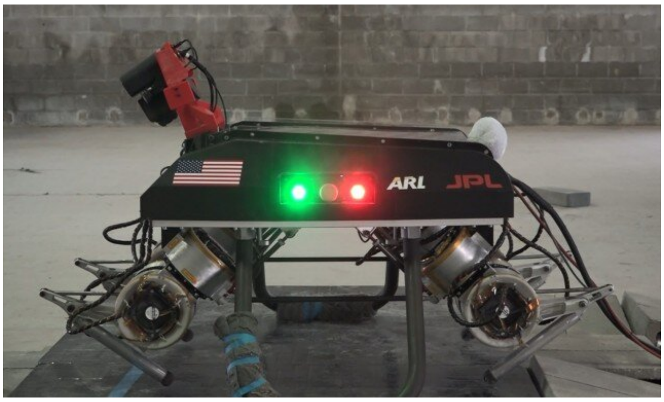
Army strengthens future tech with muscle-bound robots

17 December 2020



Credit: The Army Research Laboratory

Robotic systems packed with muscle tissue can produce never-seen-before agility and versatility, Army researchers said.

Researchers with the U.S. Army Combat Capabilities Development Command, now known as DEVCOM, Army Research Laboratory are teaming with collaborators at Duke University and the University of North Carolina on high-risk studies in biohybrid robotics.

"Though impressive in their own right, today's robots are deployed to serve a limited purpose then are retrieved some minutes later," said Dr. Dean Culver, a research scientist at the laboratory. "ARL wants robots to be versatile teammates capable of going anywhere Soldiers can and more, adapting to the needs of any given situation."Biohybrid robotics integrates living organisms to mechanical systems to improve performance.

"Organisms outperform engineered robots in so many ways. Why not use biological components to achieve those remarkable capabilities?" Culver asked rhetorically. The team's proposal involves the behavior of the proteins that drive muscle performance, he said.

Robotic systems packed with muscle tissue produce never-seen-before agility and versatility, Army researchers.

The first applications for biohybrid robotics the team expects to focus on are legged platforms similar to the Army's Legged Locomotion and Movement Adaptation research platform, known as LLAMA, and the U.S. Marine Corps' Legged Squad Support System, or LS3. Dean and his collaborators are also considering flapping-wing drones.

"One obstacle that faces ground-based robots today is an inability to instantly adjust or adapt to unstable terrain," Culver said. "Muscle actuation, though certainly not solely responsible for it, is a big contributor to animals' ability to navigate uneven and unreliable terrain. Similarly, flapping wings and flying organisms' ability to reconfigure their envelope gives them the ability to dart here and there even among branches. In multi-domain operations, this kind of agility and versatility means otherwise inaccessible areas are now viable, and those options can be critical to the U.S. military's success."

The team includes faculty collaborators from Duke University, who will direct computational research, and the University of North Carolina, who will manage experiments validating the predictions from the computational efforts. Army researchers will work on the theoretical mesomechanics that can be tested with the data collected from both the computational and experimental efforts.

Their work will be supplemented by a separate Duke University team working on macroscopic performance characteristics of muscle, tendon, and ligaments in jumping creatures for use in legged robots.

"Muscle tissue is outstanding at producing a specific amount of mechanical power at a given moment, and its versatility is unrivaled in robotic actuation today," he said.

Their research is expected to inform the biohybrid engineering community on how to culture strong muscle tissue rather than extract it from a trained organism, he said. In addition, he said researchers expect the research to offer insight into the mesomechanics that govern motor protein motion; the kind of motion responsible for muscle contraction overall.

Provided by The Army Research Laboratory