Charley M. Goodwin

Ph.D.

Staff Consultant

Dr. Charley M. Goodwin is a Staff Consultant at Engineering Systems Inc. (Esi) in the Dallas, Texas office. As a biomedical engineer, Dr. Goodwin has experience in the medical device industry where she has been involved in product development, including design, manufacturing, verification and validation testing and regulatory standards (US FDA and EU) for orthopedic implants as well as suture and mesh degradable polymers. Further, she has knowledge in medical device failure analysis and post market surveillance. As a researcher, Dr. Goodwin has a background in biomaterial surface analysis, encompassing aspects of electrochemical behavior, tribology, wear and biological interactions.

Prior to joining ESi, Dr. Goodwin earned a doctorate from Clemson University – Medical University of South Carolina Bioengineering program. Her dissertation research focused on implant retrieval analysis of a permanent birth control device paired with novel metallic biomaterial characterization. Dr. Goodwin has experience in biomaterial characterization utilizing digital optical microscopy, scanning electron microscopy, energy dispersion spectroscopy, electrical impedance spectroscopy, inductively coupled plasma mass spectrometry as well as culturing mammalian cell lines for *in vitro* biocompatibility tests.

Dr. Goodwin has presented her engineering research internationally at the World Biomaterials Congress (2024) as well as multiple national conferences, Society of Biomaterials and Orthopedic Research Society. Additionally, she is published in peer-reviewed journals including *Acta Biomateriala* and the *Journal of Orthopedic Research* and is named on one invention disclosure.

Education

PhD, Bioengineering, Clemson University, Medical University of SC, Charleston, SC, 2020-2024

BS, Biomedical Engineering, University of Cincinnati, Cincinnati, OH, 2020

Contact Information

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ESi Dallas

10338 Miller Road
Dallas, TX 75238

Areas of Specialization

- Metals
- Medical Devices
- Design Analysis
- Risk Assessment

Positions Held

Engineering Systems Inc., Dallas, Texas

- Staff Consultant, 2024 – Present

Johnson & Johnson, Norderstedt, Germany

- Research & Development Co-Op Student, 2019 - 2019

Zimmer Biomet, Warsaw, Indiana

- Staff Consultant, 2024 – Present
- Product Development Trauma Co-Op, 2017 – 2017
- Product Development Knee Co-Op, 2016 - 2016

Professional Affiliations/Honors

Society for Women in Engineering

- Collegiate Outreach Chair 2022

Orthopedic Research Society

- Member, Orthopedic Implants Section Member, 2021- Present

Society for Biomaterials

- Member, 2021 - Present

Publications

"The Effect of Implant Size on Fretting Currents of Acetabular Cup-Liner Tapers During in Vitro Cyclic Loading" P.W. Kurtz, A Mace, **C. M. Goodwin,** and J.L Gilbert, *Journal of Orthopaedic Research®*, https://doi.org/10.1002/jor.70083, 2025

"Low-energy Electron Beam Modification of Metallic Biomaterial Surfaces: Oxygen and Silicon-Rich Amorphous Carbon as a Wear-resistant Coating," Kurtz, P.W., Lee, H. Mace, A. **Goodwin, C.M**., & Gilbert, J.L., Journal of Biomed Materials Research, 113: e37849 https://doi.org/10.1002/jbm.a.37849, 2025.

"Tin Silver Alloy as a Biomaterial: Corrosion Characteristics and Cellular Behavior," **Goodwin, C.M**., Mace, A.O., & Gilbert, J.L., Journal of Biomed Materials Research, 113: e37822 https://doi.org/10.1002/jbm.a.37822, 2025.

"Wear, Material Transfer, and Electrocautery Damage Are Ubiquitous on CoCrMo Femoral Knee Retrievals," Kurtz, P.W., Kurtz, M.A., Aslani, S., Taylor, L.M., **Goodwin, C.M**. and MacDonald, D.W. & Gilbert, J.L., Journal of Biomed Materials Research Part B: Applied Biomaterials, 112(12), e35504, https://doi.org/10.1002/jbm.b.35504.

“Tin-Silver as a Novel Biodegradable Metallic Biomaterial,” Kurtz, P.W., Kurtz, M.A., Aslani, S., Taylor, L.M., **Goodwin, C.M**., All Dissertations 3641, https://open.clemson.edu/all_dissertations/3641, 2024.

“Wear, Material Transfer, and Electrocautery Damage Are Ubiquitous on CoCrMo Femoral Knee Retrievals,” Kurtz, P.W., Kurtz, M.A., Aslani, S., Taylor, L.M., **Goodwin, C.M**. and MacDonald, D.W., Piuzzi, N.S., Mihalko, W.M., Kurtz, S.M. & gilbert, J.L Journal of Biomed Materials Research, 112:e35504, https://doi.org/10.1002/jbm.b.35504, 2024.

“Fretting Corrosion Testing of Acetabular Modular Tapers for Total Hip Replacements A Comparison of two Designs,” A. Mace, **C.M. Goodwin**, and J.L. Gilbert, Journal of Orthopaedic Research®, https://doi.org/10.1002/jor.25512, 2023

“Retrieval Analysis of The Essure® Micro Insert Female Sterilization Implant: Methods For Metal Ion and Microscopic Analysis,” **C.M. Goodwin**, C. Aslan, and J.L. Gilbert, Acta Biomaterialia 162, pp 312-323 https://doi.org/10.1016/j.actbio.2023.03.025, 2023

Presentations

“Residual AI203 from Grit Blasted Tibial Trays Result in Third Body Wear Particles on the Bearing Surface of CoCrMo Retrieved Knees,” Kurtz, P., Kurtz, M., Aslani, S., Taylor, L.M., **Goodwin, C.M.**, MacDonald, D.W., Piuzzi, N.S. Mihalko, W.M., Kurtz, S.M., Gilbert, J.L., presented at the International Society for Technology in Arthroplasty, Italy, September 2025.

“The Corrosion characteristics of Induced Electrocautery Damage (ECD) in CoCrMo Implant Alloys,” Karshenas, M., Lee, H., **Goodwin, C.M.**, Gilbert, J.L., presented at the Society for Biomaterials, Chicago, April 2025.

“In Vitro Cytotoxicity of Tin Chloride on MC3T3-E1 Preosteoblasts,” **Goodwin, C.M.**, Gilbert, J.L., presented at the World Biomaterials Congress, Korea, May 2024.

“Galvanic Coupling of Tin-Silver Alloy to 316L Stainless Steel at Varying Surface Area Ratios,” **Goodwin, C.M.**, Gilbert, J.L., presented at the World Biomaterials Congress, Korea, May 2024.

“Tin Silver Impedance Behavior in Physiological Solutions,” **Goodwin, C.M.**, Aslan C., Gilbert, J.L., presented at the Society for Biomaterial April 2023.

“The Effect of Implant Size on Fretting Currents of Acetabular Cup-Liner Tapers During in vitro Cyclic Loading,” Kurtz, P., Mace, A.O., **Goodwin, C.M.**, Gilbert, J.L., presented at the Orthopedic Res Soc, February 2023.

“Synovial Fluid May Affect Ti-6AI-4V and CoCrMo Ion Release,” Kurtz, M.A., Phan, L., Lee, H., **Goodwin, C.M.**, Taylor, L.M., Gilbert, J.L., presented at the Orthopedic Res Soc, February 2023.

“Corrosion characteristics of orthopedic alloys: Effects of retrieved synovial fluid and artificial physiological solutions,” **Goodwin, C.M.**, Mace, A., Khullar, P., Walton, Z., Gilbert J.L., presented at the Orthopedic Res Soc, February 2023.

"A Retrieval Study of the Essure Micro Insert Female Sterilization Implant," **Goodwin, C.M.**, Aslan C., Gilbert, J.L., presented at the Society for Biomaterial Annual Meeting, April 2022.

Patents and Invention Disclosures

Tin Alloys as a Smart Metallic Biomaterial Invention Disclosure, 2022

Technical Skills

Material Characterization

- Implant retrieval analysis of the Essure Micro Insert Female Sterilization Device
- Metallic material preparation techniques including polishing, embedding and sterilization
- Material imaging and characterization utilizing Digital Optical Microscopy (DOM), Scanning Electron Microscopy (SEM), and Energy Dispersion Spectroscopy (EDS)
- Fatigue and wear testing using a Mechanical Test System (MTS) and Instron Machines.
- Trace metal ion analysis of biological, organic and inorganic materials using Inductively-Coupled Plasma Mass Spectrometry (ICP-MS)
- Evaluation of Electrochemical Corrosion principles though potentiostatic, potentiodynamic, galvanostatic and electrochemical impedance spectroscopy tests using Versastat, Solartron and custom-built devices equipped with CorrView and ZView softwares

Tissue and Cell Culture Techniques

- Sterile implant/tissue dissection from retrieved human samples
- Growth of Mammalian cell line, MC3T3-E1
- Fluorescent staining techniques including live-dead assay in a transmitting fluorescent microscope
- Post-imaging cellular analysis in ImageJ to determine cell size, shape and viability