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## **Future Defense Scientists Take on Challenge of Synthetic Biology**

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DoD News, Defense Media Activity

The [Defense Threat Reduction Agency](#) is leading the charge in the Defense Department's synthetic biology effort. DTRA's work to increase understanding of synthetic biology and bioengineering among future military officers is manifested in the DTRA Syn Bio Academies Challenge, which kicked off with its inaugural year in 2016, culminating in the recent presentation of a perpetual trophy to the winning team, the U.S. Naval Academy at Annapolis, Maryland. The academy's victory was the culmination of a year in which midshipmen displayed a high level of understanding of bioengineering, demonstrated through their technical progress to address a problem of importance to countering weapons of mass destruction and through the presentation of their results as the first-ever team from a U.S. service academy to participate in the International Genetically Engineered Machine competition.

### **How Synthetic Biology Can Help the Military**

Dr. Brian Pate, a science and technology manager for DTRA's Chemical and Biological Technologies Department, explained that this type of biology is important for DoD's future.

*"Synthetic biology is a highly active and expanding technological domain that evolved from the intersection of biology and engineering. The DTRA Syn Bio Academies Challenge is an opportunity for students at the U.S. military academies to increase their knowledge in this emerging field of synthetic biology, to encourage their learning via competition for a perpetual trophy in the annual DTRA sponsored inter-academy syn bio technology challenge while simultaneously competing in the International Genetically Engineered Machine competition. This is the premier annual competition for undergraduate students in the field of synthetic biology and is sponsored by a nonprofit foundation," Pate said.*

Future warfighters and DoD leaders are able to develop and maintain an understanding of synthetic biology and bioengineering through these competitions, Pate said. It's important to the DoD for service members to "understand the potential impact on military technology and the ability to combat and counter weapons of mass destruction," he added.

*DTRA's Chemical/Biological Technologies Department works with academia and U.S. labs to solve today's chem/bio problems with tomorrow's solutions. Chemical and biological threats are constantly changing, evolving and being discovered. We identify those threats, create solutions, and work with researchers and industry to provide innovative solutions to our warfighters.*

The DoD has a broad interest in synthetic biology, and is investigating field with a view toward both addressing potential security concerns and also understanding how this field may be best engaged in the development of improved countermeasures, sensing, and production of specialty materials. The DoD's Chemical and Biological Defense Program has engaged the National Academy of Sciences, Engineering, and Medicine to assess potential security vulnerabilities related to advances in [synthetic biology](#). This field is also critical to the development of the next generation of countermeasures to weapons of mass destruction, which is the focus of the work by the service academies. Pate noted that it's important for the DoD to invest in synthetic biology developments because "as

technology expands to increasing numbers of cultures and societies, it drives changes in the strategic defense environment that then affects the ability to defend against and respond to the nation's most complex, demanding, and high-risk challenges."

Participants in the iGEM and DTRA competitions get the opportunity to advance and showcase their bioengineering skills.

"It sends a message to our allies and adversaries that our nation's ongoing priority investment in the development and maintenance of the world's most technically capable defensive force will ensure our continued ability to be the primary resource capable of assisting our nation and our allies, while defending against our adversaries in any potential biologically compromised or biothreat environment," Pate said of the competitions.

## Synthetic Biology in Action



*USNA 2016 DTRA Syn Bio Academies Challenge Team Winners and DTRA Staff at Trophy Presentation From Left: Dr. Rhys Williams, Senior Executive Service; Navy Cmdr. Larry Kennedy; Midshipman Maggie Pana; Midshipman Seok Park; Midshipman Mitchell Winkie; Midshipman Trevor Karn; Dr. Brian Pate; Prof. Aurelia Minut; Midshipman Sara Peeleman. (Photo courtesy: U.S. Naval Academy)*

Pate, together with Drs. Sarah Glaven and Brian Eddie of the U.S. Naval Research Laboratory, and Professors Aurelia Minut and Navy Cmdr. Larry Kennedy of the U.S. Naval Academy, provided active mentorship of the winning academy team, which participated in the iGEM competition last October in Boston, marking the first time a U.S. military academy participated in the competition. The team's entry focused on developing a synthetic biology toolkit to enable countermeasures to conotoxins, which are small neurotoxins produced by marine cone snails that bind to and affect the opening and closing of ion channels. That opening and closing alters membrane potential and disrupts neurological signaling pathways. The goal of the team's work is to characterize the effects that conotoxins have on microorganisms in the respiratory tract in order to enable the ability to pursue cell-based conotoxin counteraction. Their work is expected to take five years to complete.

The Naval Academy team's efforts "exemplify the critical nature of DTRA's work in fostering a long term, ongoing U.S. military and civilian scientific knowledge base in the field of synthetic biology," Pate said.



DTRA Syn Bio Academies Challenge Trophy (Photo courtesy: Amber Conger)

Work has already begun on the 2017 DTRA Syn Bio Academies Challenge. DTRA is once again working with the Naval Academy's team and two West Point teams with the goal of reaching this year's iGEM competition in November, while advancing bioengineering education at the academies as applied to improving national defense. Dr. Pate and Dr. Rhys Williams, Senior Executive Service director of the DTRA Research and Development Directorate, presented the DTRA Syn Bio Academies Challenge Trophy to the U.S. Naval Academy on April 26. The perpetual trophy, custom-fabricated by sculptor Amber Conger of Refinerii, in Boise, Idaho, is held on an annual basis by the winning service academy.

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