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Testimony of
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On
Fiscal Year 2018 Appropriations for the National Science Foundation
Submitted to the
Appropriations Subcommittee on Commerce, Justice, Science, and Related Agencies
United States House of Representatives

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The Entomological Society of America (ESA) respectfully submits this statement for the official record in support of funding for the National Science Foundation (NSF). **ESA requests a robust fiscal year (FY) 2018 appropriation of $8 billion for NSF, including strong support for the Directorate for Biological Sciences (BIO).**

Research in basic biological sciences, including entomology, provides the fundamental discoveries that advance knowledge and facilitate the development of new technologies and strategies for addressing societal challenges related to economic growth, national security, and human health. Basic research on the biology of insects has provided fundamental insights across all areas of biology, including cell and molecular biology, genomics, physiology, ecology, behavior, and evolution. In turn, these insights have been applied toward meeting challenges in a wide range of fields, including conservation biology, habitat management, livestock production, and pest control. Moreover, insects have long played an essential role as model organisms for understanding basic biological processes across all organisms, including humans. Insects are often ideal laboratory experimental subjects because they are generally small in size and inexpensive to obtain, they complete development rapidly, and they can be maintained without the special facilities required for vertebrate animals. The common fruit fly *Drosophila melanogaster*, for example, has been the subject of NSF-funded research that has profoundly transformed the understanding of human health in countless ways; in 1995, NSF-funded studies elucidating the genetic control of embryo development in this insect was recognized with the Nobel Prize in Medicine or Physiology.

NSF is the only federal agency that supports basic research across all scientific and engineering disciplines, outside of the medical sciences. Each year, the foundation supports an estimated 300,000 researchers, scientific trainees, teachers, and students, primarily through competitive grants to approximately 2,000 colleges, universities, and other institutions in all 50 states. NSF also plays a critical role in training the next generation of scientists and engineers, ensuring that the United States will remain globally competitive in the future. For example, the NSF Graduate Research Fellowship Program selects and supports science and engineering graduate students demonstrating exceptional potential to succeed in science, technology, engineering, and mathematics (STEM) careers.

Through activities within its BIO Directorate, NSF advances the frontiers of knowledge about complex biological systems at multiple scales, from molecules and cells to organisms and ecosystems. In addition, the directorate contributes to the support of essential research resources, including biological collections and field stations. NSF BIO is also the nation's primary funder of fundamental research on biodiversity, ecology, and environmental biology.

One project funded by NSF that illustrates the broad reach of basic biology research is focused on how diverse insects, including flies and butterflies, use their specialized mouthparts for imbibing fluids.[1] This study examines common and divergent elements allowing these insects to ingest fluids, including wettability properties, fluid uptake mechanisms, and the influence of the form of the fluid, as a pool or a film, on dynamics of fluid acquisition. This work is yielding bio-inspired principles that can be applied to developing flexible microfluidic probes and other new engineering devices for use in diagnostic medicine and other purposes.

Another group of investigators is funded by NSF to study the reproductive biology of the red imported fire ant, an invasive species that infests over a dozen southern states and costs this region more than five billion dollars annually in health costs, crop and livestock losses, and control efforts.[2] These investigators are examining how the colonies of this species, particularly those with multiple queens, grow so rapidly, focusing on how neuronal signaling molecules respond to the nutritional status of the queen and regulate the network of genes involved in ovary development and egg maturation. Information obtained through these studies is both expanding basic knowledge of task allocation in social insects, which collectively comprise approximately 75% of all insect biomass on the planet, and provide new insights into stemming invasions and restoring the health of land lost to fire ant infestation.

Yet another example of how NSF's support for basic research on insects is important for the nation's economic, social, and environmental well-being is the collaborative project between two universities on the classification and evolutionary history of a group of beetles known as the pygmy borers.[3] These tiny beetles comprise one of the largest groups of so-called bark beetles, which collectively infest and kill millions of acres of trees every year by boring into bark or other tree parts; some species compound the damage they inflict by infecting their tree hosts with pathogenic fungi. One pygmy borer species, called the coffee berry borer, damages the coffee berries that produce coffee "beans"; this tiny insect, less than 2 mm (8/100ths of an inch) long, is capable of destroying an entire coffee harvest in some regions. These investigators are using cutting edge methods, including next-generation genome sequencing, along with automated matrix-based identification techniques to reconstruct the evolutionary history of and relationships

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[1] Adler, P. et al. Mechanisms of Fluid Feeding in Insects, from Nanoscale to Organism, Award Abstract #1354956.

[2] Pietrantonio, P. and C. Tamborindeguy, Neuropeptide Receptors and Identification of Genes in Signaling Networks Involved in Reproduction and Nutrition in the Red Imported Fire Ants. Award Abstract #1257837.

[3] Collaborative Research: Cognato, A.; Hulcr, J.The Pygmy Borers (Col., Scolytinae: Cryphalini): revision of genera, evolution of the genome, and modernization of insect systematics. Award Abstract #1256663, Award Abstract #1256968.

among the pygmy borers, determine whether widespread species in the group are actually many different cryptic species, and understand the effects of bacterial parasites on the genomes of species in the group. A product of this research will be new, powerful but cost-effective ways to differentiate among species, which can be exceedingly difficult to identify, that will enable quarantine officers to identify and prevent this species from expanding its range into new areas.

Given NSF's critical role in supporting fundamental research and education across science and engineering disciplines, ESA supports an overall FY 2018 NSF budget of $8 billion. ESA requests robust support for the NSF BIO Directorate, which funds important research studies and biological collections, enabling discoveries in the entomological sciences to contribute to understanding environmental and evolutionary biology, physiological and developmental systems, and molecular and cellular mechanisms.

ESA, headquartered in Annapolis, Maryland, is the largest organization in the world serving the professional and scientific needs of entomologists and individuals in related disciplines. Founded in 1889, ESA has over 6,000 members affiliated with educational institutions, health agencies, private industry, and government. Members are researchers, teachers, extension service personnel, administrators, marketing representatives, research technicians, consultants, students, pest management professionals, and hobbyists.

Thank you for the opportunity to offer the Entomological Society of America's support for NSF. For more information about the Entomological Society of America, please see http://www.entsoc.org/.