Delaware Valley Chapter, 2014
 - NerdScholar's *Top 40 under 40: Professors Who Inspire*, 2015
 - Rowan University's *Collaborative Innovation in Tissue Engineering Award*, 2016
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PUBLICATIONS:

Cooper, T., Trafford, R., Vernengo, A.J. "Undergraduate Laboratory Experiment Teaching Fundamental Concepts of Magnetic Materials In the Context of Nanoparticle Hyperthermia for Cancer Treatment", submitted to *Chemical Engineering Education*.

Christiani, T., Toomer, K., Sheehan, J., Nitzl, A., Branda, A., England, E., Graney, P., Iftode, C., and Vernengo, A.J. "Synthesis of Thermogelling Poly(N-isopropylacrylamide)-Graft-Chondroitin Sulfate Composites with Alginate Microparticles for Tissue Engineering". *Journal of Visualized Experiments* 116 (2016): e53704.

Farrell, S., Vernengo, A. "A challenge-based laboratory to explore drug delivery from swellable matrices", *Education for Chemical Engineers*, 17 (2016): 21-30.

Dahm, K., and Vernengo, A.J. "Teaching Tips: Bridging the Gap Between a Classroom Innovation and an Educational Publication." *Chemical Engineering Education* 50 (2016): 113.

Sclarsky, E., Kadlowec, J. and Vernengo, A.J. "Modeling stress relaxation of crosslinked polymer networks for biomaterials applications: A distance learning module." *Education for Chemical Engineers* 17 (2016): 14-20.

Balkovec, C., Vernengo, A.J., and McGill, S. "Disc height loss and restoration via injectable hydrogel influences adjacent segment mechanics in-vitro." *Clinical Biomechanics* 36 (2016): 1-7.

Balkovec, C., Vernengo, A.J., and McGill, S. "Evaluation of an injectable hydrogel and polymethyl methacrylate in restoring mechanics to compressively fractured spine motion segments." *The Spine Journal* 16 (2016): 1404-1412.

Klinger, A., Kawata, M., Villalobos, M., Jones, R.B., Wu, N., Chang, S., Zhang, P., DiMuzio, P., Vernengo, J., Benvenuto, P., Goldfarb, R.D., Hunter, K., Liu, Y., Carpenter, J.P., Tulenko, T.N., "Living scaffolds: surgical repair using scaffolds seeded with human adipose-derived stem cells", *Hernia* 20 (2016): 161-170.

Wiltsey C., Christiani T., Williams J., Scaramazza J., Van Sciver C., Toomer K., Sheehan J., Branda A., Nitzl A., England E., Kadlowec J., Iftode C., and Vernengo A.J. "Thermogelling Bioadhesive Scaffolds

for Intervertebral Disc Tissue Engineering: Preliminary *In Vitro* Comparison of Aldehyde-Based Versus Alginate Microparticle-Mediated Adhesion”, *Acta Biomaterialia* 15 (2015): 71-80.

Vernengo, A.J., Purdy, C., Farrell, S. “An Experiment for the Undergraduate Laboratory that Teaches Fundamental Concepts of Rheology within the Context of Sickle Cell Anemia”, *Chemical Engineering Education* 48 (2014): 149.

Balkovec, C., Vernengo, A.J., McGill, S. “The Use of a Novel Injectable Hydrogel Nucleus Pulposus Replacement in Restoring the Mechanical Properties of Cyclically Fatigued Porcine Intervertebral Discs”, *Journal of Biomechanics* 135 (2013): 0610041-0610046.

Wiltsey, C., Kubinski, P., Christiani, T., Toomer, K., Sheehan, J., Branda, A., Kadlowec, J., Vernengo A.J. “Characterization of Injectable Hydrogels Based on Poly(N-isopropylacrylamide)-g-chondroitin sulfate with Adhesive Properties for Nucleus Pulposus Tissue Engineering”, *Journal of Materials Science: Materials in Medicine* 24 (2013): 837-847.

Conova, L., Vernengo, A.J., Jin, Y., Himes, T.B., Shumsky, J.S., Fischer, I., Lowman, A. “N-isopropylacrylamide)-g-poly(ethylene glycol) with co-dissolved brain-derived neurotrophic factor injectable scaffold promotes recovery of motor function following cervical dorsolateral funiculotomy in the rat”, *Journal of Neurosurgery: Spine* 18 (2013): 641-652.

Farrell, S., Vernengo, A.J., “A Controlled Drug Delivery Experiment using Alginate Microspheres”, *Chemical Engineering Education* 46 (2012): 97-109.

Vernengo, A.J. and Dahm, K. “Two Challenge-based Laboratories for Introducing Undergraduates to Biomaterials”, *Education for Chemical Engineers* 7 (2012): e14–e21.

Conova, L., Vernengo, A.J., Jin, Y., Himes, T., Neuhuber, B., Fischer, I., Lowman, A. “A pilot study of poly(N-isopropylacrylamide)-g-poly(ethylene glycol) and g-methylcellulose branched copolymers as injectable scaffolds for local delivery of neurotrophins and cellular transplants into the injured spinal cord”, *Journal of Neurosurgery: Spine* 15 (2011): 594-604.

Vernengo, A.J., Fussell, G., Smith, N., Lowman A. “Synthesis and Characterization of Injectable, Bioadhesive Hydrogels for Intervertebral Disc Repair”, *Journal of Biomedical Materials Research Part B: Applied Biomaterials* 93(2010): 309-317.

Vernengo, A.J., Fussell, G., Smith, N., Lowman A. “Evaluation of Novel Hydrogels for Nucleus Pulposus Replacement”, *Journal of Biomedical Materials Research Part B: Applied Biomaterials* 84 (2010): 64-9.

PATENTS

Vernengo, A.J., Christiani, T., Iftode, C., Kadlowec, J. “Methods and Compositions for Inducing Multi-targeted Healing of Intervertebral Disc Defects”, US Patent Application No. PCT/US17/26317

Vernengo, A.J., Kadlowec, J.A., Kubinski, P., Tulenko, T., Iftode, C., Johnson, B. “Bioadhesive Compositions”, US Patent Application No. 13/652,408.

Nigel, S., Hans, M., Lowman, A., Vernengo, A., Fussell, G. "Method to Repair a Damaged Intervertebral Disc Through the Use of a Bioadhesive, Thermogelling Hydrogel", U.S. Patent 8420740

BOOK CHAPTERS:

Vernengo, A., *Adhesive Materials for Biomedical Applications*, in *Adhesives*, A. Rudawska, Editor. 2016, InTech Open Access Publishers.

CONFERENCE PROCEEDINGS:

Gehron, G., Shaji, S., King, B., Witko, J., Vernengo, A.J., Kadlowec, J., Singh, A. "Changes in Forelimb Bones After Body Weight Supported Treadmill Training in Spinal Cord Injury Rats", Orthopaedic Research Society, San Diego, CA (2017).

Christiani, T., Christy, J., Doss, K., Heckler, K., Ilic, E., Perlstein, Q., Dyer, K., Kadlowec, J., Iftode, C., Vernengo, A.J. "An Injectable Hydrogel Composite Scaffold Replacement for Nucleus Pulposus Repair for the Degenerated Intervertebral Disc", Orthopaedic Research Society, San Diego, CA (2017).

Christiani, T., Christy, T., Grootenboer, K., Dittmar, M., Dyer, K., Kadlowec, J., Iftode, C., Vernengo, A. "Injectable Scaffolds with Bioadhesive Properties for the Regeneration of the Annulus Fibrosus and Nucleus Pulposus of the Intervertebral Disc", Philadelphia Spine Research Symposium, Philadelphia, PA (2016).

Vernengo, A., Christiani, T., Dittmar, M., Giginis, F., Schmidt, E., Iftode, C., Kadlowec, J. "Injectable Scaffolds with Bioadhesive Properties for the Regeneration of the Annulus Fibrosus and Nucleus Pulposus of the Intervertebral Disc", Military Health System Research Symposium, Kissimmee, FL (2016).

Singh, A., Witko, J., King, B., Tom, B., Vernengo, A.J. "Effects of Bioengineering Scaffolds Releasing Neurotrophins and Body Weight Supported Treadmill Training on H-reflex after Spinal Cord Injury", Northeast Bioengineering Conference, Binghamton, NY (2016).

Christiani, T., Adams, R., Signor, E., Myers, P., Collins, D., Wrinn, K., Arigot, M., Guido, A., Vernengo, A.J., Kadlowec, J. "Confined Compression of a Hydrogel Composite for Nucleus Pulposus Tissue Engineering", Summer Biomechanics, Bioengineering and Biotransport Conference, American Society for Mechanical Engineering, National Harbor, MD (2016).

Christiani, T., Dittmar, M., Giginis, F., Schmidt, E., Kadlowec, J., Iftode, C., Vernengo, A.J. "Biomechanical Restoration of the IVD Using a Thermally Sensitive Hydrogel Composite for Replacement of the Nucleus Pulposus", Orthopaedic Research Society Annual Meeting, Orlando, FL (2016).

Christiani, T., Vernengo, A.J., Kadlowec, J. "Restoring Biomechanics of the Intervertebral Disc with a Thermogelling Bioadhesive Hydrogel Composite", Orthopaedic Research Society 3rd Annual International Philadelphia Spine Research Symposium, Philadelphia, PA (2015).

Schmidt, E., Dittmar, M., Giginis, F., Christiani, T., Nitzl, A., England, E., Goldschmidt, E., Kadlowec,

J., Vernengo, A.J., Iftode, C. "Proliferation of human adipose - derived mesenchymal stem cells in a thermosensitive hydrogel for regeneration of the nucleus pulposus of the intervertebral disc", American Society for Stem Cell Biology, San Diego, CA (2015).

Stanzione, J., Vernengo, A.J., Savelski, M.J. "Chemical Engineering Online Curriculum - A New Reality?", Annual Meeting of the American Institute of Chemical Engineering, Atlanta, GA (2014).

Mauriello, T.O., Gossert, S., Feil, G., Vernengo, A.J., Kadlowec, J. "Shear tests of adhesive hydrogels", Annual Meeting of the Biomedical Engineering Society, San Antonio, TX (2014).

Vernengo, A.J., Schwalbenberg, P., Farrell, S., "Undergraduate Design and Structure-Property Characterization of Biomaterials", Proceedings of the Annual Society for Biomaterials Meeting and Exposition, Denver, CO (2014).

Christiani, T., Huitt, T., Langlois, R., Whalen, M., Zurlo, C., Branda, A. Toomer, K., Sheehan, J., Nitzl, A., England, E., Iftode, C., Vernengo, A.J., "Microparticle-mediated adhesion of a thermogelling scaffold for intervertebral disc tissue engineering", Proceedings of the Annual Society for Biomaterials Meeting and Exposition, Denver, CO (2014).

Toomer, K., Sheehan, J., Branda, A., Albertson, N., Nitzl, A., England, E., Oinal, D., Wiltsey, C., Christiani, T., Williams, C., Vernengo, A.J., and Iftode, C., "Cell viability studies with poly(N-isopropylacrylamide)-based scaffolds that display increased bioadhesive properties" Annual Meeting of the American Society for Cell Biology. New Orleans, LA (2013).

Klinger, A., Kawata, M., Villalobos, M., Pike, S., Wu, N., Chang, S., Zhang, JR., DiMuzio, P.J., Benvenuto, P., Vernengo, A.J., Goldfarb, R.D., Liu, Y., Carpenter, J.P., Tulenko, T.N., "Living Scaffolds: Surgical Repair using Scaffolds Seeded with Human Adipose-Derived Stem Cells", Intl Fed Adipose Therapy and Science, New York, NY (2013).

Wiltsey, C, Christiani, T., Williams, J., Scaramazza, J., Van Sciver, C., Toomer, K., Sheehan J., Branda, A., Iftode, C., Vernengo, A.J., "Self-assembling "smart" hydrogels with bioadhesive properties for tissue engineering applications", Proceedings of the Annual Society for Biomaterials Meeting and Exposition, Boston, MA (2013).

Farrell, S., Vernengo, A.J., Yermagambetova, M., Zhatkanbaeva, Z., "An Experiment to Introduce Temperature-responsive Polymers for Biomedical Applications: Polymer Synthesis", Proceedings of the Annual Conference of the American Society for Engineering Education, Atlanta GA, (2013).

Farrell, S., Vernengo, A.J., Yermagambetova, M., Schwalbenberg, P.J., "An Experiment to Introduce pH-responsive Hydrogels for Controlled Drug Delivery: Mechanical Testing, Proceedings of the Annual Conference of the American Society for Engineering Education", Atlanta GA, (2013).

Farrell, S., Vernengo, A.J., Staehle, M., Kadlowec, J., Merrill, T., Polikar, R., Strobel, J., "Organizing the curriculum: Introducing engineering principles through biomedically related experiments: Module Development", Proceedings of the Annual Conference of the American Society for Engineering Education, Atlanta GA, (2013).

Wiltsey, C., Christiani, T., Williams, J., Coulter, J., Demiduke, D., Toomer, K., English, S., Hess, B., Branda, A., Sheehan, J., Kadlowec, J., Tulenko, T., Iftode, C., Vernengo, A.J., "Self-assembling

Biomimetic Hydrogels with Bioadhesive Properties for Tissue Engineering Applications”, Proceedings of the Northeast Bioengineering Conference, Philadelphia, PA (2012).

Cleary, H., Barkley, H., Goodman, A., Payne, M., Virtue, J., Vernengo, A.J., Kadlowec, J. “Design of a Bioreactor for Mechanical Stimulation of Adipose Derived Stem Cells for Intervertebral Disc Tissue Engineering”, Proceedings of the ASME Summer Bioengineering Conference, Fajardo, Puerto Rico (2012).

Wiltsey, C., Christiani, T., Williams, J., Coulter, J., Demiduke, D., Toomer, K., English, S., Hess, B., Branda, A., Sheehan, J., Kadlowec, J., Tulenko, T., Iftode, C., Vernengo, A.J., “Self-assembling Biomimetic Hydrogels with Bioadhesive Properties for Tissue Engineering Applications”, Proceedings of the ASME Summer Bioengineering Conference, Fajardo, Puerto Rico (2012).

Conova, L.; Vernengo, A.J.; Jin, Y.; Himes, B.T.; Neuhuber, B.; Shumsky, J.S.; Fischer, I.; Lowman, A. The use of poly(N-isopropylacrylamide)-poly(ethylene glycol) branched copolymer as an injectable scaffold for local delivery of neurotrophins and cellular transplants into the injured spinal cord. Society for Neuroscience, Washington, DC (2011).

Farrell, S., Vernengo, A.J., “Drug Delivery Education Using Microsphere Technology”. Proceedings of the American Society for Engineering Education Annual Conference & Exposition, Vancouver, Canada (2011).

Vernengo, A.J. “Active and Cooperative Learning Activities for Introducing Undergraduate Students to Biomaterials”. Proceedings of the American Society for Engineering Education Annual Conference & Exposition, Vancouver, Canada (2011).

Conova, L., Vernengo, A.J., Jin, Y., Himes, B.T., Neuhuber, B., Fischer, I., Lowman, A., “The use of poly(N-isopropylacrylamide)-g-poly(ethylene glycol) branched copolymer as an injectable scaffold for local delivery of neurotrophins and cellular transplants into the injured spinal cord.” Annual Society for Biomaterials Meeting and Exposition, Orlando, FL (2011).

Vernengo, A.J., Fussell, G., Lowman, A., “Thermal Cycling to Eliminate Water Loss Upon Gelation of Injectable Hydrogels for Nucleus Pulposus Replacement,” Annual Society for Biomaterials Meeting and Exposition, Chicago, IL (2007)

Vernengo, A.J., Fussell, G., Lowman, A., “Evaluation of Novel Injectable Hydrogels,” Annual Society for Biomaterials Meeting and Exposition, Pittsburgh, PA (2006).

INVITED PRESENTATIONS:

Invited seminar speaker, “Functional Biomedical Polymers for Regenerative Medicine”, South Jersey Chapter of the American Chemical Society Meeting, March 2012.

Invited seminar speaker, “Structure-Property Relationships in Matrix-based Oral Dosage Tablets”, Bristol-Meyers Squibb, New Brunswick, New Jersey, November 2011.

Invited seminar speaker, “Injectable Biomaterials for Neural Tissue Engineering”, Department of Surgical Research, Cooper University Hospital, January 2011.

Invited seminar speaker, “*In vitro* and *In Vivo* Studies on Injectable Polymers Matrices for Tissue Engineering Applications”, Department of Neuroscience, Temple University School of Medicine, Philadelphia, PA, April 2010.

Invited seminar speaker, “Multi-functional Scaffolds for Spinal Cord Repair”, Spinal Cord Research Center, Drexel University Department of Biomedical Engineering, Philadelphia, PA, January 2010.

Vernengo, A.J., Fussell G, Smith N, Lowman A. “Injectable Bioadhesive Hydrogels for Nucleus Pulposus Replacement and Repair of the Damaged Intervertebral Disc”, 5th annual Philadelphia Spine Research Symposium, December 2009, Philadelphia, PA.

Invited seminar speaker, “PNIPAAm-PEG Copolymers for Biomedical Applications”, Spinal Cord Research Center, Drexel University College of Medicine, August 2009.

SERVICE TO THE PROFESSION:

Invited Ad Hoc Reviewer:

- Orthopaedic Research Society
- Acta Biomaterialia
- Elsevier
- Biomacromolecules
- Chemical Engineering Education
- Carbohydrate Polymers
- Polymer Bulletin
- Journal of Biomedical Materials Research: Part B- Applied Biomaterials
- Early Career Reviewer (ERC) member, Musculoskeletal Tissue Engineering Study Section

Scientific Organizations:

- Orthopaedic Research Society (ORS)
- Society for Biomaterials (SFB)
- American Institute of Chemical Engineers (AIChE)
- American Society for Engineering Education (ASEE)

TEACHING EXPERIENCE:

Courses:

1. Material and Energy Balances I, Department of Chemical and Biological Engineering, Drexel University.
2. Separations Processes I, Department of Chemical Engineering, Rowan University.
3. Materials Science, Department of Chemical Engineering, Rowan University.
4. Biomaterials Engineering, Department of Chemical Engineering, Rowan University.
5. Freshman Engineering Clinic I (Laboratory Course), Rowan University.
6. Fundamentals of Tissue Engineering (Laboratory Course), Departments of Chemical Engineering and Biomedical Engineering (cross-listed), Rowan University

RESEARCH MENTORING:

1. Kubinski, Pamela (M.S. Chemical Engineering, 2012) – Currently PhD Student, Drexel University
 2. Wiltsey, Craig (M.S. Chemical Engineering, 2013) – Currently Scientist, Arsenal Medical
 3. Christiani, T. (Ph.D. student, Biomedical Engineering, current) – Rowan University
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INDUSTRIAL EXPERIENCE:

Scientist I, Synthes Biomaterials, West Chester, PA 19380, February 2007 – June 2009.

- Developed novel ceramic-polymer composites for bone substitution.
- Work involved the addition of degradable esters or natural polysaccharides to calcium phosphates to improve handling properties, increase load-bearing capabilities, or control the delivery of active agents.
- Responsible for providing detailed data, results, and analyses to project teams and recommending paths forward.
- Decision process required knowledge of related intellectual property and regulatory issues.
- Extensive collaboration with internal researchers and external partners, such as vendors and clinicians.

Chemical Engineering R&D Intern, Dr. Dan Campos, Dupont Experimental Station, Wilmington, DE 19898, September 2001- March 2002.

- Played a significant role in the development of a lab reactor system for oxetane chemistry by designing, testing and optimizing the process.
- Created standard operating procedures for the system and all instrumentation diagrams.
- Provided complete analytical support by conducting sample preparation and quantitative analysis of product samples by gas chromatography (GC).

Junior Chemical Engineer, Thao Hwang, Dupont Fluoroproducts, Deepwater, NJ 08023, September 2000- March 2001.

- Supervised the production of purified Zyron© C-318 via an extractive distillation system.
- Major responsibilities included chemical plant troubleshooting and process studies. Acted as a liaison between production, maintenance and process engineering.