



Biodiversity: a Source of Next Generation Military Power?

Birds can fly, fish can breathe underwater, cheetahs run at remarkable speed, reptiles show incredible regenerative abilities and bacteria amazing resistance to attack.

The biodiversity of the planet is filled with what could be considered “super-powers”, and scientists and researchers with DARPA are now looking to that world to bring the Next Gen advantages to US warfighters.

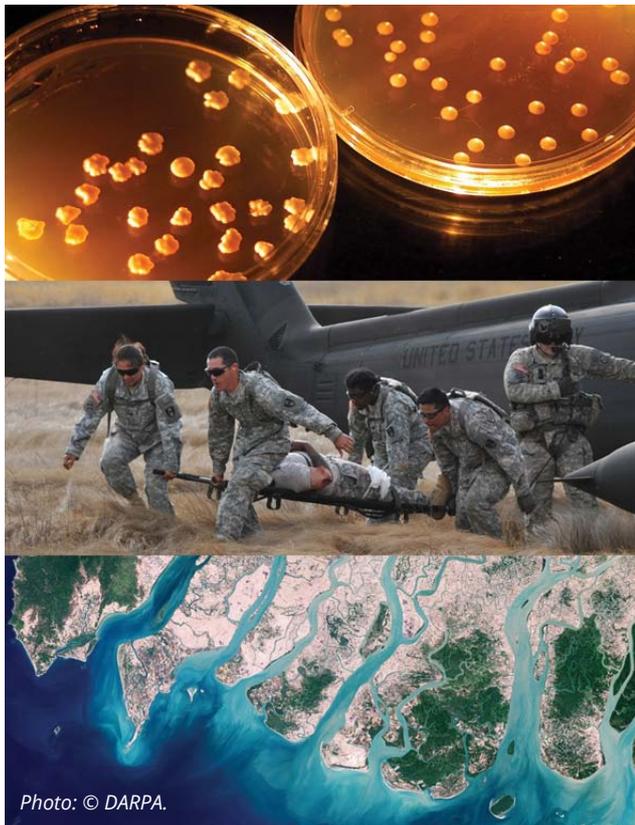


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In an April Press Release DARPA announced the launch of a new technology office that “will merge biology, engineering and computer science to harness the power of natural systems for national security.” While that may sound like the plot of the next “Spider-man” movie, it’s not. Testifying before the House Subcommittee on Intelligence, Emerging Threats and Capabilities, just prior to the April announcement, DARPA Director Arati Prabhakar said, “Biology is nature’s ultimate innovator and any agency that hangs its hat on innovation would be foolish not to look to this master of networked complexity for inspiration and solutions.”

With the launch of the new office, DARPA feels that biology takes its rightful place among the core sciences that represent the future of defense technology. Officially known as the Biological Technologies Office (BTO), its goals are to harness the power of biological systems by applying the rigorous tools of engineering and related disciplines, and to design next-generation technologies that are inspired by insights gained from the life sciences. BTO’s programs will operate across a wide range of spatial and temporal scales—from individual cells to humans and other organisms and the communities in which they operate. The purpose, according to Director Prabhakar, is for “BTO to explore the intricate and highly adapted mechanisms of natural processes and demonstrate how they can be applied to the mission of national defense.”

Recent progress in such diverse disciplines as neuroscience, sensor design, microsystems, computer science and other long-standing areas of DARPA investment has been converging rapidly over the last few years, revealing newly emergent possibilities ready to be realized. Forming BTO was the next logical step to harness that potential.

“The Biological Technologies Office will advance and expand on a number of earlier DARPA programs that made preliminary inroads into the bio-technological frontier,” said

- ▶ Geoff Ling, who has been named by Prabhakar to be the first head of BTO. “We’ve been developing the technological building blocks, we’ve been analyzing our results and now we’re saying publicly to the research and development community, ‘We are ready to start turning the resulting knowledge into practical tools and capabilities.’”

As far-reaching and ambitious as these may seem, BTOs Mission will focus on Three Critical Areas of Force Modernisation:

- **Restore and Maintain Warfighter Abilities:** Because military readiness depends on the health and wellbeing of service members, a critical focus is on cultivating new discoveries that help maintain peak warfighter abilities and restoring those abilities as quickly and fully as possible when they are degraded — including through the development of advanced prosthetics and neural interfaces. BTO will seek to develop new techniques and therapeutic strategies for addressing current and emerging threats, but its work will extend beyond medical applications to include exploration of complex biological issues that can affect a warfighter’s ability to operate and interact in the biological and physical world.
- **Harness Biological Systems:** The highly evolved functional and synthetic capabilities of biological systems
- **Apply Biological Complexity at Scale:** Biological systems operate over an enormous range of spatial, physical and temporal scales. Some organisms thrive as individual cells but most depend on dynamic interactions with other species. A better understanding of the interactions between mammalian and non-mammalian species and micro- and macro-organisms could foster new approaches to enhancing mental and physical health in routine and threatening situations. Similarly, disease vectors migrate around the globe slowly and stealthily at times, and at other times in devastating waves of breathtaking speed — reflecting poorly understood dynamics that can undermine national security. BTO is looking into pursuing new insights derived from biological complexity and living-system dynamics with the goal of developing applications to enhance global-scale stability and human wellbeing. ■

can be harnessed to develop new products and systems in support of national security with advantages over what even the most advanced conventional chemistry and manufacturing technologies can achieve. BTO seeks to establish a fundamental understanding of natural processes and the underlying design rules that govern the behavior of biological systems and apply that knowledge to forward-engineer new systems and products with novel functionality.



DARPA Robo fly Photo: © DARPA.