TICK-BORNE DISEASE RESEARCH PROGRAM

Program History

The Tick-Borne Disease Research Program (TBDRP) was established in fiscal year 2016 (FY16), when the efforts of Lyme disease advocates led to a Congressional appropriation of $5 million (M). The TBDRP has received funding at a rate of $5M annually, totaling $20M for the period FY16-FY19. In FY20, the TBDRP appropriation was increased to $7M. Each year, with input from the peer and programmatic review panels, the TBDRP strives to maximize its investment by supporting research that is innovative and impactful and aims to address fundamental knowledge gaps in the field of tick-borne diseases (TBDs).
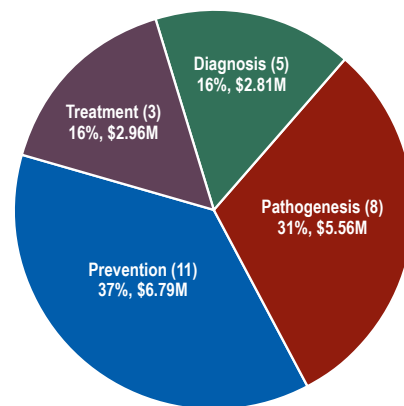
Overarching Challenges

Currently, there are at least 18 known infectious tick-borne pathogens resulting in 20 conditions and 13 illnesses.[1] As tick populations increase and geographically expand, it is anticipated that new pathogens and conditions/illnesses associated with tick-bites will emerge,[2] and the number of annual cases of Lyme disease and other bacterial, viral, and parasitic TBDs will continue to rise.
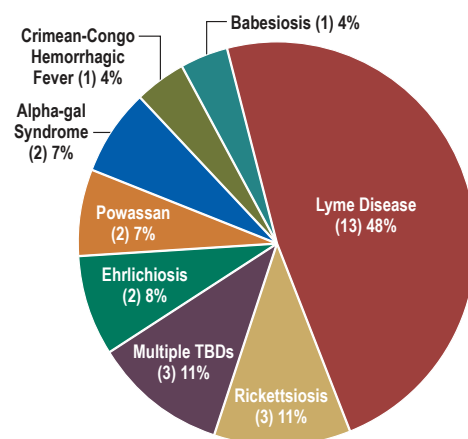
Continued research efforts are necessary to elucidate the mechanisms of tick-borne pathogen transmission, the human immune response to pathogens and pathogen immune evasion, the establishment of persistent infections and chronic clinical manifestations of disease, and the implications of co-infections on all of these complex processes. A need still exists for new and improved tick bite and TBD prevention strategies, as well as tick- and rodent-targeted infection prevention and control interventions. For those who are bitten, sensitive and specific assays for direct pathogen detection are vitally important, as they would ideally allow for tailored and rapidly initiated treatment plans for patients suffering acute infection to prevent the progression toward persistent infection and symptoms. The TBDRP intends to support researchers focused on development, validation, and translation efforts that will address these critical issues, improve the capabilities in the field of TBD prevention, diagnosis, and treatment, and ultimately benefit patients.

Diagnosis (5) 16%, $2.81M
Treatment (3) 16%, $2.96M
Pathogenesis (8) 31%, $5.56M
Prevention (11) 37%, $6.79M

FY16-FY19 TBDRP Portfolio Investment by Scientific Classification System Code[3]

Babesiosis (1) 4%
Crimean-Congo Hemorrhagic Fever (1) 4%
Alpha-gal Syndrome (2) 7%
Powassan (2) 7%
Ehrlichiosis (2) 8%
Multiple TBDs (3) 11%
Rickettsiosis (3) 11%
Lyme Disease (13) 48%

FY16-FY19 TBDRP Portfolio Investment by Disease Classification[3]

[1] Tick-Borne Disease Working Group, 2018 Report to Congress, Chapter 1, p.5 (https://www.hhs.gov/sites/default/files/tbdwg-report-to-congress-2018.pdf).
[2] https://www.cdc.gov/media/dpk/diseases-and-conditions/lyme-disease/index.html.
[3] Percentage of total TBDRP investment, (number of awards).

https://cdmrp.army.mil/tbdrp

Vision: To prevent the occurrence, better diagnose, and resolve or minimize the impact of Lyme disease and other tick-borne illnesses, with emphasis on burden of disease

Mission: To understand the pathogenesis of Lyme disease and other tick-borne illnesses, to deliver innovative solutions to prevent, diagnose, and treat their manifestations for the benefit of US Service members and the American public, and to disseminate this knowledge

"After 10 years of misdiagnoses, I was finally diagnosed with Lyme disease and another TBD, babesiosis. Obtaining proper diagnosis and treatment is a challenge due to inadequate TBD diagnostics. I'm grateful that the Congressionally Directed Medical Research Programs (CDMRP) is addressing the many Americans infected with TBDs."
Lia Gaertner, M.S., Director of Education and Outreach at the Bay Area Lyme Foundation, Consumer Reviewer

Program Goals and Strategy

The FY20 TBDRP offers award mechanisms for career and idea development to recruit new investigators mentored by established TBD scientists, support existing TBD researchers, and foster collaboration among fields. The TBDRP's vision places emphasis on burden of disease, and the program encourages investigators to focus their efforts on TBDs prevalent in the United States, of concern to military personnel and their beneficiaries in the U.S. and overseas, and/or in understudied patient populations. Applications submitted to the TBDRP must address at least one of the following focus areas in Lyme disease and other TBDs: diagnosis, pathogenesis, prevention, and treatment. Current TBDRP-funded diagnosis research is focused on the sensitive, specific, and rapid detection of acute TBD infection, including development and optimization of innovative assays and biomarker panels. Pathogenesis studies in the portfolio include mechanistic studies to evaluate pathogen dissemination, epigenetic and transcriptomic changes defining pathology, host-immune responses to tick-borne infection, and neurologic symptoms linked to persistent infection. TBDRP prevention research spans tick- and reservoir-targeted prevention, prediction, and control interventions, as well as novel TBD pre-exposure prophylaxis and vaccine approaches. Research on novel treatments and therapeutic strategies addresses TBD symptoms and mitigation of long-term sequelae following TBD infection and includes antibiotic and non-antibiotic approaches.

Funded Investigator Perspective

Nicole Baumgarth, DVM, Ph.D., University of California, Davis
"Our laboratory aims to understand how Lyme disease-causing bacteria can survive and establish a persistent infection by evading the immune system. Our TBDRP-funded project uses a mouse model to understand why antibodies generated in response to infection can reduce, but not fully eliminate, infection and provide insight into human inability to clear infection. Defining the mechanistic differences between effective and non-effective antibodies can aid development of therapies that can overcome this limitation of the immune system and help patients return to health."
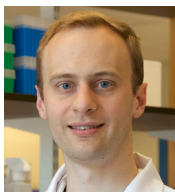
Kevin Esvelt, Ph.D., MIT
"Mice Against Ticks is a community-guided effort on the islands of Martha's Vineyard and Nantucket to prevent TBDs by disrupting disease transmission between white-footed mice and the ticks that feed on them. The TBDRP-funded portion of the study aims to isolate and characterize the best antibodies against Lyme bacteria and tick salivary components, and, to develop our genome insertion strategy and assess antibody production via pilot studies in mice. Our team has responsively adapted the project to local community needs toward a lasting solution for reducing the risk of human exposure to ticks."

Ulrike Munderloh, DVM, Ph.D., University of Minnesota
"The goal of our TBDRP-funded research is to develop a flexible, live vaccine platform against TBD agents that can quickly be modified by replacing or adding protective antigens from pathogens as they are recognized instead of having to develop new vaccines from the ground up. With a core component that is proven safe, this platform would dramatically shorten the time required for vaccine development, allowing for more urgent deployment against a new or emerging TBD."
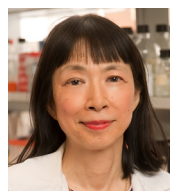
Yasuko Rikihisa, Ph.D., The Ohio State University
"Ehrlichia, the causative agent of human ehrlichiosis, is a member of the Rickettsiales order of bacteria, for which no human vaccines exist. Our TBDRP-funded award evaluates whether an ehrlichia surface protein is expressed in tick cells and can be blocked with antibodies in vitro to limit spread from tick to mammalian cells. In vivo studies aim to assess the ability of the ehrlichia surface protein-vaccine candidate to elicit a protective immune response against ehrlichia infection by tick bite and if successful, could provide a prototype human rickettsiosis vaccine."

"The uniqueness of the TBDRP lies in the invaluable contributions of the advocates who bring their own personal perspective and the voice of the advocacy groups they represent. Discussions greatly emphasize impactful research that promises to revolutionize the way that TBD patient care is managed. I have the greatest respect for the intellectual open-mindedness and for the plurality of views that I have encountered when serving as a TBDRP scientific reviewer."
Alessandra Luchini, Ph.D., Scientific Peer Reviewer