Kristan S. Worthington

1402 Seamans Center
Iowa City, IA 52242
(319)-335-5632
kristan-sorenson@uiowa.edu

CURRENT POSITION

Assistant Professor	Biomedical Engineering, University of Iowa Researcher, Wynn Institute for Vision Research	Aug 2017 – Present

EDUCATION

Post doctorate	Ophthalmology and Visual Sciences, University of Iowa	2014 – 2017
Ph.D.	Chemical and Biochemical Engineering, University of Iowa	2014
M.S.	Chemical and Biochemical Engineering, University of Iowa	2013
B.S./M.S.	Biological Engineering, Utah State University	2010

GRANTS AND FELLOWSHIPS

2016 Fight for Sight Postdoctoral Fellowship

2015 ARVO Foundation/Tyson Research Initiative/PAOF/RRF Travel Grant

2009 University of Iowa Presidential Graduate Research Fellowship
Five years of full stipend plus tuition and fees

2004 Utah State University Undergraduate Research Fellowship

AWARDS AND HONORS

2017 Vision Travel Award – FASEB: Biology and Chemistry of Vision

2016 Outstanding Poster Award – Midwest Eye Research Symposium
Member-in-Training Poster Award in Nanotechnology and Regenerative Medicine - ARVO
2nd Place, Art in Science Contest – Iowa Microscopy Society

2015 *Kammermeyer Research Award - UI Chemical and Biochemical Engineering Department
Cover Art Contest Winner – UI Health Sciences Research Week
UI Three-Minute Thesis Finalist – Physical Sciences and Engineering Category

2014 Excellence in Graduate Polymer Research – ACS Polymer Division
*Osborne Teaching Award - UI Chemical and Biochemical Engineering Department
Exemplary Senator – UI Graduate Student Senate

2013 Innovative Member – UI Society of Women Engineers

2011 *Vetter Service Award – UI Chemical and Biochemical Engineering Department

2009 Woman of the Year Award Finalist – USU Robins Award Committee

2007 Burtis L. & Anna E. Embry Scholar – USU Biological Engineering Department

2004 Presidential Scholar – USU Office of Admissions

*First to receive all three awards available to graduate students in the department

PUBLICATIONS

Refereed Journal Articles

K.R. Chirco, **K.S. Worthington**, M.J. Flamme-Wiese, M.J. Riker, J.D. Andrade, B.M. Ueberheide, E.M. Stone, B.A. Tucker, R.F. Mullins, "Preparation and evaluation of human choroid extracellular matrix scaffolds for the development of cell replacement strategies" *Acta Biomaterialia* 57, 293-303 (**2017**).

A.E. Songstad, **K.S. Worthington**, K.R. Chirco, S.S. Whitmore, K.R. Anfinson, C. Cranston, E.M. Stone, R.F. Mullins and B.A. Tucker, "Connective Tissue Growth Factor (CTGF) promotes efficient generation of human iPSC-derived choroidal endothelium" *Stem Cells Translational Medicine* 6, 1533–1546 (**2017**).

K.S. Worthington, L.A. Wiley, E.E. Kaalberg, M.M. Collins, R.F. Mullins, E.M. Stone and B.A. Tucker, "Two-photon polymerization for production of human iPSC-derived retinal cell grafts" *Acta Biomaterialia* 55, 385 - 395 (**2017**).

K.S. Worthington, C. Baguenard, B.S. Forney, and C.A. Guymon, "Photopolymerization kinetics in and of self-assembling lyotropic liquid crystal templates" *Journal of Polymer Science Part B: Polymer Physics* 55, 471-489 (**2017**).

K.S. Worthington, B.J. Green, M. Rethwisch, L.A. Wiley, B.A. Tucker, C.A. Guymon, and A.K. Salem, "Neuronal Differentiation of Induced Pluripotent Stem Cells on Surfactant Templated Chitosan Hydrogels" *Biomacromolecules* 17, 1684-1695 (**2016**).

K.S. Worthington, L.A. Wiley, C.A. Guymon, A.K. Salem, and B.A. Tucker, "Differentiation of Induced Pluripotent Stem Cells to Neural Retinal Precursor Cells on Porous PLGA Scaffolds" *Journal of Ocular Pharmacology and Therapeutics* 32, 310-316 (**2016**).

K.S. Worthington, L.A. Wiley, R.F. Mullins, B.A. Tucker, and E. Nuxoll, "Pre-vascularized silicon membranes for the enhancement of transport to implanted medical devices," *Journal of Biomedical Materials Research Part B: Applied Biomaterials* 104, 1602-1609 (**2016**).

K.S. Worthington, L.A. Wiley, A.M. Bartlett, A.K. Salem, C.A. Guymon, and B.A. Tucker, "Mechanical properties of murine and porcine ocular tissues in compression" *Experimental Eye Research,* 121, 194-99 (**2014**).

K.S. Worthington, A. Adamcakova-Dodd, A. Wongrakpanich, I.A. Mudunkotuwa, K.A. Mapuskar, V.B. Joshi, C.A. Guymon, D.R. Spitz, V.H. Grassian, P.S. Thorne, and A.K. Salem, "Chitosan coating of copper nanoparticles reduces *in vitro* toxicity and increases inflammation in the lung," *Nanotechnology,* 24, 395101 (**2013**).

Manuscripts Submitted or in Preparation

*J.R. Thompson, *B.J. Green, S.J. Bunn, M. Rethwisch, L.A. Wiley, C.A. Guymon, B.A. Tucker and **K.S. Worthington**, "Effect of molecular weight and degree of functionality on degradation, biocompatibility and two-photon polymerization of acrylated poly(caprolactone)" (**in preparation**). *co-first-authors

K.S. Worthington, B.A. Tucker, S.R. Russell and E.H. Sohn, "Surgical tools for sub-retinal biomaterial transplantation" (**in preparation**).

A-V. Do, **K.S. Worthington**, B.A. Tucker and A.K. Salem, "Effect of structure size, slicing and hatching on drug release from two-photon polymerized poly(ethylene glycol) methacrylate structures" (**in preparation**).

PROPOSAL WRITING

Proposal Leader or Major Contributor

2016 Pappajohn Biomedical Institute Convergence Grant "Two-photon polymerized 3D degradable poly(caprolactone) structures as photoreceptor cell substrates" (letter of intent, **co-PI**)

NIH R01 proposal "Autologous Photoreceptor Replacement" (under review, **co-investigator)**

2015 Fight for Sight Postdoctoral Fellowship "Development of 3D-printed photoreceptor cell grafts" (**successful**)

NIH R01 proposal "Development of Photoreceptor Grafts" (**co-investigator**)

L'Oreal for Women in Science Postdoctoral Fellowship "Retinal Engineering: Biomaterials for photoreceptor regeneration"

NIH R01 proposal "Retinal Tissue Engineering" (**key personnel**)

2014 Research to Prevent Blindness Catalyst Award "Development of a multi-layer autologous cell replacement strategy for the treatment of atrophic age related macular degeneration" (**successful**)

NIH F32 Postdoctoral Fellowship "Fabrication and characterization of tissue-engineered multilayer outer retinal grafts"

Action on Hearing Loss Flexi Grant "Swellable hydrogels to achieve perimodiolar electrode positioning with preserved cochlear structure and function" (**collaborator**)

2010 DoD NDSEG Graduate Fellowship "Photopolymerized Chitosan Hydrogels for Wound Healing"

2009 NSF Graduate Fellowship "Site-Specific Cancer Treatment Using Photopolymeric Nanoparticles as Drug Delivery Systems"

2007 NSF Graduate Fellowship "Ethanol Production and Gene Expression of Alginate-Encapsulated *Saccharomyces cerevisiae*"

Minor Contributor or Content Editor

2015 W.M. Keck Foundation Science and Engineering Research Proposal "Zwitterionic and Two-Photon Polymerized Materials for the Improvement of Electrode-Neural Interfaces"

2014 NSF CBET Grant "Control of Photopolymerization Kinetics and Thermodynamics in Self-Assembled Surfactant Systems to Direct Polymer Nanostructure" (**successful**)

2012 Oakridge National Laboratory Spallation Neutron Source Research Proposal "Nanostructure Evolution during Photopolymerization in Lyotropic Liquid Crystalline Templates" (**collaborator**)

2011 DoE Nuclear Energy University Program "Enhanced Uranium Extraction via Photografted Nanostructured Interpenetrating Networks"

PRESENTATIONS

Invited Talks

K.S. Worthington and B.A. Tucker "Combining Stem Cells and Tissue Engineering to Rebuild the Outer Retina," FASEB Summer Research Conference: Biology and Chemistry of Vision, Steamboat Springs, CO, June 25-30 **2017**

K.S. Worthington, "Human Retinal Engineering: Controlling Biomaterial Chemistry, Structure and Mechanics for Optimization in the Posterior Eye," Biomedical Engineering Graduate Seminar, University of Iowa, Iowa City, IA, February 17, **2017**

K.S. Worthington and B.A. Tucker "Development of a multi-layer autologous cell replacement strategy for the treatment of atrophic age related macular degeneration – year one Catalyst Award update," Research to Prevent Blindness Scientific Advisory Board Meeting, New York, NY, October 12, **2015**

K.S. Worthington, "Transitioning to Graduate School," Biological Engineering Department Seminar, Utah State University, January 16, **2013**

Selected Conference Presentations

K.S. Worthington, R.F. Mullins, E.M. Stone and B.A. Tucker, "High-resolution, 3D-printed chitosan tissue scaffolds for retinal regeneration," Gordon Research Seminar and Conference: Biomaterials and Tissue Engineering, July 22-28, **2017**, Holderness, NH (poster)

K.S. Worthington, J.R. Thompson, B.J. Green, S.J. Bunn, E.E. Kaalberg, R.M. Johnston, L.A. Wiley, R.F. Mullins, E.M. Stone, C.A. Guymon and B.A. Tucker, "Two-Photon Polymerization of High-Resolution 3D, Biodegradable Photoreceptor Cell Scaffolds," ARVO Annual Meeting, May 7-12, **2017**, Baltimore, MD

K.S. Worthington, J.R. Thompson, B.J. Green, S.J. Bunn, E.E. Kaalberg, R.M. Johnston, L.A. Wiley, R.F. Mullins, E.M. Stone, C.A. Guymon and B.A. Tucker, "Two-Photon Polymerization of High-Resolution 3D, Biodegradable Photoreceptor Cell Scaffolds," Society for Biomaterials Annual Meeting, April 5-8, **2017**, Minneapolis, MN (poster)

K.S. Worthington, L.A. Wiley, B.B. Banach, A.E. Songstad, E.E. Kaalberg, R.F. Mullins, E.M. Stone and B.A. Tucker, "Human retinal engineering using 3D two-photon polymerization and chitosan hydrogels," ARVO Annual Meeting, May 1-5, **2016**, Seattle, WA (poster)

K.S. Worthington, E.E. Kaalberg, R.F. Mullins, E.M. Stone, B.A. Tucker, "Fabrication and characterization of tissue-engineered multilayer outer retinal grafts" ARVO Annual Meeting, May 3 – 7, **2015**, Denver, CO

K.S. Worthington, A.M. Bartlett, A.K. Salem, B.A. Tucker and C.A. Guymon, "Physical properties of photopolymers in ocular regenerative scaffolds," RadTech Global Conference, May 12 – 14, **2014**, Chicago, IL

K.S. Worthington, A.M. Bartlett, E.M. Stone, A.K. Salem, C.A. Guymon and B.A. Tucker, "Nanostructured photopolymers as stem cell scaffolds for photoreceptor regeneration," ARVO Annual Meeting, May 4 – 9, **2014**, Orlando, FL (poster)

K.S. Worthington, A.M. Bartlett, A.K. Salem, B.A. Tucker and C.A. Guymon "Micro- and nano-structured photopolymers as photoreceptor regeneration scaffolds" ACS National Meeting, March 16 – 20, **2014**, Dallas, TX

K.S. Worthington, A.M. Bartlett, A.K. Salem and C.A. Guymon, "Controlled micro- and nano-structure of stem cell scaffolds for photoreceptor regeneration," AIChE Annual Meeting, November 3 – 8, **2013**, San Francisco, CA

K.S. Worthington, A.K. Salem, C.A. Guymon and B.A. Tucker "Controlled properties of stem cell scaffolds for photoreceptor regeneration," ARVO Annual Meeting, May 5 – 9, **2013**, Seattle, WA (poster)

K.S. Worthington, A.K. Salem, B.A. Tucker and C.A. Guymon "Improving the design of retinal regenerative stem cell scaffolds," ACS National Meeting, April 7 – 11, **2013**, New Orleans, LA

K.L. Sorenson, A.K. Salem and C.A. Guymon, "Nanostructured photo cross-linked biopolymers in wound-healing and drug delivery applications," AIChE Annual Meeting, October 16 – 21, **2011**, Minneapolis, MN

Campus Talks

The University of Iowa

K.S. Worthington, B.B. Banach and B.A. Tucker, "Human retinal engineering: tissue-engineered multilayer retinal grafts," Eye Interest Group, Wynn Institute for Vision Research, October 22, **2015**

K.S. Worthington, "Retinal Engineering: building biomaterials for better vision" Three-minute thesis competition, April 18, **2015**

K.S. Worthington, M. Rethwisch, A.K. Salem, C.A. Guymon and B.A. Tucker, "Chitosan hydrogels with tune-able physical properties for retinal regeneration applications," Eye Interest Group, Wynn Institute for Vision Research, October 2, **2014**

K.S. Worthington, A.M. Bartlett, A.K. Salem, C.A. Guymon and B.A. Tucker "Control of polymer physical, mechanical, and chemical properties for retinal regenerative stem cell scaffolds," Eye Interest Group, Wynn Institute for Vision Research, December 5, **2013**

K.S. Worthington, A.K. Salem, B.A. Tucker and C.A. Guymon, "Controlling polymer properties for optimized interactions with cells" Department of Chemical and Biochemical Engineering, January 31, **2013**

TECHNICAL EXPERIENCE

The University of Iowa, Postdoctoral Research Fellow

- Evaluation of cell pluripotency and differentiation by rt-PCR and Western blotting
- Imaging of tissues, cells, and polymers by SEM, immunocytochemistry and confocal microscopy
- Encapsulation of stem cells in visible light photo-crosslinked chitosan hydrogels
- Fabrication of crosslinked tropoelastin Bruch's membrane constructs
- Development of tissue scaffold 3D models, including vascular mimics (i.e. choroid)
- Fabrication of precisely patterned cell/tissue scaffolds via two-photon polymerization

The University of Iowa, Presidential Graduate Research Fellow

- Photopolymerization of nanostructured polymer hydrogels using ultraviolet radiation
- Evaluation of hydrogel physical properties including modulus and network swelling
- Surfactant templating of hydrogels and subsequent structure evaluation

- Evaluation of drug release capabilities of various polymer constructs
- Modification, purification, and characterization of biopolymers
- Evaluation of various material interactions with induced pluripotent stem cells

Utah State University, Graduate Research Assistant (sponsored by Thermo Fisher Scientific)

- Oxygen mass transfer studies in small and large scale fermentation and cell culture vessels
- Preparation and operation of numerous disposable processing biotechnologies
- Fabrication of fermentation process hardware
- Pilot-scale microorganism cultivation feasibility studies

NON-ACADEMIC WORK

Consulting

2013 OPI Industries – produced methacrylate-functionalized organoclays

2012 Maxwell Products – recommended alternative sources for scarce component of roadway crack sealant

TEACHING

The University of Iowa

2016 **Guest Instructor** – Polymer Chemistry
10 sessions throughout the semester on molecular weight measurements, polymerization mechanisms and kinetics
Adjunct Lecturer – Materials Science and Engineering
Responsible for overseeing all aspects of the summer course; rated 5.74/6.00 on instructor effectiveness, 5.58/6.00 on student basic understanding

2015 **Graduate Certificate in College Teaching**
Courses: Design and Facilitation of Online Courses, College Teaching Seminar
Practicums: Materials Science and Engineering, Polymer Chemistry (see below)
Portfolio: Created an online academic professional web page
Student Teacher - Materials Science and Engineering
8 sessions on mechanical properties, deformation and strengthening mechanisms, mechanical failure and phase transformations; utilized lecture capture and clicker technologies.

2014 **Student Teacher** - Polymer Chemistry
5 sessions on polymerization kinetics and copolymers; created and graded 50% of homework and exam problems for the course.
Teaching Assistant - Design of Experiments Short Course

2013 **Primary Instructor** - Process Dynamics and Control in Design
Responsible for overseeing all aspects of the course; rated 5.57/6.00 on instructor effectiveness, 5.86/6.00 on student basic understanding

2012 **Teaching Assistant** - Materials Science and Engineering

2009 **Teaching Assistant** - Engineering Problem Solving I

Utah State University

2007 **Teaching Assistant** - Biological and Environmental Thermodynamics

MENTORING

2017	Research supervisor to MSTP summer rotation student (BiomedE)
2016 – Present	Research supervisor and mentor to fast-track B.S./M.S. student (BiomedE)
2015	Research supervisor and mentor to undergraduate summer student (BiomedE)
2014 – Present	Peer mentor to Ph.D. student (ChemE)
2014	Research supervisor and mentor to undergraduate summer student (ChemE)
2013 – Present	Peer mentor to Ph.D. student (ChemE)
2012 – 2017	Peer mentor to Ph.D. student (ChemE)
2012 – 2014	Research supervisor and mentor to Undergraduate Research Fellow and Goldwater Nominee (ChemE)
2012	Research supervisor and mentor to REU summer student (Chemistry)
2010	Research supervisor and mentor to REU summer student (Engr)

SERVICE

Manuscript Review Journals

Proceedings of the Materials Research Society
Experimental Biology and Medicine

University Service

The University of Iowa

2016 – 2017	Postdoctoral Representative, UI Research Council
	Vice President, Postdoctoral Association
	Chair of Policy and Advocacy Committee, Postdoctoral Association
2015 – 2016	Professional Development Committee, Postdoctoral Association
	College of Medicine Co-Rep, Postdoctoral Association
2013 – 2014	Math, Engineering and Physical Sciences Student Representative, Graduate Council
2012 – 2014	Department Senator, Graduate Student Senate
	Co-Chair of Academic Mentoring Committee, Graduate Student Senate
2012 – 2013	K-12 Outreach Chair, the Society of Women Engineers

Utah State University

2008 – 2009	Peer Mentor, New Student Orientation Program
2007 – 2009	Public Relations Officer, College of Engineering Student Council
	President, Alternative Spring Break Service Club

2007 – 2008 Vice-president, Biological Engineering Club

Community Outreach

The University of Iowa

2013 – Present Volunteer Judge, Eastern Iowa Science and Engineering Fair
2012 Co-Organizer, UI Engineering Girl Scout Day
Volunteer Instructor, Go! Girls STEM Day
2011 – 2012 Volunteer Instructor, UI PharmCamp
Volunteer Instructor, Open Minds, Open Doors

Utah State University

2008 Volunteer Chaperone, Engineering State

PROFESSIONAL MEMBERSHIPS

- Society for Biomaterials (SFB)
- The American Association for the Advancement of Science (AAAS)
- The Association for Research in Vision and Ophthalmology (ARVO)
- The American Chemical Society (ACS)
- American Institute for Chemical Engineers (AIChE)
- Materials Research Society (MRS)
- The Society of Women Engineers (SWE)
- Tau Beta Pi
- Institute for Biological Engineers (IBE)
- Order of the Engineer