Jeffrey Kagle

M.S. Candidate, Mechanical Engineering · Cornell University
425-326-9532 · JeffKagle@hotmail.com

RESEARCH INTERESTS

Soft and bio-inspired robotics; underwater locomotion; embodied energy and multifunctional energy storage for robots; soft actuators; microfluidic and organ-on-chip devices for biomedical research.

EDUCATION

Cornell University, Ithaca, NY — Expected May 2027
M.S., Mechanical Engineering · GPA: 3.9 · Advisor: Prof. Robert Shepherd
Thesis: RCADE: A Redox Cooled Acoustic Damping Enclosure for an Embodied Energy Fish

Case Western Reserve University, Cleveland, OH — May 2025
B.S.E., Mechanical Engineering · GPA: 3.6 · Dean's Honors List

RESEARCH EXPERIENCE

Organic Robotics Lab, Cornell University, Ithaca, NY — October 2025 – Present
Graduate Researcher · PI: Prof. Robert Shepherd

- Designing and modeling a metamaterial motor enclosure that damps vibration and acoustic emission in an underwater biomimetic swimming robot powered by an embodied-energy redox flow battery. The enclosure is designed to use the battery electrolyte as motor coolant, with the aim of improving both motor and battery efficiency.
- Conducting cyclic voltammetry experiments to evaluate redox flow battery performance.
- Optimizing thunniform swimming for a large-scale biomimetic embodied-energy swimming robot.
- Mentoring undergraduates in

Cao Research Group, Case Western Reserve University, Cleveland, OH — September 2024 – May 2025
Graduate Researcher · PI: Prof. Chase Cao

- Led a team of four student researchers in designing and prototyping a soft robotic motor based on Peano-HASEL actuators for lightweight, flexible, and durable underwater propulsion.
- Developed biomimetic robots based on cuttlefish fin biomechanics, applying bio-inspired design principles to robotic locomotion.

Dixon Lab, Case Western Reserve University, Cleveland, OH — April 2023 – September 2024
Undergraduate Researcher and Engineering Technician · PI: Prof. Angela Dixon

- Designed and prototyped a Modular Microfluidic Incubator (MMI) that resolves heating and accessibility problems in "nose-on-chip" experiments, improving experimental reliability.
- Tested the MMI with locally harvested nasal epithelial cells in collaboration with the University of Tours (France), validating that the device works across laboratories.
- Worked with CWRU's intellectual property office to submit a provisional patent application on the MMI and presented the device to prospective industry partners.
- Built custom apparatus for biological research, including microscopy holders and 3D-printed respiratory models.

Advanced Platform Technology (APT) Center, Cleveland, OH — October 2021 – September 2022
Undergraduate Researcher · Supervisor: Dr. Nathan Makowski

- Designed and CAD-modeled a thigh enclosure module for lower-limb prosthetic exoskeletons, integrating circuit boards and accelerometers for gait analysis and real-time feedback.
- Assisted clinical trials with stroke patients alongside clinicians, engineers, and rehabilitation specialists, evaluating hybrid prosthetics that combine an exoskeleton with TENS electrode units to improve gait and rehabilitation outcomes.

MANUSCRIPTS IN PREPARATION

Jeffrey Kagle, Douglas Palumbo, Robert Shepherd. "Redox Cooled Acoustic Damping Enclosure for an Embodied Energy Redox Flow Battery Robot." In preparation.

Douglas Palumbo, **Jeffrey Kagle**, Robert Shepherd. "Zinc-Iodide Redox Flow Battery Tendon-Driven Embodied Energy Swimming Robot." In preparation.

Jeffrey Kagle, Isira Vinthage, …, Angela Dixon. "Design of Affordable Benchtop Cell-Culture Incubator Using 3-D Printable Housing and Basic Electronics for Lab-on-Chip Devices Integrating Respiratory-Like Airflow." In preparation with Nathalie Heuzé-Vourc'h (University of Tours); full author list to be finalized.

Airflow testing of particle deposition in locally harvested upper nasal epithelial cells (working title). In preparation with Nathalie Heuzé-Vourc'h (University of Tours) and additional co-authors; author list to be finalized.

PATENTS AND PRESENTATIONS

Jeffrey Kagle, Angela Dixon, Isira Vinthage. "Modular Microfluidic Incubator (MMI)." Provisional patent application, Case Western Reserve University, 2024.

Jeffrey Kagle, Kat Lobas, Jarod Lau. "Liquid Dielectric Elastomer Actuator Motor for Underwater Propulsion." Poster presentation, Intersections Research Symposium, Case Western Reserve University, April 2025.

INDUSTRY EXPERIENCE

Inductive Robotics, Seattle, WA — May 2024 – August 2024
Mechanical Engineering Intern

- Designed and prototyped a J1772-to-universal-plug smart adapter for an EV-charging robot to SAE International safety and compatibility standards, iterating on human factors, ergonomics, and cost.
- Coordinated with six interns across disciplines to integrate the adapter into the full robotic system and worked with Tamarisk Labs to adapt the design for a future NACS smart adapter.

LEADERSHIP

Case Western Reserve University Fencing Team — September 2023 – May 2025
Foil Captain (2024–25)

Treasurer (2023–24)

TECHNICAL SKILLS

Design and CAD: SolidWorks (CSWA certified), AutoCAD, Onshape, Autodesk Fusion 360

Modeling and Simulation: COMSOL, Ansys, OpenSim

Programming and Embedded Systems: MATLAB, Python, Java, ROS, Linux, Arduino, Raspberry Pi

Experimental methods: Cyclic voltammetry, photolithography, polymerization, microfluidic device prototyping, ISO 7 cleanroom work

Fabrication: 3D printing (Resin and FDM), CNC machining, waterjet cutting, TIG welding, milling, lathe, soldering

SELECTED COURSEWORK

Dynamics; Control of Mechanical Systems; Fluid Mechanics; Heat Transfer; Thermodynamics; Design of Fluid, Thermal, and Mechanical Elements; Design and Manufacturing; Circuits and Instrumentation; Statics and Strength of Materials; Chemistry of Materials; Musculoskeletal Biomechanics; Differential Equations; Statistics.