United States – Israel
Binational Science Foundation

SPECIAL BSF CALL FOR PROPOSALS IN A JOINT NSF-BSF PROGRAM IN ECOLOGY AND EVOLUTION OF INFECTIOUS DISEASES (EEID)

The U.S. – Israel Binational Science Foundation (BSF) is pleased to announce the opening of a round of applications in a new joint funding program in Ecology and Evolution of Infectious Diseases (EEID), with the Environmental Biology Division (DEB) in the Biological Sciences Directorate (BIO) of the U.S. National Science Foundation (NSF), and in cooperation with other agencies (as described below).

The terms of this program are as follows:

General

1. **Synopsis of Program:**

The Ecology and Evolution of Infectious Diseases program supports research on the ecological, evolutionary, and socio-ecological principles and processes that influence the transmission dynamics of infectious diseases. The central theme of submitted projects must be quantitative or computational understanding of pathogen transmission dynamics. The intent is discovery of principles of infectious disease transmission and testing mathematical or computational models that elucidate infectious disease systems. Projects should be broad, interdisciplinary efforts that go beyond the scope of typical studies.

They should focus on the determinants and interactions of transmission among humans, non-human animals, and/or plants. This includes, for example, the spread of pathogens; the influence of environmental factors such as climate; the population dynamics and genetics of reservoir species or hosts; the cultural, social, behavioral, and economic dimensions of disease transmission. Research may be on zoonotic, environmentally borne, vector-borne, or enteric diseases of either terrestrial or freshwater systems and organisms, including diseases of animals and plants, at any scale from specific pathogens to inclusive environmental systems. Proposals for research on disease systems of public health concern to developing countries are strongly encouraged, as are disease systems of concern in agricultural systems. Investigators are encouraged to develop the appropriate multidisciplinary team, including for example, modelers, bioinformaticians, genomics researchers, social scientists, economists, epidemiologists, entomologists, parasitologists, microbiologists, bacteriologists, virologists, pathologists or veterinarians, with the goal of integrating knowledge across disciplines to enhance our ability to predict and control infectious diseases.

2. **Program description**

The goal of the Ecology and Evolution of Infectious Diseases (EEID) program is to support important and innovative research on the ecological, evolutionary, and socio-ecological principles that influence the transmission dynamics of infectious diseases. The program's focus is on the discovery of general principles and processes and on

building and testing models that elucidate these principles. **Projects must address quantitative or computational understanding of pathogen transmission dynamics.**

Research in EEID is expected to be an interdisciplinary effort that goes beyond the scope of typical studies funded by the standing programs of the partner agencies. They should bring together such areas as anthropology, bioinformatics, computational science, ecology, economics, epidemiology, evolution, food science, genomics, geography, global health, mathematics, medicine, microbiology, plant science, population biology, sociology, physical environmental sciences, systems science, and veterinary medicine. Research within EEID is expected to generate rigorously characterized and tested models that are of value to the scientific community, but also may be useful in decision making. **The history of the EEID program has shown that the most competitive proposals are those that advance broad, conceptual knowledge that reaches beyond the specific system under study and that may be useful for understanding public, agricultural or ecosystem health, natural resource use and wildlife management, and/or economic development. Such proposals are typically interdisciplinary in their approach and/or the nature of the question(s) being addressed.**

Infectious disease transmission reflects complex, dynamic relationships that occur on varying spatial and temporal landscapes, are created by both ecological and evolutionary processes, and are revealed in genome architecture, physiological systems, population dynamics, and community structure, as well as behavioral and social dynamics. The interactions between disease-causing organisms, their vectors, and their host(s) are embedded within much larger networks of interacting systems, including other microorganisms that may or may not cause disease, one or more vector species, and multiple host species. Analysis of environmental influences (biological, geophysical, economic, and social) on individual and population susceptibility is fundamental to understanding these complex systems of infectious diseases. Research into the ecology (population, community, evolutionary, and social) of infectious diseases will contribute to a deeper understanding of these complex infectious disease systems, to the development of well characterized and tested models, and to the elucidation of general ecological and evolutionary principles. Insights into the dynamics of infectious disease systems may require integration across several temporal, spatial, and functional scales including molecular, individual, population, societal, and ecosystem levels. Similarly, they may require integration across biological, socio-economic, and geophysical domains. The field of evolutionary ecology, which focuses on both the importance of ecological context in studies of evolution and the importance of evolutionary change for ecological systems, may also provide important insights into infectious disease systems. The interplay of evolution and ecology has implications for understanding how infectious agents emerge as pathogens, adapt to one or more hosts, interact with other microbial communities (e.g., microbiome), and are transmitted among hosts.

A critical goal of research supported by this program is the generation of principles and conceptual frameworks that organize and inform the research and that lead to mathematical, computational, and statistical models of infectious disease dynamics.

Diverse modeling approaches are appropriate, including, but not limited to, mathematical equations, computational simulations, geospatial algorithms, and statistical models. **For the EEID program, the most competitive proposals are organized around an overarching conceptual framework that leads to such a model.** Models should aim to be explanatory beyond the specific system under study and must be well-characterized and rigorously tested. Proposals must describe how models will be developed, evaluated, and disseminated. Proposals must identify which individual(s) will oversee the quantitative approaches and provide evidence of demonstrated expertise in mathematical, computational, or statistical modeling and/or data analysis. Likewise, strategies for data collection must be well designed to contribute to and test model design. Proposals must include plans for dissemination of data, models, and tools developed by this program.

A variety of *topics, questions, systems and approaches* are appropriate. Among the areas of particular interest are: the role of social influences on the susceptibility of individuals or populations; multiway interactions between pathogenic and non-pathogenic organisms and their mutual hosts; the role of medical, agricultural or environmental practices on pathogen emergence and transmission; emergence of pathogens from non-pathogenic populations; host switching; evolutionary dynamics in an ecological context such as disease control interventions and drug resistance. These topics have significant ecological and evolutionary components that should be studied as a system, not in isolation. Depending on the hypotheses or research questions being addressed, investigations might entail some combination of laboratory experiments, field observations or manipulations, public health interventions (although clinical trials are beyond the scope of the EEID program), analysis of social and cultural processes, or ethnographic studies. Research may also focus on novel analyses of existing data and/or theoretical investigations of ecological and evolutionary dynamics. Investigations may focus on model infectious disease systems in natural (terrestrial or freshwater) or laboratory settings where those systems elucidate general principles.

Research may use a variety of study systems. The organism(s) or system(s) selected for study should be justified with respect to its suitability to study questions of ecology and/or evolutionary ecology. Research may involve a variety of infectious agents, individual diseases, or groups of diseases, and might involve one or more social systems, regions, habitats, or groups of organisms. Proposals may focus on terrestrial or freshwater systems and organisms and may include infectious diseases of humans, non-human animals, or plants. Proposals for research on diseases of public or agricultural health concern to developing countries, including potential pandemic diseases, are encouraged.

Regardless of the system or approach taken, a proposal must have a significant focus on the ecology of disease transmission to be eligible for funding.
Because of the complexity of studies on the ecology and evolutionary ecology of infectious diseases, multidisciplinary teams of domestic and international collaborators with expertise from diverse disciplines are likely to be most effective. Investigators are encouraged to develop collaborations with public health research communities where that is appropriate. Collaborative teams could include, for

example: ecologists, epidemiologists, medical scientists, veterinary scientists, social and behavioral scientists, entomologists, food scientists, microbiologists, pathologists, and parasitologists, geologists, hydrologists, geospatial analysts, and mathematicians. The research plan should indicate how multiple disciplines will be integrated and how new investigators in U.S. and collaborating foreign institutions will be prepared to further this research.

The EEID program is not intended to be the only avenue of support by the participating agencies for supporting research on infectious diseases. Specifically, proposals submitted in response to this announcement must address ecological dynamics and among-host transmission, even when evolutionary studies are a substantive part of the proposal. Investigations that are outside the scope of this EEID announcement include:

- Those limited solely to genetic patterns of evolutionary change (e.g., comparative genomics),
- Those that focus solely on human diseases without considering the broader ecological context,
- Those that focus solely on within-host biological processes,
- Those that focus solely on vector species ecology, and
- Those that have not pre-identified at least one pathogenic organism that will be the focus of the study (i.e., metagenomic surveys to identify the pathogenic organism are not included in this solicitation).

Projects focusing on **marine systems are no longer accepted**, except for those dealing with aquacultural systems within the purview of the USDA-National Institute of Food and Agriculture.

3. The program began in 2000; 2014 will be the fourteenth round of competition. The competition is run jointly by the Directorates for Biological Sciences (BIO) and the Social, Behavioral and Economic Sciences (SBE) at NSF, along with the Fogarty International Center (FIC) and the National Institute for General Medical Science (NIGMS) at the National Institutes of Health (NIH), the National Institute of Food and Agriculture (NIFA) at the United States Department of Agriculture (USDA), the Biotechnology and Biological Sciences Research Council (BBSRC) of the U.K. Research Council for the US-UK Collaborative Projects, and starting this year, the U.S.-Israel Binational Science Foundation (BSF) for US-Israel Collaborative Projects.

A full description of the current program can be found in the Solicitation of the NSF. It is *strongly advised* for all potential applicants (including Israelis) to read this document carefully:
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5269&org=DEB&from=home

4. Applications are to be submitted to the NSF according to its submission regulations, even if the application may eventually be chosen for a grant by the NIH or USDA. See the NSF solicitation for further details on the joint review process.

5. Applications must be submitted jointly by an Israeli, and an American scientist from a U.S. research institution. Adding a British scientist will possibly be allowed, as long as a

U.S. partner is included. However, at this time no agreements have been signed by the BSF with the British agency, and interested Israeli PIs are requested to consult the BSF before making arrangements with potential British partner.

6. If awarded a grant, the Israeli scientist will receive a grant from the BSF, while the U.S. scientist will receive a grant from the relevant U.S. government institution that is a partner in this program.

7. The size of the BSF grant to the Israelis is expected to be up to $100,000/year for the duration of the grant. BSF will follow the decision by the U.S. funding agency regarding the length of the project (note that the amounts mentioned in the NSF solicitation document regarding NSF, NIH and British investment in the program is for new as well as continuing grants, while the amount mentioned for BSF is only for the first year of new projects).

8. Submission to the NSF should be by the U.S. PI alone. Nevertheless, the project description should include a description of the work that will be carried out by the Israeli partner, including a detailed Israeli budget. Furthermore, it should be clearly explained why his contribution to the research project is essential. Submission of applications with relevance to medicine, or to agriculture, should also be made to the NSF.

9. Both the U.S. and Israeli PIs are required to submit to the BSF a copy of the NSF proposal, as explained in the "***Submission***" chapter below.

10. The program is expected to be held annually.

Eligibility

1. All regulations regarding eligibility of the BSF (for the Israeli) will apply to the new program.

2. Each scientist is allowed to submit up to two proposals. However, the BSF is not likely to award two grants to a single scientist.

3. A scientist who is presently receiving funding from the BSF in a program other than an NSF-BSF program is permitted to receive funding in this program. However, it is not permitted to submit a project that is similar or significantly overlapping a currently supported BSF project.

4. BSF allows joint Israeli-US-UK applications. However, at this time no agreements have been signed by the BSF with the British agency, and interested Israeli PIs are requested to consult the BSF before making arrangements with potential British partner.

Evaluation

1. Proposals will be evaluated by the NSF, using its criteria. The BSF is likely take part in the evaluation process by providing panel members, external reviewers, etc.

2. BSF will not conduct a parallel review and will not rank the proposals, and is likely to fund any Israeli whose partner in this program is funded by the relevant U.S. funding agency.

3. NSF uses a conventional peer review system with expert panels and ad-hoc (external) reviews. However, unlike the practice in Israel, panel members serve in an advisory capacity, and final decisions lie with the program manager(s) and his/their management(s). These post-panel officials may introduce additional considerations, such as whether the research topic already has support from the U.S. government, whether support from other NSF programs may be sought, etc.

4. NIH and USDA staff members are likely to participate in the NSF panel meeting as observers, and later select for funding those applications that were scored high by the panels and are relevant to their areas of interest. However, occasionally an application in one of these areas that was scored high by the panel will not be picked up and will not be funded. An application that was selected for funding by the NIH will have to be resubmitted using the NIH format, but will not go through additional evaluation.

5. Israeli applicants are advised that they should pay particular attention to the NSF evaluation criteria, http://nsf.gov/bfa/dias/policy/merit_review/, which may include issues such as broad impact (including postdoc and undergraduate training), data management, etc. Failure to refer to such topics by the U.S. partner may be detrimental to the proposal.

Submission

1. Proposals will be submitted to the program twice. The U.S. scientist (only) will submit to the NSF using its regulations (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg) and submission system (https://www.fastlane.nsf.gov/). Both the Israeli and the American will submit to the BSF, according to its regulations and submission system: http://www.bsf.org.il/ElectronicSubmission/GatewayFormsAndGuidelines.aspx?PageId=7&innerTextID=0. The applicants must submit to the BSF a copy of the PDF of their NSF application, with the added required information.
2. Any scientist who wishes to submit two proposals to the BSF in the EEID program should contact the BSF for special technical instructions regarding the submissions.

Timetable

Proposals will be submitted to the BSF no later than 5 pm (Israel time) on November 24, 2014. NSF deadline is November 19, 2014.

Applicants are requested to acquaint themselves with the BSF regulations for this NSF-BSF program before they submit applications. The forms and regulations can be downloaded from the BSF website (www.bsf.org.il) under 'Guidelines & Forms'.

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Questions regarding the applicability of the proposed research for this program should be directed by the U.S. partner to the program officer at the NSF. Other questions regarding this special BSF-NSF program can be discussed with the BSF management by mail or phone (972-2-5828239): Dr. Yair Rotstein (yair@bsf.org.il; ext. 105) or Dr. Rachel (Heni) Haring (heni@bsf.org.il; ext. 110). Questions regarding the online application system should be directed to Ms. Orli Rozencwajg (orli@bsf.org.il; ext. 109) or Ms. Eti Alfandary (eti@bsf.org.il; ext. 101).