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Emily Wilts, Ph.D.

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Professional Profile

Dr. Wilts consults on proactive and reactive projects involving materials selection, risk assessment, and failure analysis for medical devices, combination products, and consumer products. Dr. Wilts utilizes her background in polymer structure-property-processing relationships and biocompatibility to predict, verify, and validate how materials behave in complex manufacturing and biological settings. Specifically, Dr. Wilts leverages her experience to assist clients in product development, biocompatibility assessments, and regulatory submissions.

She has practical knowledge in free-radical, RAFT, melt step-growth, and cationic ring opening polymerization and uses thermal, mechanical, and photo/melt/solution rheology to identify bulk and solution properties. She regularly uses 1H, 13C, and 31P NMR spectroscopy and FTIR for chemical characterization, DSC, TGA, DMA, and melt/solution/photo rheology for bulk polymer characterization. She has experience creating new polymers for binder jetting, selective laser sintering, stereolithography, and extrusion additive manufacturing processes and traditional manufacturing processes such as melt extrusion, reactive extrusion, and spray coating. Additionally, Dr. Wilts has extensive experience in translational medicine where she developed Class II, Class III, active-implantable, in-vitro diagnostic, and combination medical devices from design and preclinical stages to regulatory submissions. She is well versed in chemical and biological risk assessments, disease modeling, and histological characterization to determine biocompatibility of polymers and medical devices in vivo and in vitro.

Dr. Wilts completed her doctorate in Macromolecular Science and Engineering at Virginia Tech in 2020. She investigated structure-property-processing relationships of water-soluble and biodegradable polymers for 3D printing and biomedical applications. While researching personalized dosage pharmaceuticals, she synthesized varying polymer architectures of water-soluble polymers to increase binding strength of additively manufactured oral tablets and printed one of the strongest reported in literature. She also discovered a key physical property to predict printability of liquid adhesives for binder jetting using complex rheological characterization. She completed a Postdoctoral Fellowship in 2022 at the University of British Columbia studying immunoprotective biomaterials used for encapsulation of islets for cell-therapy treatments of diabetes. She identified time-releasing anti-inflammatory agents attached to PEG-based polymer to decrease immune attack in vivo and prolong islet survival.

Academic Credentials & Professional Honors

Ph.D., Macromolecular Science and Engineering, Virginia Polytechnic Institute and State Univ, 2020

B.S., Chemistry, Penn State University, 2016

Dragon’s Den Pitch Competition Winner, British Columbia Regenerative Medicine, 2021

Jean Ann Russe Skiles Ph.D. ’87 Graduate Fellowship, 2018

Runner-up, College of Science Roundtable Make-a-Difference Scholarship, 2018, 2019

Interdisciplinary Graduate Education Program Fellowship, 2016

Licenses and Certifications

NAMSA ISO 10993 Series 1 Biocompatibility Testing, Evaluation and Risk Management

Prior Experience

Postdoctoral Research Fellow, University of British Columbia, 2020 - 2022

Ph.D. Candidate, Virginia Tech, 2016 - 2020

R&D Intern - Waterborne Automotive Paints and Coating, Axalta Coating Systems, 2016

R&D Intern - Film Manufacturing and Supply Chain Operations, 3M Company, 2015

Professional Affiliations

Regulatory Affairs Professionals Society

American Chemical Society

Adhesion Society

Patents

Patent Application No. 17/442,811: Star, Branched, and Graft Polymers in Binders for Inkjet Additive Manufacturing of Personalized Tablets, September 2021 (Wilts EM, Ma D, Williams CB, Long TE)

Publications

Ramzy A, Belmonte PJ, Braam MJS, Ida S, Wilts EM, Levings MK, Rezania A, Kieffer TJ. A century-long journey from the discovery of insulin to the implantation of stem cell–derived islets. Endocrine Review, 2023, 44(2), 222-253.

Brown JR, Herzberger J, Spiering GA, Wilts EM, Moore RB, Long TE. Binary Thiol-Acrylate Photopolymerization for the Design of Degradable Acetal-Functionalized Hydrogels. ACS Applied Polymer Materials, 2022, 5(1) 1030-1036.

Khan ZM, Wilts EM, Vlaisavljevich E, Long TE, Verbridge, S.Characterization and structure-property relationships of an injectable thiol-Michael addition hydrogel toward compatibility with glioblastoma therapy, Acta Biomaterialia, 2022; 144, 266-278.

Russo V, Jalili R, Yang Y, Agarwal R, Pan S, Hakimi N, Jahan K, Wilts EM, Ida S, Getsios S, Kieffer TJ, Wadsworth S. Bioprinted Allogeneic Islet–Containing Implants Normalize Blood Glucose Control in Diabetic Rat Models without Immune Suppression, Diabetes, 2022; 71(Supplement_1):816-P.

Ramzy A, Belmonte PJ, Braam MJS, Ida S, Wilts EM, Levings MK, Rezania A, Kieffer TJ. A century long journey from the discovery of insulin to the implantation of stem cell derived islets, Endocrine Reviews, 2022; bnac021.

Zawaski CE, Chatham CA, Wilts EM, Long TE, Williams CB. Using fillers to tune material properties of an ion-containing semi-crystalline poly (ethylene glycol) for fused filament fabrication additive manufacturing. Additive Manufacturing 2021; 39, 101844.

Khan ZM., Wilts EM, Vlaisavljevich E, Long TE, Verbridge SS. Electroresponsive Hydrogels for Therapeutic Applications in the Brain. Macromolecular Bioscience 2021; 2100355.

Wilts EM, Long TE. Sustainable Manufacturing: Predicting Jettability of Water-Soluble, Biodegradable, and Recyclable Polymers for Binder Jetting Additive Manufacturing, Polymer International 2020; 70 (7), 958-963.

Wilts EM, Long TE. Thiol-Ene Addition Enables Tailored Synthesis of Poly(2-oxazoline)-graft- Poly(vinyl pyrrolidone) Copolymers for Binder Jetting 3D Printing. Polymer International 2020; 69 (10), 902-911.

Wilts EM, Gula A, Davis C, Chartrain N, Williams CB, Long TE. Vat Photopolymerization of Liquid, Biodegradable PLGA-based Oligomers as Tissue Scaffolds. European Polymer Journal 2020; 130, 109693.

Wilts EM, Ma D, Bai Y, Williams CB, Long TE. Comparison of Linear and 4-arm Star Poly(vinyl pyrrolidone) for Aqueous Binder Jetting Additive Manufacturing of Personalized Dosage Tablets. ACS Applied Materials and Interfaces 2019; 11, 27, 23938-23947.

Zawaski CE, Wilts EM, Chatham CA, Stevenson AT, Pekkanen AM, Li C, Tian Z, Whittington AR, Long TE, Williams CB. Tuning the material properties of a water-soluble ionic polymer using different counterions for material extrusion additive manufacturing. Polymer 2019; 176, 2, 283-292.

Wilts EM, Pekkanen, AM, White BT, Meenakshisundaram V, Aduba D, Williams CB, Long TE. Vat Photopolymerization of Charged Monomers: 3D Printing with Supramolecular Interactions. Polymer Chemistry 2019; 10 (12), 1442-1451.

Wilts EM, Herzberger J, Long TE. Addressing Water Scarcity: Cationic Polyelectrolytes in Water Treatment and Purification. Polymer International 2018; 67 (7), 799-814.

Moon NG, Mazzini F, Pekkanen AM, Wilts EM, Long TE. Sugar Derived Poly(β-thioester)s as a Biomedical Scaffold. Macromolecular Chemistry and Physics 2018; 219, 1800177. Wilts EM, Modzelewski T, Allcock HR. Elastomeric Polyphosphazenes with Phenoxy-cyclotriphosphazene Side Groups. Macromolecules 2015; 48, 7543-7549.

Presentations

Emily M. Wilts, Priye Iworima, Reza Jalili, Shogo Ida, Spiro Getsios, and Timothy J. Kieffer. 4D Manufacturing: Immunoprotective Materials for Islet Tissue Patches in Cell-Based Diabetes Treatments. Oral Presentation, American Society for Artificial Internal Organs, San Francisco CA, 2023.

Wilts EM, Ma D, Bai Y, Williams CB, Long TE. Additive manufacturing of personalized medicine: comparison of linear, 4-arm star, and graft poly(vinyl pyrrolidone) as polymeric binders for binder jetting. Oral Presentation, American Chemical Society National Meeting, Philadelphia PA, Virtual, 2020.

Wilts EM, Ma D, Bai Y, Williams CB, Long TE. Comparison of Linear and 4-arm Star Polyvinylpyrrolidone for Aqueous Binder Jetting Additive Manufacturing of Personalized Dosage Tablets. Oral Presentation, Adhesion Society National Meeting, San Diego CA, 2020.

Emily M. Wilts, James R. Brown, Jana Herzberger, Nicholas Chartrain, Ashwath Kumar, Christopher B. Williams, and Timothy E. Long. Polymer Design for Drug Delivery Systems: Acid and Hydrolytically Cleavable Network Scaffolds for Personalized Dosage Pharmaceuticals. Macromolecules Innovation

Institute Conference and Review, Blacksburg VA, 2019.

Wilts EM, Pekkanen, AM, White BT, Meenakshisundaram V, Aduba D, Williams CB, Sirrine J, Pekkanen AM, Zawaski C, Long TE. Additively Manufacturing Demands Advanced Materials Characterization: Influences of Molecular Weight Distribution, Rheology, and Photo-reactivity'. Oral Presentation, Materials Characterization Summit, Akron OH, 2018.

Moon NG, Mazzini F, Pekkanen AM, Wilts EM, Long TE. Derived Poly(β-thioester)s as a Biomedical Scaffold. Poster Presentation, Polycondensation, Alexandria VA, 2018.

Emily M. Wilts, Herzberger, J.; Brown, J. R.; Chartrain, N.; Kumar, A. Y.; Williams, C. B.; Long, T. E. Polymer Design for Drug Delivery Systems: From acid cleavage network scaffolds to water-soluble 3D printed polymers. Poster Presentation, Virginia Tech Drug Discovery Symposium, Blacksburg VA, 2018.

Emily M. Wilts, Herzberger, J.; Brown, J. R.; Chartrain, N.; Kumar, A. Y.; Williams, C. B.; Long, T. E. Polymer Design for Drug Delivery Systems: From acid cleavage network scaffolds to water-soluble 3D printed polymers. Oral Presentation, Adhesion Society National Meeting, Hilton Head NC, 2018.

Wilts, E. M., Pekkanen, A. M., Moon, N.; Da, M.; Bai, Y.; Williams C. B.; Long, T. E. Isocyanate-free Polyurethanes based on Biocompatible Monomers'. Poster Presentation, American Chemical Society National Meeting, Washington DC, 2017.