



NATIONAL SCIENCE FOUNDATION
2415 EISENHOWER AVENUE
ALEXANDRIA, VIRGINIA 22314

NSF 20-105

Dear Colleague Letter: Sentinel Cells for Surveillance and Response to Emergent Infectious Diseases (Sentinels)

July 15, 2020

Dear Colleagues:

Given the immense reservoirs of zoonotic diseases, it is unlikely that the current COVID-19 pandemic is the last seen in our lifetime. Indeed, with increased contact between humans and animals, environmental pressures, stochastic mutation and evolutionary processes, the probability that new infectious diseases will emerge is almost certain. There is an opportunity to use the power of synthetic biology, cellular engineering, biosensing, and immunoengineering, and other approaches at the intersection of biology and engineering to address this new threat. In particular, there is an urgent need for novel approaches to predict or detect the emergence of new infectious diseases, including agents that have recently appeared within a population or have existed and are showing signs of rapid expansion. Even more powerful would be novel biotechnology for sensing and responding to the new infectious agent via destruction of the agent and/or protection of the host against the agent.

At the heart of any of these new biotechnologies would be cell- or organism-based flexible biosensing platforms to detect and respond to emerging threats. For example, immune systems of bacteria or higher organisms might be leveraged to detect or capture nucleic acid, protein and/or membrane components associated with emerging infectious agents. Other innovative approaches supported by an organism's innate, modified, or redesigned biology, or by a synthetic system, could lead to the construction of robust and evolvable sensing and actuation platforms.

With this Dear Colleague Letter (DCL), we highlight the interest of existing programs in the Directorate for Biological Sciences (BIO) and the Directorate for Engineering (ENG) in interdisciplinary research for the development of novel biological platforms that are capable of sensing and responding to emerging infectious agents. The mechanism of sensing should be adaptable and or evolvable such that the sentinel cells, or other appropriate biotechnology solutions, are robust to a range of emergent threats, and/or can easily be reprogrammed and deployed once a new threat is identified. The platform's response should be one or more of

the following: alert the user, destroy the threat, protect the host, initiate an immune response or other strategies that would ensure mitigation of the threat. Sentinel cells and organisms that detect and respond to infectious agents with expanding footprints in a host population or expanding host ranges are of particular interest, as the early detection of these infectious agents might have value in preventing future pandemics. In addition, fundamental science and technology that would lead to the development of the envisioned sentinel cells and organisms are also of interest. Investigators are encouraged not to be limited in their approach, but to think broadly about innovations leveraging biology and engineering to advance adaptable detection of emerging biological threats.

Proposals responsive to this DCL should be submitted to the program most closely related to the research:

- [The Systems and Synthetic Biology Cluster](#) (SSB) in the Division of Molecular and Cellular Biosciences (MCB) ([NSF 18-585](#)).
- The Biosensing Program (PD 20-7909) or the Cellular and Biochemical Engineering (CBE) Program (NSF PD 20-1491) that are part of the [Engineering Biology and Health Cluster](#) in the Division of Chemical, Bioengineering, Environmental and Transport Systems (CBET).

The proposal title should be prefaced with "Sentinels:" Neither Division puts a limit on proposal budgets and expects budgets to be appropriate for the scope of the proposed project. The relevant programs in BIO/MCB and ENG/CBET all accept proposals without deadline. Proposals are reviewed as they are received.

Points of Contact: Investigators interested in submitting a proposal are strongly encouraged to contact one of the Program Directors listed below for further information:

Anthony Garza, BIO/MCB/SSB, aggarza@nsf.gov

Aleksandr Simonian, ENG/CBET/Biosensing, asimonia@nsf.gov

Steven Peretti, ENG/CBET/CBE, speretti@nsf.gov

Sincerely,

Joanne S. Tornow
Assistant Director
Directorate for Biological Sciences

Dawn M. Tilbury
Assistant Director
Directorate for Engineering