

Designing Biomimetic Robots

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Abstract

The *Designing Biomimetic Robots: Researching the impact of an interdisciplinary bio-engineering-computational design curriculum on middle school engineering and science education* project is funded by the STEM+Computing program, which seeks to advance applied research on the integration of computational thinking and computing activities within the disciplines of science, technology, engineering, and mathematics (STEM) in early childhood education through high school (preK-12). In most middle schools, learning is segregated by discipline — science is taught in one class, and engineering or computing are taught in another, if at all. Yet today discovery and innovation are interdisciplinary and students need to use skills and practices from multiple subject areas to solve problems. The *Designing Biomimetic Robots* project will develop and study an education program that integrates science, engineering, and computing by engaging students in biomimicry design challenges to support students in developing computational thinking and scientific reasoning, as well as engineering design practices, while practicing interdisciplinary problem solving skills. Students will study the natural world to learn how animals and plants accomplish different tasks and then engineer a robot that is inspired by what they learned. For example, they may use what they learn about how different animals pick up objects to design a robot that can assist wheelchair-bound people in picking up dropped items. In addition, the project will demonstrate how teachers can foster interdisciplinary learning, and can broaden participation in science, engineering and computing among middle school students in diverse settings.

The project will develop an innovative intervention to support the development of interdisciplinary STEM knowledge and practices through a series of biomimetic design challenges. The program will include:

- a) a 4-week modular and flexible curriculum that integrates bio-inspired engineering design, robotics, and computer programming content and practices into middle school STEM classrooms,
- b) a teacher professional development program, and
- c) web resources to support integration of biomimetic robotics into middle schools.

The goal is for all participating students to develop knowledge, practices, and skills consistent with engineering and science standards, and computational thinking principles, and demonstrate an understanding that computing enhances STEM practice and knowledge development. Participating teachers will learn how to enact interdisciplinary instruction through integrating STEM and computing, and how to create task structures and discursive practices that support the participation of all students. The project will contribute to theory about interdisciplinary and participatory learning environments that can foster students' learning about the intersections of computation, engineering, and biomimicry. The project will work with 24 middle school teachers and approximately 3,200 students in urban, suburban, and rural districts in Massachusetts, Maryland, and Maine that have diverse student demographics.