Kelly W. Broadhead, Ph.D.

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University of Utah
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Summary of Qualifications

2023-Present

Dept. of Biomedical Engineering, University of Utah
Salt Lake City, Utah

- Director of BME Undergraduate Operations
- Associate Professor - Lecturer
- Undergraduate Advisor including the Department Honors Laison
- ABET Accreditation Committee Chair for Department-three successful reviews
- Course Instructor for Biomedical Design (bioDesign, BME 3801 & 4801), and Thesis Writing and Communication Classes (BME 4990, 4991, 4992)
- Guest lecturer in Biomedical Innovation (bioInnovation)

2013-2023

Dept. of Biomedical Engineering, University of Utah
Salt Lake City, Utah

- Associate Professor - Lecturer
- Undergraduate Advisor including the Department Honors Advisor
- ABET Accreditation Committee Chair for Department-three successful reviews
- Course Instructor for Biomedical Design (bioDesign), Biomedical Innovation (bioInnovation) and Thesis Writing and Communication Classes
- CoPI on NIBIB Undergraduate Training Grant (ended in 2018)

2003-2013

Dept. of Bioengineering, University of Utah
Salt Lake City, Utah

- Assistant Professor - Lecturer
- Undergraduate Advisor
- ABET Accreditation Coordinator
- Course Instructor for Biomedical Design (bioDesign) and Senior Project Classes
- Principle Investigator: Bioengineering PI for NSF STEP: Utah Engineers: A Statewide Initiative for Growth

2001-2003

Dept. of Bioengineering, University of Utah
Salt Lake City, Utah

- Postdoctoral Research Associate
- Development of a Bioreactor for Investigating the Role of Mechanical Strain
- Directed Two Bioengineering Undergraduates in a Semester Long Research Rotation
- Directing the Senior Project of an additional Bioengineering Undergraduate
- Developed, set up, and ran the BIEON 5301 Intro to Modern Bbiomaterials Laboratory

Education

2002-2003

University of Utah
Salt Lake City, Utah

- Postdoctoral Research Associate at the Keck Center for Tissue Engineering at the University of Utah

2002

University of Utah
Salt Lake City, Utah
- Ph.D. in Bioengineering
- Defended Oct 2001, GPA = 3.89 (A=4.00)
- Dissertation Advisor: Dr. Patrick A. Tresco
- Dissertation Title: "Elucidating the Structural and Functional Properties of Poly(Acrylonitrile-Vinylchloride) Phase-Inversion Membranes and their Influence in Cell Encapsulation"

1991

Utah State University
Logan, Utah
- Bachelor of Science in Chemistry with a Biochemistry Emphasis
- June 1991, GPA = 3.88 (A=4.00)
- Minor in Mathematics
- Graduated Magna Cum Laude

Professional Experience

2023-Present

Associate Professor - Lecturer and Director of BME Undergraduate Operations
Dept of Biomedical Engineering, Univ. of Utah, Salt Lake City, UT
- Undergraduate Advisor including the Department Honors Laison
- ABET Accreditation Committee Chair-led successful reviews in 2009, 2015, and 2021
- Instructor for BME 3801&4801 bioDesign 2006 to present.
- Instructor for BME 4991 & 4992 (formerly 4201&4202) Biomedical Engineering Project 2003 to present.
- Instructor for BME 4999: Honors Thesis for 2012 to present with about 7 or 8 theses completed per year.
- Guest Lecturer for BME 6081&6082: bioInnovate.
- Typically serve on 10-15 graduate committees each year.
- Coach an average of 20 bioDesign teams per year.

2013-2023

Associate Professor - Lecturer and Undergraduate Advisor
Dept of Biomedical Engineering, Univ. of Utah, Salt Lake City, UT
- Undergraduate Advisor: Premajor and Honors
- ABET Accreditation Committee Chair-led successful reviews in 2009, 2015, and 2021
- Instructor for BME 3801&4801 bioDesign 2006 to present.
- Instructor for BME 4991 & 4992 (formerly 4201&4202) Biomedical Engineering Project 2003 to present.
- Instructor for BME 4999: Honors Thesis for 2012 to present with about 7 or 8 theses completed per year.
- Instructor for BME 6081&6082: bioInnovate for 2011 to present.
- Typically serve on 10-15 graduate committees each year.
- Coach an average of 20 bioDesign teams per year and work with average of 5 bioInnovate teams each year.
- CoPI on NIH-NIBIB grant (R25EB0131223): Using Clinical Immersion as an Empathetic Training tool in Medical Device Innovation. 6/1/12-5/31/18.
- PI for Bioengineering Department on NSF STEP: Utah Engineers: A Statewide Initiative for Growth. 9/1/07-9/30/14.

2003-2013

Assistant Professor - Lecturer and Undergraduate Advisor
Dept of Bioengineering, Univ. of Utah, Salt Lake City, UT
- Undergraduate Advisor: Premajor (currently) and Honors (except 2012)
- ABET Accreditation Coordinator

- Instructor for BIOEN 3801&4801 Biomedical Engineering Design 2006 to present.
- Instructor for BIOEN 3802 Biomedical Engineering Design Seminar for 2005
- Instructor for BIOEN 4201&4202 Biomedical Engineering Project 2003 to present.
- Instructor for BIOEN 5001 Biophysics for 2005
- Instructor for BIOEN 6081&6082: bioInnovate I for 2011 to present.
- PI for Bioengineering Department on NSF STEP: Utah Engineers: A Statewide Initiative for Growth. 9/1/07-9/30/14

1997-2001

Postdoctoral Research Associate Leading the Development of a Tissue Bioreactor for Investigating the Role of Mechanical Strain on Laryngeal Fibroblasts in 3D culture
Keck Center for Tissue Engineering, Univ. of Utah, Salt Lake City, UT

- Characterized and Optimized a Bioreactor Design for Vocal Fold Tissue Engineering
- Designed a Reactor that Incorporates Computer Controled Axial and Vibratory Strain

2002-2003

Leader of Medical Membrane Fabrication and Characterization Group
Keck Center for Tissue Engineering, Univ. of Utah, Salt Lake City, UT

- Designed, Built, and Used a Novel Membrane Extruder Head to Fabricate Membranes
- Instrumental in the Integration of Various Electronic Sensors and Motor Control into Experimental Instrumentation using Labview
- Designed Structural and Functional Membrane Test Procedures and Test Devices
- Advised Researchers in Proper Use of Computers for Digital Imaging, Instrumentation, Computer Aided Design, Statistical Analysis and Office Productivity Software

1997-2001

Database Developer, Project Manager, and Proprietor
Broadhead Solutions, Salt Lake City, UT

- Developed and Marketed a Relational Database for Monitoring Treatment of at Risk Children
- Interacted with Customers to Generate Specifications and Managed Project
- Followed Design Control Paradigm including Software Qualification
- Developed a Complete set of SQL Queries for Data Entry and Reporting
- Assembled Modules together using Visual Basic and MS Access

1993-1996

Research Assistant in Tissue Engineering Laboratory
Dept. of Bioengineering, Univ. of Utah, Salt Lake City, UT

- Accomplished at Cell Engineering, Implant Design, and In Vitro Toxicity Testing
- Experienced with Issues important to the Clinical Environment including Sterile Technique, Biomaterial Sterilization, and General Clinical Practice
- Developed Research Processes for Surface Science Analysis Using State-of-the-Art Instrumentation and High-Resolution Microscopy

1992

Research Technician
Dept. of Nutrition and Food Science, Utah State Univ., Logan, UT

- Investigated Effectiveness of Novel Chemicals as Hypocholesterolemic Drugs
- Developed Animal Experimental Protocol and Chemical Analysis Method

1991

Biochemical Research Technician in FRRL Lab
U.S. Dept. of Agriculture, Logan, UT

- Studied Cold Temperature Effects on Gene Expression and Protein Production in Plants
- Analyzed Proteins and Worked on cDNA Library Using Electrophoretic Separation

1989 **NIH Summer Internship Trainee**

Dept. of Pharmaceutics, Univ. of Utah, Salt Lake City, UT

- Awarded NIH Training Internship to do Pharmaceutics Research
- Isolated, Purified, and Characterized Immunoglobulins used in Site Specific Drug Delivery

Teaching Experience

- Classes Taught as Instructor or Coinstructor
  - Spring 2013 to present, BME 4999: Honors Thesis
  - Spring 2013 to present, BME 6082:bioInnovate II
  - Fall 2011 to present, BME 6081: bioInnovate I
  - Fall 2006 to present, BME 4801: Biomedical Engineering Design II
  - Spring 2006 to present, BME 3801: Biomedical Engineering Design I
  - Spring 2005, BIOEN 5001/6001: Biophysics
  - Spring 2005, BIOEN 3802: Junior Design Seminar
  - Spring 2004 to present, BME 4992: Biomedical Engineering Project II
  - Fall 2003 to present, BME 4991: Biomedical Engineering Project I
- Selected Lectures Delivered
  - Spring 2014 to present, BIOEN 6081, "Biomaterials and Biocompatibility Testing"
  - Spring 2014 to present, BIOEN 6081, "Labview and Data Capture"
  - Spring 1999, Laboratory Meeting, “Semipermeable Membrane Technology”
  - Spring 1997 and 1998, BIOEN 562, Physiology for Engineers, “Hormones of the Pancreatic Islet”
  - Winter 1995, Laboratory Meeting, “Transplantation Immunology”
- Teaching Assistant Responsibilities
  - Fall 1998, Principles of Physiology for Engineers

Other Experience

- Computer Experience
  - FORTRAN, C, Visual Basic, and Labview Programming
  - Development of Relational Databases using MS Access and VBA
  - Windows including XP and 7; and Macintosh: Systems and Software
  - Use of Design Software like Autocad, ProEngineer, and Solidworks
  - Network Administration
  - Motor Contorl and Data Collection using Computers
- Chemical Instrumentation and Procedures
  - Apparatus Utilized in Lab Experience:
    - SEM, SFM, Confocal Microscopy, HPLC, FT-IR, ESCA, NMR, GC, Mass Spec, LC, Fluorometry, Voltametry, Polarography, UV-Vis Spec, Electrogravimetry, and Atomic Absorption
  - Methods Used in Lab Experience:
    - Mammalian Cell Culture, Redox, Chelate, and pH Titrations, Ion Exchange Chromatography, mRNA Isolation, Affinity Chromatography, and Non-denatured and Denatured Protein Electrophoresis

Publications

- Broadhead, KW and Tresco, PA. Effects of Fabrication Conditions on the Structure and Function of Membranes formed from Poly(Acrylonitrile-Vinylchloride), J. Membrane Sci. *147:* 235-245, 1998.
- Bridge, MJ, Broadhead, KW, Hitchcock, RW, Webb, CK, Tresco, PA. A Novel Instrument to Characterize Transport of A Single Hollow Fiber of Short Length, J. Membrane Sci. 183: 223-233, 2001.

- Bridge, MJ, Broadhead, KW, and Tresco, PA. Ethanol Treatment Alters the Transport Properties of PAN-PVC Hollow Fiber Cell Encapsulation Membranes, J. Membrane Sci. 195: 51-64, 2002.
- Broadhead, KW, Biran, R and Tresco, PA. Hollow Fiber Membrane Diffusive Permeability Regulates Encapsulated Cell Line Biomass, Proliferation, and Small Molecule Release, Biomaterials, 23: 4689-4699, 2002.
- Titze, IR, Hitchcock, RW, Broadhead, KW, Gray, S, and Tresco, PA, Design of a Bioreactor for Engineering Vocal Fold Tissues under Combined Tensile and Vibrational Stresses, J Biomech. 37: 1521-1529, 2004.
- Kim YT, Hitchcock R, Broadhead KW, Messina DJ, Tresco P , A cell encapsulation device for studying soluble factor release from cells transplanted in the rat brain. J Control Release 102:101-111, 2005.
- Titze, IR, Broadhead, KW, Tresco, PA, andGray, S Strain distribution in an elastic substrate vibrated in a bioreactor for vocal fold tissue engineering, J Biomech. 38: 2406-2414, 2005.
- Williams, L, Hitchcock, R , Bialowas, A. and Broadhead, K, Biomedical Engineering Design and the Development of High-Value Relationships with Clinical Medicine, National Capstone Design Course Conference, Boulder, CO, June 13-15, 2007.

Abstracts

- Broadhead, KW, Tresco, PA, The Fine Surface Morphology of Ultrafiltration Membranes: Correlation to Membrane Function, Center for Biopolymers at Interfaces, Salt Lake City, March 19 - 21, 1995.
- Tresco, PA, Broadhead, KW, LeSauter, J, Silver, R, A Novel Encapsulation Membrane for the Transplantation of Embryonic Tissue to the Central Nervous System, Keystone Symposium on Tissue Engineering, Taos, New Mexico, Jan. 24 - 28, 1996.
- Broadhead, KW, LeSauter, J, Silver, R, Tresco, PA, A Novel Encapsulation Membrane for the Transplantation of Embryonic Tissue to the Central Nervous System, Center for Biopolymers at Interfaces, Salt Lake City, March 17 - 19, 1996.
- Broadhead, KW, LeSauter, J, Silver, R, Tresco, PA, A Novel Encapsulation Membrane for Studying Embryonic Tissue Grafted into the Central Nervous System, Fifth World Biomaterials Congress, Toronto, May 29 - June 2, 1996.
- Broadhead, KW, Bridge, M, Hitchcock, R, Kreuger, G, and Tresco, PA, Cell Encapsulation Membranes Engineered for Transferrin Release from Genetically Modified NIH-3T3 Fibroblasts, Society for Biomaterials Conference, San Diego, April 22 - 26, 1998.
- Broadhead, KW, Bridge, M, Hitchcock, R, Tresco, PA, The Effect of Membrane Performance on Encapsulated Cell Viability, Proliferation, and Biomass, Society for Biomaterials Conference, Providence, RI, April 28 - May 2 1999.
- Robins, MR, Broadhead, KW, and Tresco, PA, Evaluation of Polysulfone Phase Inversion Membranes for Cell Encapsulation, Sixth World Biomaterials Congress, Kameula, HA, May 15 - 20, 2000.
- Kang, E, Broadhead, KW, and Tresco, PA, Functional Properties of PAN-PVC Membranes Used in Various Tissue Engineering Applications, Society for Biomaterials Conference, Saint Paul, MN, April 24-29,2001.
- Bridge, MJ, Broadhead, KW, Hitchcock, RW, Webb, CK, and Tresco, PA, A Novel Instrument for Transport Characterization of Cell Encapsulation Membranes, Society for Biomaterials Conference, Saint Paul, MN, April 24-29,2001.
- Broadhead, KW, and Tresco, PA, The Effect of Membrane Transport on the Release of Dopamine from Encapsulated PC-12 Cells, Society for Biomaterials Conference, Saint Paul, MN, April 24-29,2001.

- Kim, YT, Broadhead, KW, Messina, DJ, and Tresco, PA, Reversible Delivery of Cell Derived Soluble Factors to Brain Tissue Using a Refillable Cell Encapsulation Device, Society for Biomaterials Conference, Tampa, FL, April 24-27, 2002
- Bridge, MJ, Broadhead, KW, Kim, YT, Messina, DJ, and Tresco, PA, Estimatin the Diffusive Properties of an Implanted Cell Encapsulation Membrane and the Adjacent Tissue within Adult Brain Tissue, Society for Biomaterials Conference, Tampa, FL, April 24-27, 2002
- Broadhead, KW, Kang, E, and Tresco, PA, The Influence of Spinneret Size and Flow Rate on the Structure and Permeability of PAN-PVC Hollow Fiber Membranes, Tampa, FL, April 24-27, 2002
- Kim, YT, Broadhead, KW, Messina, DJ, and Tresco, PA, Reversible Delivery of Cell Derived Soluble Factors to Brain Tissue Using a Refillable Cell Encapsulation Device, Society for Neuroscience Conference, Orlando, FL, November 2-7, 2002
- Roberts MC, Biran R, Webb K, Broadhead KW, and PA Tresco, (2003) Three-dimensional astrocyte cultures as bridging substrates for regenerating axons, Transactions of 29th Annual Meeting Society for Biomaterials, 449.
- Bridge MJ, Broadhead KW, and PA Tresco, (2003) Modeling diffusive transport of solutes in brain tissue adjacent to implanted cell encapsulation membranes, Transactions of 29th Annual Meeting Society for Biomaterials, 525.
- Wolchok, J.C., Broadhead, K. , Underwood, C.J. and Tresco, P.A., (2004) Investigating The Response Of Vocal Fold Fibroblasts To Vibratory Stresses Using A Novel Bioreactor, Proceeding of the Annual Fall Meeting, Biomedical Engineering Society, Philadelphia, PA, 675.
- Hitchcock, R and Broadhead, K, Biomedical Engineering Design and the Development of High-Value Relationships with Clinical Medicine, National Capstone Design Course Conference, Boulder, CO, June 13-15, 2007.

Podium Presentations

- Broadhead, KW, LeSauter, J, Silver, R, Tresco, PA. A Novel Eencapsulation Membrane for Studying Embryonic Tissue Grafted into the Central Nervous System, Fifth World Biomaterials Congress, Toronto, May 29 - June 2, 1996.
- Broadhead, KW, Bridge, M, Hitchcock, R, Kreuger, G, and Tresco, PA., Cell Encapsulation Membranes Engineered for Transferrin Release from Genetically Modified NIH-3T3 Fibroblasts, Biomaterials Conference, San Diego, April 22 - 26, 1998.
- Broadhead, KW, Bridge, M, Hitchcock, R, Tresco, PA., The Effect of Membrane Performance on Encapsulated Cell Viability, Proliferation, and Biomass, Society for Biomaterials Conference, Providence, RI, April 28 - May 2 1999.
- Broadhead, KW, and Tresco, PA., The Effect of Membrane Transport on the Release of Dopamine from Encapsulated PC-12 Cells, Society for Biomaterials Conference, Saint Paul, MN, April 24-29,2001.
- Broadhead, KW, Petelenz, T, Hitchcock, R, Presentation on Biomedical Engineering Education and bioDesign program, Technology and Engineering Summer Conference, Ogden, UT, June 13, 2017. (Invited Talk)
- Broadhead, KW, Biomedical Engineering Assessment and ABET Accreditation. University of Utah Assessment Workshop, Salt Lake City, UT, April 13, 2022. (Invited Talk)

Poster Presentations

- Broadhead, KW, LeSauter, J, Silver, R, Tresco, PA. A Novel Encapsulation Membrane for the Transplantation of Embryonic Tissue to the Central Nervous System, Center for Biopolymers at Interfaces, Salt Lake City, March 17-19, 1996.

- Broadhead, KW, Tresco, PA. The Fine Surface Morphology of Ultrafiltration Membranes: Correlation to Membrane Function, Center for Biopolymers at Interfaces, Salt Lake City, March 19-21, 1995.
- Kang, E, Broadhead, KW, and Tresco, PA, Functional Properties of PAN-PVC Membranes Used in Various Tissue Engineering Applications, Society for Biomaterials Conference, Saint Paul, MN, April 24-29,2001.

Service

Professional

- Utah State Board of Regents. Role: Committee member. Engineering Majors Meeting, 4/1/2003-10/1/2007
- Utah State Board of Regents. Role: Committee member. Engineering Majors Meeting, 6/1/2014 to present
- Utah State Board of Regents. Role: Committee Chair. Engineering Majors Meeting.10/1/2007-6/1/2014
- Peer Reviewer for Computer Methods and Programs in Biomedicine, July 2017
- Outside Reviewer for Light Line Medical, July and Dec. 2022

Internal-University of Utah

- Campus Planning Advisory Committee. Member, 09/01/2005 - 05/01/2007
- University Financial Aid and Scholarship Committee. Member, 08/02/2013 - 07/31/2016
- Senate Advisory Committee on Information Technology (SACIT). Member, 07/01/2017 - 06/01/2023
- University of Utah Assessment

Internal-College of Engineering

- ABET Committee. Representative for Biomedical Engineering, 11/01/2002 to present
- Undergraduate Advising Committee. Representative for Biomedical Engineering, 11/01/2002 to present
- College Council. Substitute representative for Biomedical Engineering, 08/25/2004 - 06/30/2008

Internal-Department of Bioengineering

- Undergraduate Premajor Advisor. Advising students from initial orientation until reaching major status, 11/01/2002 to present
- ABET Committee. Chair. Responsible for assessment activites, 11/01/2002 to present
- Undergraduate Scholarship Committee. committee member, 02/01/2003 to present
- Biomedical Engineering Undergraduate Committee. Member, 07/01/2003 to present
- Department Honors Advisor. Advising honors students and reviewing thesis, 8/20/2004 - 2/28/2012 then 8/22/2011 to present
- Served on the ad-hoc plagiarism committee chaired by Dr. Greg Clark. Worked on a program wide academic integrity policy for the program. committee member, 01/30/2017 - 04/28/2017.