Open-source software designed to minimize synthetic biology risks

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A software package designed to minimize the potential risks of synthetic biology for the nation's defense and security is now available to the gene synthesis industry and synthetic biology community in an open-source format.

Virginia Tech has licensed GenoTHREAT, a software tool that helps detect the use of synthetic DNA as bioterrorism agents. Developed as an open-source project by a team led by Jean Peccoud, associate professor at Virginia Bioinformatics Institute at Virginia Tech, it is being released using the Apache License Version 2.0 to ensure broad accessibility.

GenoTHREAT implements the "best match" screening protocol method recommended by the federal government to minimize the risk that unauthorized individuals or those with malicious intent will obtain toxins and other potentially dangerous materials from DNA synthesis providers. The process of developing GenoTHREAT allowed Peccoud's team to conduct a rigorous bioinformatic analysis of the strengths and limitations of the best match method which was published in the March issue of Nature Biotechnology.

"It was natural to start developing GenoTHREAT around the federal guidance on synthetic DNA," said Peccoud. "Since this regulation is only one of many regulations and policies that providers of synthetic DNA need to comply with, our current efforts aim at developing a more comprehensive biosecurity solution that can be customized for a variety of users."

Five of the report's co-authors – Arunima Srivastava of Delhi, India, a sophomore majoring in computer science in the College of Science; Michael Kozar of Harwich, Mass., a junior majoring in biology in the College of Science and French in the College of Liberal Arts and Human Sciences; Tyler Stewart of Springfield, Va., a junior majoring in biological sciences in the College of Science and biochemistry in the College of Agriculture and Life Sciences; and Gaelle Letort and Olivier Mirat, visiting students from ENSIMAG, an engineering school in Grenoble, France – are undergraduate students who worked with Peccoud and were part of a team of undergraduate students enrolled in the 2010 International Genetically Engineered Machines (iGEM) competition. The other two authors are Laura Adam, graduate research assistant, and Mandy Wilson, database administrator with Peccoud's group

"This project exemplifies how it is possible to train students to use interdisciplinary strategies to confront today's most important scientific problems," said Virginia Tech Vice President and Dean for Undergraduate Education Daniel Wubah. "By breaking down the separation of basic and applied research, and by combining engineering and life science expertise, this team has made a valuable contribution to a real-world problem directly related to the security of our nation."

Since the first synthetic cell in May 2010, the security and ethical aspects of synthetic biology have been debated in congressional hearings and by the Presidential Commission for the Study of Bioethical Issues and the National Academy of Science, among others.

"While the U.S. government does not endorse any particular tools, as stated in the Guidance, the U.S. government is supportive of efforts to develop new and improved methods to screen double-stranded DNA sequences for biosecurity purposes," explained Capt. Theresa Lawrence of the U.S. Department of Health and Human Services. "We applaud

efforts to advance this important field of science and enhance security."

More information: Adam L et al, Strengths and limitations of the federal guidance on synthetic DNA, *Nature Biotechnology* (2011) 29, 208. doi:10.1038/nbt.1802

Provided by Virginia Tech

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