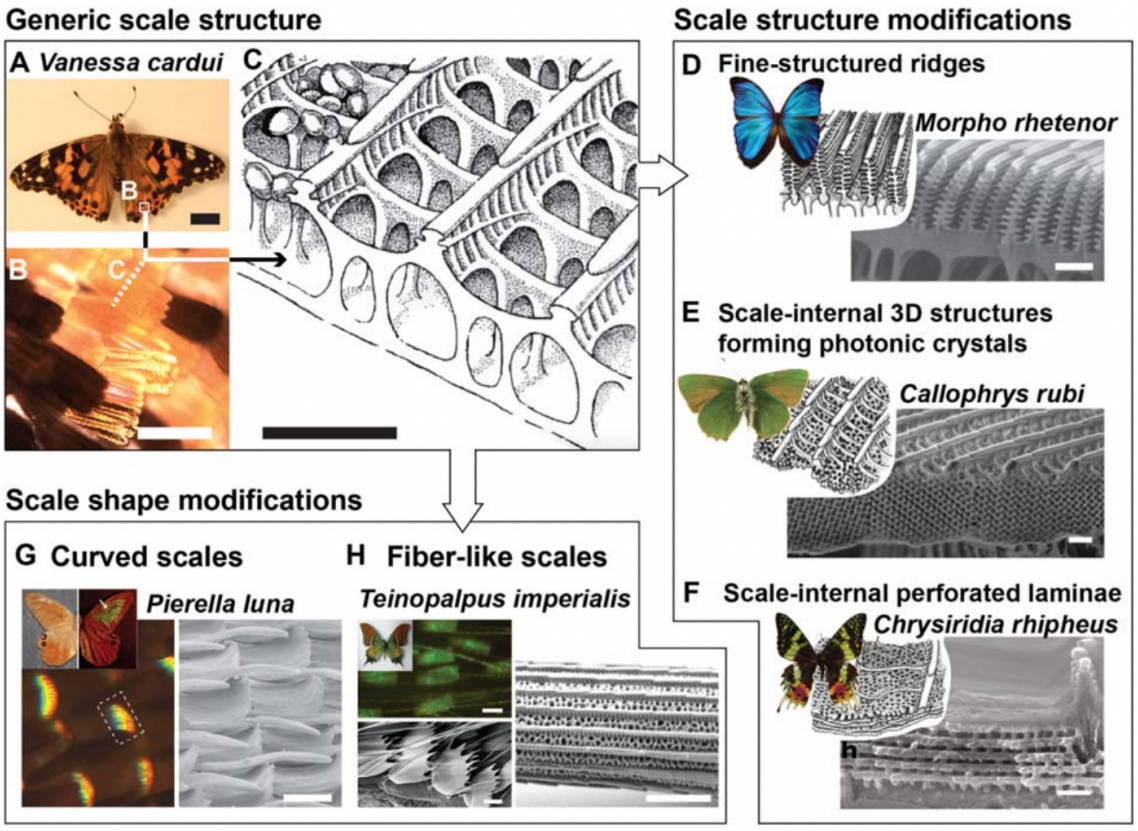
Postdoctoral Position in Computational Mechanics and Bio-Inspired Materials Design

This postdoc is funded through the MURI "Cellular Mechanics and Process Principles of 3D Secretion for Ultralight Multifunctional Materials in Butterfly Wing Scales." The goal of this project is to decipher the biological, physical, and chemical mechanisms that enable living cells to secrete complex hierarchical structures in functional biological materials, specifically butterfly wing scales. By understanding these cellular processes, we aim to identify novel design principles for building robust bio-derived and bioinspired materials with exceptional mechanical, optical, and thermal performance under physiological conditions.

This postdoctoral position is focused on developing imaging-informed computational models that predict how cytoskeletal organization, membrane configuration, and cuticle precursor dynamics control the formation of multiscale hierarchical structures during butterfly wing scale development.

This project is a collaboration between MIT, Boston University, Brandeis University, George Washington University, and University of California, San Francisco. This postdoctoral position has a primary appointment at Boston University in the Mechanical Engineering Department working in Emma Lejeune's lab, with an opportunity for a Visiting Scholar position at MIT in the Mechanical Engineering Department working in Mathias Kolle's lab. Prospective applicants should be comfortable working in person from both locations and traveling between campuses as needed for collaboration.



(Image from McDougal, A., Miller, B., Singh, M., & Kolle, M. (2019). Biological growth and synthetic fabrication of structurally colored materials. Journal of Optics, 21(7), 073001.)

The ideal candidate will have:

- A PhD in mechanical engineering, computational mechanics, applied mathematics, physics, or a related field
- Strong background in Finite Element Method (experience with FEniCS/FEniCSx or other open source software is a major plus; experience with large deformation mechanics and geometric instabilities also a plus)
- Experience with image analysis and integrating multi-modal experimental data into computational frameworks
- Proficiency in scientific programming (Python preferred) and experience with/exposure to software development best practices (version control, documentation, reproducibility)
- Strong publication record demonstrating ability to conduct independent research
- A collaborative mindset, where prior experience working with experimentalists in biology, biophysics, materials science, and related fields is a major plus
- Interest in open science practices and disseminating research tools to the broader community

Responsibilities will include:

- Developing phenomenological and energetically-informed computational models of scale structure formation
- Implementing finite element models incorporating experimental kinematic data from time-lapse microscopy
- Analyzing geometric instabilities and growth-induced deformations in biological materials
- Collaborating closely with experimental team members across multiple institutions
- Contributing to open source modeling frameworks and reproducibility packages
- Mentoring graduate and undergraduate students
- Presenting research at conferences and publishing in peer-reviewed journals

Position details:

- Three-year appointment with opportunity for extension based on performance and funding
- Competitive salary commensurate with experience.
- Comprehensive benefits package
- Professional development opportunities including workshops, conferences, and networking with DoD collaborators.
- Expected start date: Spring/Summer 2026

Application instructions: If you are interested, email your CV, a brief (1 paragraph) statement of interest in the body of the email describing how your background and future goals are aligned with this project, and the names of two references to Emma Lejeune at elejeune[at]bu[dot]edu with the subject line "MURI postdoc application: [your name]."

Applications will be reviewed on a rolling basis until the position is filled. Early application is encouraged.