



CHARLEY M. GOODWIN, Ph.D.

STAFF CONSULTANT

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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 and 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 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 Biomaterialia* and the *Journal of Orthopedic Research*, and is named on one invention disclosure.

Areas of Specialization

Metals
Medical Devices
Design Analysis
Risk Assessment

Education

B.S., Biomedical Engineering, University of Cincinnati, Cincinnati, OH, 2020
Ph.D., Bioengineering, Clemson University, Medical University of SC, Charleston, SC, 2020-2024

Professional Affiliations

Society for Women in Engineering

Collegiate Outreach Chair 2022

Orthopedic Research Society

Society for Biomaterials

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

Product Development Upper Extremities Co-Op, 2018 - 2018

Product Development Trauma Co-Op, 2017 - 2017

Product Development Knee Co-Op, 2016 - 2016

Publications/Presentations

Mace, A., **Goodwin, C. M.**, & Gilbert, J. L. (2023). Fretting Corrosion Testing of Acetabular Modular Tapers for Total Hip Replacements: A comparison of two designs. *Journal of Orthopaedic Research*. <https://doi.org/10.1002/jor.25512>

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

Goodwin C.M., Mace.A.O., Gilbert J.L., *Tin Silver Alloy as a Biomaterial: Corrosion Characteristics and Cellular Behavior*. *Journal of Biomedical Materials Research, Part A* 2024. [Under Review]

Goodwin CM, Aslan C, Gilbert JL, “A Retrieval Study of the Essure Micro Insert Female Sterilization Implant”, Soc for Biomat, Annual Meeting, Apr, 2022.

Goodwin CM, Mace A, Khullar P, Walton Z, Gilbert JL, “Corrosion characteristics of orthopedic alloys: Effects of retrieved synovial fluid and artificial physiological solutions”, Orthop Res Soc, Feb, 2023.

Kurtz MA, Phan L, Lee H, **Goodwin CM**, Taylor LM, Gilbert JL, “Synovial Fluid May Affect Ti-6Al-4V and CoCrMo Ion Release”, Orthop Res Soc, Feb, 2023.

Kurtz P, Mace, AO, **Goodwin CM**, Gilbert JL, “The Effect of Implant Size on Fretting Currents of Acetabular Cup-liner Tapers During In vitro Cyclic Loading”, Orthop Res Soc, Feb 2023

Goodwin CM, Gilbert JL, “Tin Silver Impedance Behavior in Physiological Solutions”, Soc For Biomat, Apr. 2023

Goodwin CM, Gilbert JL, “Galvanic Coupling of Tin-Silver Alloy To 316L Stainless Steel at Varying Surface Area Ratios”, World Biomaterials Congress, Korea, 2024, Accepted.

Goodwin CM, Gilbert JL, “In Vitro Cytotoxicity of Tin Chloride on MC3T3-E1 Preosteoblasts”, World Biomaterials Congress, Korea, 2024, Accepted.

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 through 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