THE PAUL G. ALLEN FRONTIERS GROUP

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THE PAUL G. ALLEN FRONTIERS GROUP NAMES MIT'S JAMES J. COLLINS A NEW ALLEN DISTINGUISHED INVESTIGATOR

Synthetic biology pioneer will engineer bacteria to fight deadly antibiotic-resistant infections

WASHINGTON, D.C. — **March 23, 2016** — The Paul G. Allen Frontiers Group announced today the award of an Allen Distinguished Investigator (ADI) award for "Synthetic Biology Applications to Antimicrobial Resistance" to James J. Collins, Ph.D., at the Massachusetts Institute of Technology, for research at the frontier of antibiotic resistance. Collins is also a Core Faculty member at the Wyss Institute for Biologically Inspired Engineering at Harvard University. His work will use techniques from the burgeoning field of synthetic biology to discover entirely new ways to fight deadly drug-resistant bacteria and uncover the root causes of how resistance arises. The grant is funded at $1.5 million over three years.

"Jim Collins is one of the true artists in the new world of synthetic bioengineering," says Tom Skalak, Ph.D., Executive Director of The Paul G. Allen Frontiers Group. "His vision for this project is highly unconventional and creative. We anticipate that his strategy to detect even small changes in bacterial genome sequence and automatically re-design them could usher in a new era of design-based medicine."

The Centers for Disease Control reports that the rise of antibiotic resistance has become a public health crisis, leading to over two million infections and 23,000 deaths per year in the United States alone. Broad-spectrum antibiotics can exacerbate resistance, since they target many different kinds of bacteria and create a niche for opportunistic pathogens to take root.

"We seek to determine the principles underlying the gene network functions that confer antimicrobial resistance, a major problem for human health worldwide," says Collins, Termeer Professor of Bioengineering in the Department of Biological Engineering and Institute for Medical Engineering & Science at MIT. "The basic frontier knowledge we gain in the project, however, will also be a platform for developing reliable, cost-effective antibacterials."

Synthetic biology is a growing field that uses principles and techniques from engineering to design and program biological systems. Rather than developing small-molecule drugs to target bacteria—the method commonly employed in drug development—Collins will engineer safe, frequently consumed bacteria to detect and kill dangerous bacteria. Highly drug-resistant *Staphylococcus aureus*, commonly known as MRSA, is the most frequently identified drug-resistant pathogen in United States hospitals, and will be their first target.

Using synthetic biology, Collins proposes to engineer safe bacteria to sense the presence of MRSA bacteria with a specifically programmed receptor. The engineered microbe will then release a series of targeted peptides known to be effective in controlling MRSA infection.

Collins also proposes to use synthetic biology tools to understand the root causes of antibiotic resistance. Despite the significant arsenal of antibiotic drugs used by physicians, scientists understand relatively few

mechanisms by which those drugs perform their functions. A better understanding of how antibiotic drugs work could lead to new drug design approaches to combat and prevent long-term resistance.

“At MIT, in our drive to solve hard problems facing society, we have a deep appreciation for the importance of generating new fundamental knowledge, and of deploying it rapidly at the forefront of innovation,” says Rafael Reif, President of MIT. “Jim Collins is a superb practitioner in both realms, as he works to solve the looming challenge of antimicrobial resistance that threatens human lives around the world.”

The Paul G. Allen Frontiers Group seeks to open new frontiers in science, and the ADI program supports early-stage research with the potential to reinvent entire fields. As antibiotic resistance poses an increasingly serious threat to public health, new avenues to fight infection and understand how dangerous bacteria are able to resist traditional therapies will be an invaluable scientific and medical tool.

About The Paul G. Allen Frontiers Group
The Paul G. Allen Frontiers Group is dedicated to exploring the landscape of science to identify and fund pioneers with ideas that will advance knowledge and make the world better. Through continuous dialogue with scientists across the world, The Paul G. Allen Frontiers Group seeks opportunities to expand the boundaries of knowledge and solve important problems. Programs include the Allen Discovery Centers at partner institutions for leadership-driven, compass-guided research, and the Allen Distinguished Investigators for frontier explorations with exceptional creativity and potential impact. The Paul G. Allen Frontiers Group was founded in 2016 by philanthropist and visionary Paul G. Allen. For more information visit allenfrontiersgroup.org.

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Media Contact:
Rob Piercy, Sr. Manager, Media Relations
206.548.8486 | press@alleninstitute.org