



DEFENSE THREAT REDUCTION AGENCY
8725 JOHN J. KINGMAN ROAD, STOP 6201
FORT BELVOIR, VA 22060-6201

January 10, 2022

Sharon Lerner
The Intercept
114 Fifth Avenue
New York, NY 10011

Re: FOIA Case No.: 22-003

Dear Ms. Lerner:

This is a final response to your Freedom of Information Act (FOIA) request perfected on September 30, 2021, and assigned FOIA case number 22-003 by the Defense Threat Reduction Agency (DTRA). You requested a copy of grant proposals, including continuations, for and any and all progress reports related to the following grants:

1. HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2017) \$782,330.
2. HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2018) \$1,101,959.
3. HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2018) \$1,101,958.
4. HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2019) \$997,624.
5. HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2019) \$997,623.
HDTRA11710064 - Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia, Ecohealth Alliance Inc. (2020) \$1,509,531.

On December 14, 2021, you were provided an interim response letter with a copy of documents totaling 163 pages. Enclosed is a copy of additional documents totaling 1,555 pages. These records are being released to you in part. Some information is being withheld under FOIA Exemptions 4 and 6.

Exemption 4 of the FOIA protects trade secrets and commercial or financial information obtained from a person that is privileged or confidential. The confidential commercial information withheld under Exemption 4 in the responsive documents is treated as private by Ecohealth and Ecohealth provided the information to DTRA under an assurance of privacy.

Exemption 6 applies to information, which, if released, would constitute a clearly unwarranted invasion of the personal privacy of an individual. In this case, some individuals' names, salaries, personal email addresses, and cell phone numbers have been redacted due to security and privacy concerns. Those names do not directly reveal the operations of the federal government and therefore, fall outside the ambit of public interest that FOIA was enacted to serve. As a result, the privacy interest outweighs the public interest in those names.

Determinations for this interim release were made by the Initial Denial Authority (IDA), Mr. Earl Washington, Chief, Records Management, FOIA, and Privacy Act Division / DTRA Records Officer, Information Management and Technology Directorate, on behalf of DTRA. If you consider this decision to be an adverse determination, you may file a written appeal that is postmarked no later than 90 calendar days after the date of this letter to the Deputy Director, Defense Threat Reduction Agency, Information Management and Technology Directorate, ATTN: FOIA/PA Office, 8725 John J. Kingman Road, MSC 6201, Fort Belvoir, Virginia 22060. The appeal should reference the FOIA/Privacy Act case number, contain a concise statement of the grounds upon which the appeal is brought, and a description of the relief sought. A copy of this letter should also accompany your appeal. Both the envelope and your letter should clearly identify that a Freedom of Information Act and/or a Privacy Act Appeal is being made.

Should you have additional questions or concerns regarding this case, you may seek dispute resolution services from the DTRA FOIA Public Liaison or the Office of Government Information Services (OGIS). The DTRA FOIA Public Liaison, Mr. Mario Vizcarra, may be contacted by phone at (703)767-1792 or by email at dtrafoiaprivacy@mail.mil. The contact information for OGIS can be found at www.archives.gov/ogis.

Sincerely,

Eugene McGirt

Eugene McGirt
FOIA/Privacy Act Specialist
Freedom of Information/Privacy Act Office

Enclosure(s):
As stated

Phase II Technical Proposal

I. ABSTRACT.

In line with Thrust Area 6 - Cooperative Counter Weapons of Mass Destruction Research with Global Partners FRCWMD, we propose a multi-disciplinary research project to identify key factors correlated with the risk of bat viral zoonoses from sites across Western Asia. Bats are natural reservoir hosts to several emerging viruses with pandemic potential, including Ebola, Marburg, Nipah, and SARS and MERS-coronaviruses, but current research on the distribution of bats, diversity of their viruses, and potential for zoonotic disease emergence in Western Asia is severely limited. To fill this gap and contribute to biological threat reduction, we propose a hypothesis-driven One Health research project focused on characterizing bat coronavirus diversity and the risk of bat-borne zoonotic disease emergence. This will include extensive non-lethal field sampling of bats, screening and characterization of viruses from bat specimens with select partner laboratories currently operating within the region, and modeling emerging disease risk by combining viral data with host, geographic, and ecological data. Data for risk modeling will be collated across a larger region than our field sampling will allow through the creation of a collaborative Western Asia Bat Research Network (*WAB-Net*) including key researchers and public health representatives from >12 countries. Research activities will be strengthened via laboratory exchanges and annual data sharing and capacity building workshops. This integrated approach presents a coordinated strategy to advance scientific knowledge around transboundary zoonotic disease emergence risk in Western Asia to inform early detection, diagnosis, and response to support the Global Health Security Agenda and CBEP goals.

II. SCOPE.

A. OBJECTIVE.

Our primary objective is to characterize the diversity of coronaviruses (CoVs) and test key hypotheses about bat-borne zoonotic virus emergence risk in Western Asia in order to reduce the threat of infectious diseases. Despite growing recognition that bats are important zoonotic disease hosts, and the emergence of the Middle East Respiratory Syndrome coronavirus (MERS-CoV), there remains limited scientific knowledge of the distribution and ecology of bats, their pathogen diversity, and potential interfaces for transmission to humans and other species in Western Asia – an area encompassing over 20 countries in the Middle East and Near East. Our project is designed to detect emerging viruses at their source (wildlife populations) through hypothesis-driven research, and to provide a mechanism for improved risk assessment, information sharing and scientific collaboration in an area with fragmented, and often limited, capacity for zoonotic disease investigations. Through partnerships with laboratories within the region and extensive field investigations, we will establish a statistically rigorous research platform to characterize endemic pathogen diversity for coronaviruses, a key viral family with known pandemic potential. Data on pathogen diversity, host distribution, and ecological traits will be curated, exchanged, and used to model zoonotic disease risk in this politically volatile region.

B. BACKGROUND.

Bats are hosts to a wide-range of viral zoonoses of concern to DoD, CDC, WHO, and OIE due to their pandemic potential, high mortality rates, and lack of treatment options, including Ebola virus, Marburg virus, Nipah virus, SARS-CoV and MERS-CoV². Our previous research has

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

shown that MERS-CoV is a bat-origin virus currently spread in humans, in part, via an intermediate host of dromedary camels^{3,4}. For MERS-CoV, important questions remain regarding the geographic range of bat infection, the timing and causes of spillover to camels, and role of bats in camel and human infection – highlighting the need for a better understanding of bat ecology, distribution, and viral evolution and diversity in this region⁵. War and famine are also important drivers for disease emergence globally⁶, and socio-political instability may increase vulnerability to zoonotic disease emergence in Western Asia. Despite the risk that viral zoonotic threats from bats pose worldwide, **virtually nothing is known about viral pathogens in natural bat populations from Western Asia**. Bat research coordination networks exist in Southeast Asia (Southeast Asian Bat Conservation Research Unit, SEABCRU); in Europe (Eurobats); and in Africa (Bat Conservation Africa), but Western Asia represents a major geographic gap. Bat research in Western Asia is highly fragmented and largely undeveloped – with often only one or two experts per country usually working in isolation within national boundaries, and with poor linkages to laboratories for disease investigations. As bats are mobile and do not respect political borders, there is a critical need to develop scientifically robust zoonotic surveillance activities more broadly across Western Asia,

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Scientific Impact for C-WMD science: Acknowledging that viral emergence, both nefarious and natural, poses a significant threat to global security, the current regional gap in capabilities to conduct research and facilitate early detection of bat-borne diseases in Western Asia severely weakens our ability to counter the threats of biological weapons of mass destruction. Over 70% of emerging zoonotic diseases come from wildlife⁷; thus, ignoring the wildlife sector diminishes the capacity to establish baseline “normal” for viral presence and to preempt and/or rapidly respond to emerging disease threats. Our proposed project will identify specific viral threats and will enhance the scientific proficiency of wildlife biologists, ecologists, public health specialists, and virologists in the region by testing hypotheses to understand the natural diversity and spillover potential of bat-borne CoVs. Our geographic focus will include four core (e.g. ‘high-engagement’) countries and additional (e.g. ‘medium-engagement’) countries found within zoonotic bat virus ‘hotspots’ in Western Asia – areas with a high likelihood of bat-human virus spillover (Figs 1 and 2). Our proposed research will improve early detection, and ultimately mitigation, of bat viral emergence in this region via 1) wildlife disease ecology and viral surveillance investigations in the field; 2) laboratory diagnostic support and CoV characterization to facilitate ‘pre-emergence’ detection of potential zoonoses and to differentiate natural vs. nefarious disease emergence events; and 3) epidemiological and spatial disease risk analyses. **Our proposed research project will additionally serve multiple goals and objectives of the CBEP mission**, by: 1) engaging partner country scientists in high-quality, hypothesis-driven research; 2) enhancing understanding of endemic viruses to allow differentiation of natural vs. nefarious emergence events in the future; 3) supporting biosurveillance capacity building by enhancing partner capability to detect, diagnose, and report select agents; 4) employing responsible bio-risk management best practices; 5) training partner country researchers to think critically about ethical research and be competitive in soliciting international funding; and 6) promoting a One Health concept.

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Key Hypotheses. Our regional, hypothesis-driven research project is focused on bat-borne CoVs due to their relative ease of detection and abundance, and their importance to global health security and pandemic emergence. We will support and link wildlife field research with

appropriate regional (or sometimes in-country) laboratories to build capacity for basic pathogen discovery and early detection using existing technologies, and provide training in proper specimen collection and biosafety. Our project is designed to rigorously test the following initial hypotheses (and develop DTRA-relevant *outputs* to understand viral threats); these may be refined during Year 1 in consultation with project scientists and DTRA personnel:

- H₁.** Bat CoV diversity correlates with host species diversity in a given geographic area. (*Output: Refined spatial maps of naturally-occurring viruses and susceptible hosts*)
- H₂.** Ecological and host demographic traits predict CoV strain diversity. (*Output: Analysis of ecological and host life-history data to predict undetected viral diversity*)
- H₃.** Bats and their CoVs have significant levels of evolutionary co-divergence. (*Output: Improved ability to predict CoV strain diversity and cross-species transmission risk*)

Additionally, during Year 3 – Option Year 2 of our proposed project, we will combine the above analyses with spatial data on human demography, land use, ecological and climatic variables, and bat species ranges to refine bat viral zoonoses ‘hotspot’ maps for Western Asia (Fig 1).

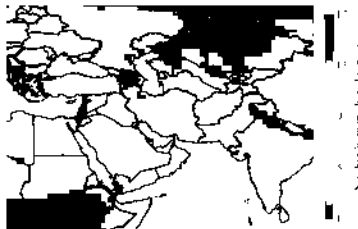


Fig 1. Currently known distribution of bat zoonotic viruses¹. ‘Hotspots’ of bat zoonoses are non-uniform across Western Asia, and highest (red/orange) in areas including Georgia and Jordan where this project will initially focus, as well as parts of Pakistan, Iraq, and Turkey. However, the accuracy and resolution of these maps is currently limited by the paucity of data and urgently need ‘ground truthing’ of bat species ranges, ecological variables, and viral richness, combined with more refined modeling approaches.

Methods and study design details for the above hypotheses are later described by task.

A coordinated research network approach to improving underlying data to model the risk of CoV emergence. Current disease ‘hotspot’ maps rely on species distribution data based on limited records from museum collections, and other coarse-scale global datasets. A vast wealth of data on the occurrence and distribution of bat species exists in the hands of individual scientists, but this data remains mostly unpublished and is not currently shared with policy makers and other scientists largely because the wildlife and disease research sectors are not linked. As part of our project, data for risk modeling will be collated across a larger regional footprint than our proposed field sampling sites through annual data-sharing workshops and the creation of the Western Asia Bat Research Network (*WAB-Net*) – a collaborative, sustainable network of key wildlife researchers and public health representatives from >12 countries. We will promote a culture of scientific collaboration via workshops, research exchanges, and a dedicated *WAB-Net* website, and collate geo-referenced field data of bat occurrence and ecological data via a cloud-based information management system modified from our existing database structure built with support from CBEP for our ongoing Rift Valley Fever project.

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C. PROGRAMMATICS.

Where: We have selected four high-engagement countries of strategic interest to DoD/DTRA (Jordan, Georgia, Turkey, and Pakistan to begin in Y1) to be the focal sites for our CoV research program, and additional (medium-engagement) countries to be part of the broader *WAB-Net* to contribute data and, in some cases, additional specimens for testing (e.g. Iraq, Saudi Arabia, Armenia, Azerbaijan). The geographic focus of our research platform was designed to form a

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

contiguous geographic block to address our proposed hypotheses, realizing that bats are often migratory and not confined to political boundaries (Fig 2). We already have strong buy-in from key scientists and public health experts to serve as the points of contact in proposed countries (*Attachment 3, letters of support and C O s*), and will identify additional experts at the start of the project. Specific geographic focus will be determined with DTRA-CBEP guidance.

Fig 2. Project geographic focus . = high-engagement research countries; – medium-engagement *WAB-Net* members and countries for program expansion; and – countries not included. We view high-engagement countries as representing biogeographic ‘gateways’ for bat (and potentially pathogen) dispersal in the region e.g. Pakistan as a gateway to South Asia; Jordan to Africa and Arabia; and Georgia and Turkey to Europe.

Who: EcoHealth Alliance (EHA) (prime) will design, implement, and oversee the research project; train and ensure participants follow US standards for ethical handling of animals, biosafety and biosecurity; lead all contractual obligations with DTRA and project subawardees; coordinate travel and organize workshops; manage website and information database; ensure coordination between steering committee, scientific advisory board, and *WAB-Net* members (see Fig 3); and collaborate with our partners in analyzing the data and publishing it. Our proposed organizational structure:

- Steering Committee (SC) of 8-10 people will be formed, including Dr. Kevin Olival (PI, EHA); Dr. William Karesh (Co-PI, EHA); DTRA/CBEP representative TBD; selected country representatives (TBD, *see letters of support*).
- Scientific Advisory Board (SAB) will initially include: Dr. Tigga Kingston (SEABCRU Lead); Dr. Paul Bates (Harrison Institute); Dr. Paul Racey (Former IUCN Bat Specialist lead); Dr. Jon Epstein (EHA, bat disease and veterinary medicine); Dr. Vincent Munster (NIH, laboratory expert) and additional experts to be added as needed (*see letters of support*). The SAB will oversee and review the proposed scientific activities and provide expertise during data sharing and capacity building workshops, and help liaise with regional and global stakeholders. Excluding salary requested for EHA scientists and regional laboratory leads (see budget justification), both the SC and SAB will consist of volunteer experts, compensated for travel expenses during annual workshops.
- Country Representatives: 1-2 lead research scientist identified as points of contact in each country for the *WAB-Net*, with working groups by geographic sub-regions (see Fig 3)
- Regional Laboratories: Two regional laboratories will lead pathogen characterization: Center For Excellence In Biosafety, Biosecurity And Biotechnology Royal Scientific Society (Jordan); and R. Lugar Center for Public Health Research (Georgia).

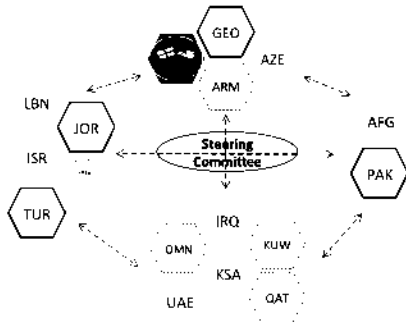


Fig 3. Organizational Chart. Field and laboratory research will initially focus in four high-engagement countries (bold border). Other countries (thin or dotted border) will be members of the *WAB-Net* and may additionally contribute specimens for CoV study. Countries grouped by geographic sub-region (colors). RSS in Jordan and Lugar Center in Georgia will serve as regional hubs for laboratory research and training (represented by lab logos). The Scientific Advisory Board will provide scientific oversight, and serve as lead experts during workshops. The Steering Committee will lead communication and ensure adherence to project aims within and between the country regions and with government ministries.

Potential Challenges and Proposed Solutions

Two inherent risks of multi-national research projects are 1) dependence on the stability and capabilities of research partners and collaborators, and 2) lack of communication. We have selected our core collaborators based on their excellent scientific reputation and existing relationships with EHA (see Attachment 3, sections 1 and 2). EHA successfully coordinated animal and human pathogen surveillance and reporting among 30 countries for the last 7 years under our USAID Emerging Pandemic Threats PREDICT project, which now also includes Jordan. We have trained hundreds of local partners in safe and ethical handling of bats for biological sampling. We are confident in our project management skills, level of expertise in this arena, and that our organizational structure will facilitate information exchange and collaboration. While we recognize that Western Asia is both highly-diverse and challenging in regards to political trust amongst some partner countries, our experience is that scientific research – notably wildlife and ecological research – has the ability to rise above such political challenges when faced with a common goal and driven by passionate individuals. We believe that our project will embody a ‘bats for peace’ mission – by promoting data sharing and a culture of meaningful transboundary scientific collaboration especially as the *WAB-Net* matures.

Another potential challenge is in working with biological specimens in developing countries, especially regarding logistics and export. EHA’s work in Saudi Arabia with MERS-CoV^{3,4} and Jordan under PREDICT demonstrates our ability to conduct safety and Personal Protective Equipment (PPE) training with local partners, collect and transport samples from the field, and work with biosecure laboratories in the US and in Saudi Arabia. Similarly, under this project we will work with the regional partner labs (see PRAT forms) and US NIH scientists (see letter, Rocky Mountain Laboratories) to ensure strict adherence to biosecurity standards.

While we are aware of the unique security challenges the region presents, we view the structure our multinational research effort as providing a resilient system for bat virus research in this politically volatile region. Our sampling design includes multiple sampling sites within our high-engagement countries and additional sites from medium-engagement countries to ensure the necessary spatial coverage of bat species and specimens for CoV investigations (see Attachment 3, section 7 “Detailed Sampling Framework”) – even if individual sites are disrupted due to security concerns. Information gained from even a subset of countries will add critical information about baseline diversity of CoVs and potential for zoonotic spillover in the region. Given the scope of the research, which determines the broader geographic distribution of bat

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species and viruses, rather than a temporal prevalence analysis, any interruptions in work in participating countries would not jeopardize the project as a whole nor the validity or power of the research results. Additionally, the high-engagement countries are dispersed in the region, so border conflicts are not expected to affect project-wide operations. Jordan and Georgia, where reference laboratory analyses will be centralized, have demonstrated relative stability and we can shift the proportion of laboratory work between the two countries if this becomes necessary to ensure meeting deliverables. Our project's Communication Plan requires monthly calls with our foreign partners and adequate advance notice for all planned fieldwork to assess travel warnings and advisories (see Attachment 3, section 5). The prime organization, EHA, is well situated to anticipate and address any political challenges that arise during the project given 1) our experience in navigating political instability in countries where we work, including risks in accessing and performing work in remote field sites, 2) strong existing collaborations with local researchers who can inform us of early threats and suggest contingency plans, and 3) our prior field work in the region during high-alert periods, including in Saudi Arabia in response to the MERS outbreak in 2012 ahead of the Hajj and current work in Jordan lead by Co-PI Karesh.

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D. RELEVANCE.

This project will represent the first coordinated research effort to understand the distribution and diversity of bats and their viruses, and, subsequently, risk of bat-borne disease emergence in Western Asia. Importantly, the capabilities generated will be shared across the region and with other sectors (i.e. agriculture and public health authorities), allowing for sustainable growth of zoonotic One Health research and improved capacity for the early detection and characterization of select biological agents (CoVs) with pandemic potential. Our research will provide critical information about the baseline diversity of viruses in natural populations, allowing for more rapid differentiation of intentional or nefarious versus natural disease emergence events. For example, sequences obtained from any future CoV emergence events in people or domestic animals can be compared against our georeferenced CoV sequence database to help determine if the event was likely to be 'natural' based on observed and predicted baseline levels of CoV diversity from the outbreak site. The One Health model implemented through our research approach will be shared openly to guide development of complementary efforts in countries, and the scientific results generated will be disseminated to stakeholders, including health, agriculture, and environment ministries, intergovernmental organizations, and the greater research community via presentations and posters at international and regional conferences. Annual summaries of research findings and a final policy brief based on the spillover risk assessment model will be provided to DTRA and local government authorities in participating countries.

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II. CREDENTIALS.

PI: Dr. Kevin Olival is Associate VP for Research at EHA. He has been conducting research on bat ecology, evolution, population genetics, and viral discovery for the past 12 years, including as the organizational team lead for recent MERS-CoV investigations in Saudi Arabia and manager of several other international projects. Dr. Olival serves on the Steering Committee of the Southeast Asian Bat Conservation Research Group (an NSF-funded Research Coordination Network), the Scientific Advisory Board for the Lubei Bat Conservancy, and as a disease advisor for Bat Conservation International. He has coordinated field and laboratory wildlife disease surveillance efforts under the USAID PREDICT project in several countries over the last

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

7 years, and also serves as the Modeling & Analytics Coordinator under PREDICT-2. Dr. Olival is also co-PI on a NIH R01 award to investigate the risk of CoV emergence from bats in China.

Prime Organization: EcoHealth Alliance (EHA) is a scientific organization with over 40 years of experience working with local partners in over 30 countries at the nexus of health, biodiversity conservation and international development. EHA has a staff of >40 in New York, including multidisciplinary scientists, wildlife veterinarians, administration, and communications staff. EHA has an extensive record of publishing high quality, peer-reviewed papers, briefing documents and reports, including work on bat CoVs. Through strong collaborations with in-country partners, EHA promotes scientific capacity building that enhances knowledge of ecology and health, e.g to understand MERS-CoV ecology in Saudi Arabia and other long-term collaborations with wildlife health experts in the region (Jordan, UAE, Israel). EHA's demonstrated expertise in producing highly-utilized and understandable science-based outputs will contribute significantly to achieving project goals and developing a strong and sustainable scientific network.

Regional Partner Laboratories: Two laboratories will serve as regional centers for bat pathogen investigations and laboratory training for this project (*see CVs and support letters*). Additional in-country labs to be added to project if deemed necessary, and pending approval and completion of the DTRA protocol risk assessment tool (PRAT).

- **Center For Excellence In Biosafety, Biosecurity And Biotechnology Royal Scientific Society** (Amman, Jordan). The largest applied research institution in Jordan, the Center is at the forefront of science and biosecurity in Jordan. The lab currently leads scientific trainings and regional partnerships (including with Iraq) and is focused on developing affordable biosecurity and biosafety. Jordan is also headquarters for the Eastern Mediterranean Public Health Network (EMPHNET) that links together Ministries of Health in Iraq, Pakistan, Saudi Arabia, and other countries in the region. Through our contacts at RSS Jordan we will use the EMPHNET to engage with government-level public health colleagues and to communicate relevant findings from our proposed research. (Key Personnel: Dr. Nisreen AL-Hmoud)
- **R. Lugar Center for Public Health Research** (Tbilisi, Georgia). The Lugar Center is supported via US-Georgia collaborations with the goal of combatting especially dangerous pathogens (EDPs) through rigorous scientific research. The Lugar Center has BSL-2 and BSL-3 facilities, and houses the National Repository of EDPs and a ABSL-2 vivarium. The Lugar center has established collaborations with neighboring countries, including Armenia, Azerbaijan, and Turkey, that include specimen and data sharing agreements. (Key Personnel: Drs. Ketevan Sidamonidze and Lela Urushadze)

Rocky Mountain Laboratories (Montana, USA) is a premier NIH-NIAID facility with a BSL-4 laboratory and extensive experience on CoV diagnostics and MERS-CoV infection. Dr. Munster will provide expertise in virology, in-kind support for additional testing pending agreement and specimen export, and advise on development of diagnostics at two regional laboratories, above. (Key Personnel: Dr. Vincent Munster)

Additional High-Engagement Country Field Partners: We will work directly with two world-class research institutions to lead field-sampling efforts in Turkey and Pakistan: the **University of Veterinary & Animal Sciences (UVAS), Lahore, Pakistan** (Key Personnel: Dr. Shahzad Ali) and **Boğaziçi University** (Key Personnel: Dr. Rasit Bilgin). **See Attachment 3 for CVs and facility information.**

I. WORK TO BE PERFORMED.

A. GENERAL. By the end of the proposed three-year base period of the project, plus two optional years, we will have collected sufficient bat and viral data to statistically test our three central hypotheses, created the first coordinated regional project for bat disease investigations in Western Asia, and generated spatial analytic tools to inform bat disease risk. **Outputs include:** **a)** extensive characterization and sequence data from bat CoVs; **b)** a website and information management system for sharing field ecology and laboratory data (via an add-on to EHA's existing web-based spatial database); **c)** the first-ever comprehensive models using ecological and disease data from Western Asia to assess zoonotic spillover and spread risk; **d)** locally-hosted, annual workshops to improve core competencies in partner countries' ability to conduct viral surveillance in wildlife and share data; **e)** improved capacity for bat specimen collection and testing; and **f)** improved scientific capacity for analyzing, publishing, and reporting data to enable early detection of high priority bat pathogens in the region.

B. SUMMARY

Year 1

Task 1: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia.

Task 2: Bat specimen and disease ecology field data collection.

Task 3: Regional bat coronavirus characterization.

Task 4: Compile and disseminate research results and reports to stakeholders.

Year 2

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia.

Task 2: Continued: Bat specimen and disease ecology field data collection.

Task 3: Continued: Regional bat coronavirus characterization.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders.

Year 3

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia.

Task 2: Continued: Bat specimen and disease ecology field data collection.

Task 3: Continued: Regional bat coronavirus characterization.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders.

Task 5: Synthesize data and conduct analyses of bat pathogen spillover risk.

Option Year 1

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia.

Task 2: Continued: Bat specimen and disease ecology field data collection.

Task 3: Continued: Regional bat coronavirus characterization.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders.

Task 5: Continued: Synthesize data and conduct analyses of bat pathogen spillover risk.

Option Year 2

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia.

Task 2: Continued: Bat specimen and disease ecology field data collection.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

Task 3: Continued: Regional bat coronavirus characterization.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders.

Task 5: Continued: Synthesize data and conduct analyses of bat pathogen spillover risk.

C. DETAILED TASKS.

YEAR # 1.

Task 1: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Y1-OY2).

Description and execution: Building on existing relationships and strong interest from 12 potential partner countries (*see Attachment 3 CV's and letters of support*), we will design a multi-national, zoonotic disease research platform (**Figs 2 and 3**). The *WAB-Net* (extended data sharing network) representatives (*see letters of support*) were selected because of their expertise in bat and/or virus research in their country and for their strong connections with government, NGO, and academic institutions. The process of coordinating and building the network will be ongoing throughout the project with the intention of organic and sustainable growth. Participants will be added through networking opportunities, including at conferences, workshops, and as in-country contacts grow in ministries and academic and research institutions. PI Olival has identified additional participants during a pilot workshop "Assessing priorities and gaps in bat research in Western Asia" held at the International Bat Research Conference (Durban, South Africa 2016). **A simple core competency assessment tool** (*see draft, Attachment 5*) will be developed to measure individual competency of project participants in the areas of: best practices for wildlife **field investigations**, safe animal handling, **specimen collection and transport**, personal protective equipment and **biosafety**, **cold chain management**, specimen tracking, and pathogen testing. The **Steering Committee** and **Scientific Advisory Board** will refine and agree upon proposed research hypotheses and oversee *WAB-Net* growth and communication. **An annual workshop** will be coordinated by EHA with input from the Steering Committee and will rotate to a different high-engagement country each year, each lasting 5 days. Three days will focus on training to meet project field and lab deliverables, including animal ethics, biosafety and biosecurity, and two days on data sharing. Activities to promote sustainment of the annual workshop, via cost-sharing and identification of additional sponsors, will be put in place in Year 3 and OY1-2. **The Year 1 workshop** topics will include taxonomic identification and bat diversity; ecological survey study design; and basics of One Health wildlife epidemiological investigations. Attendees will be encouraged to provide a poster or oral presentation on current research efforts. We will focus on refining hypotheses, identifying mechanisms for data sharing and communication across countries, as well as introducing the core competency assessment tool. Travel approvals will be determined in agreement with DTRA each year. Regional laboratories at RSS (Jordan) and the R. Lugar Center (Georgia) will provide diagnostic support for CoV characterization and training during **short-term laboratory research exchanges** primarily to facilitate testing of specimens collected from collaborating partner countries (e.g. Pakistan, Iraq, Turkey). Annually, 2-4 scientists will be selected for the research exchange program to enable scientists to strengthen their laboratory capacity and regional collaboration. Funding will be provided for extended stays (typically 2-3 weeks) in regional hub laboratories and possibly external reference laboratories (e.g. NIH Rocky Mountain Laboratories) for hands-on training on diagnostic techniques. All *WAB-Net* participants will be invited to apply for a research exchange through an expression of interest detailing whether or not bat specimens are available for testing, target skill sets to learn, and any proposed exchange site(s) or expert. The

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

project PIs, in coordination with DTRA personnel and the Scientific Advisory Board, will review proposals for appropriate fit, considering the findings of the Core Capacity Assessment (where available). Participants will be limited to a maximum of one funded research exchange. At the conclusion of the exchange, the visiting researcher will be encouraged to present their research to the host institution laboratory team to build scientific presentation skills, as well as complete an evaluation on skills learned through the exchange and ideas on opportunities for capacity dissemination in his or her country. All data from laboratory testing during research exchanges will be entered into the project database and contribute to risk modeling. As a critical part of the research platform we will create and maintain an information-sharing **website** and cloud-based **database**. The **database** will store ecological and viral data enabling testing of hypotheses related to CoV diversity and enable spatial modeling. EHA, with existing DTRA and US Fish and Wildlife funds, developed a multi-use One Health spatial database under our CBEP funded Rift Valley Fever project in South Africa. We will leverage and customize this platform to create a user friendly spatial infectious disease database for the bat community that links to other infectious disease databases and ecological and biodiversity datasets. Project data will be stored on the cloud, and accessed via a secure system with varying levels of permission where the user can decide whether to hide, share with spatial obfuscation, or to completely share with other users in the community. A stand-alone web site will also be built in Year 1 to facilitate information sharing and discussion among research teams, and provide the public information about *WAB-Net*, its members, and ongoing research. The website will be linked with the back-end spatial database.

Resources: EHA: 3 scientists (oversee network formation, provide input on core competency tool, plan agenda and present at annual workshop and meeting), 1 EHA field scientist to train country teams and provide expertise for field sampling; 1 program assistant (plan logistics of annual meeting, support for Steering Committee and research network partners). High-engagement countries: 2-3 research scientists per country (attend workshop; host or attend cross-training opportunities); Other countries: at least 1 research scientist per country (attend workshop); Steering Committee and Scientific Advisory Board: all members (develop competency assessment and data sharing standards, lead workshop sessions and training). *Progress Metrics:* Number of research collaborators and *WAB-Net* participants who participate in research platform and workshops; training modules covered; hypotheses generated; presentations delivered. Website developed and launched; program database and custom APIs for linking databases; establish data hosting and services on the Amazon Cloud Services. *Deliverable(s):* Regional capacity building workshop; professionals trained and engaged in scientific research projects; and core competency tool. *Subtasks: (Format: Year #, Task #, Subtask #).* 1.1.1 Confirm and identify research partners and diagnostic laboratories; 1.1.2 Develop, pilot and implement core scientific competency assessment; 1.1.3 Host workshop and data-sharing meeting in a high-engagement partner country; 1.1.4 Refine hypotheses for CoV study; 1.1.5 Organize and implement field-to-lab research exchange program; 1.1.6 Develop and maintain website for project; 1.1.7. Develop and maintain information sharing database.

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Task 2: Bat specimen and disease ecology field data collection. (Y1-OY2).

Description and execution: Improving the quality of bat species distribution and abundance data is essential for understanding the risk of zoonotic disease emergence and testing hypotheses relevant to the diversity and distribution of CoVs and other endemic bat pathogens. Species

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

composition and population size are likely important predictors of how many pathogens a wildlife community is able to maintain (e.g. critical community size theory), and the structure of bat communities can influence the degree of viral sharing between hosts⁸. Our recent work has shown that, including a control for research bias, species-specific traits including ecological and life-history variables and phylogenetic information can predict up to 80% of the variance in the number of zoonotic viruses a host species may harbor⁹. We will train for and support field investigations for targeted non-lethal bat specimen collection using standardized ecological methods for capture, species identification, and characterization of bat communities from geographic gaps identified in the first year of the project. All bats will be non-lethally sampled with strict adherence to US IACUC (animal use) approved protocols following those currently implemented by EHA scientists globally (see IACUC example in Attachment 3). Longitudinal datasets will be additionally identified among WAB-Net scientists, and where possible, trends in population decline or increase will be measured over the duration of the project from field trapping data. Data will be collated and entered into the database with appropriate permission controls for data access, agreed upon by each member. **Site selection:** Using spatial gap analyses and existing maps of bat zoonoses^{1,9}, we will select 3-5 unique sites for field investigations in participating high-engagement countries. Additional sites in medium-engagement countries will be selected for WAB-Net-supported standardized ecological surveys to assess bat species diversity and distributions and to collect additional specimens for CoV characterization. **Field methods:** Field survey methods include 4-5 nights of mist netting and harp trapping at each site to capture a range of insectivorous and fruit bat species, with a minimum target of 30 bats *per species per site*. We will additionally set up bat echolocation monitoring equipment for remote monitoring during the trapping period, using 1-2 SM2BAT | Passive Ultrasonic Bat Recorder to automatically record bat calls for 12 hours each night. Echolocation calls will be analyzed to identify additional bat taxa (e.g. genera or families) not sampled using trapping and to quantify nightly bat activity using published algorithms^{10,11}. Data will later be analyzed using rank abundance and rarefaction curves to compare diversity and abundance in tandem between sites, and we will apply standard statistical comparisons of bat and CoV diversity and abundance among sites. **Specimen and data collection:** Specimens for the CoV study will be collected during bat field surveys using previously validated, non-lethal capture and sampling strategies to capture animals and collect blood, oral swabs, and feces, and/or rectal swabs for viral discovery¹² (see example IACUC in Attachment 3 for further details on methods). See further details of CoV study and specimen sample sizes under Task 3, below. Morphological measurements, sex and age, locality, and representative echolocation calls will be recorded for each specimen, and wing tissue biopsies collected for host DNA sequencing and cophylogeny analysis. Specimens for CoV screening (Task 3) will be transported from field sites to local and regional laboratories following strict cold-chain and biosafety protocols and stored at -80C. Funding for supplies to survey, capture, and sample bats that can be locally sourced will be provided via subawards to the four high-engagement countries; additional supplies will be procured in Years 1 and 2 by EHA for four medium-engagement countries. At each annual workshop we will review biosafety and animal handling protocols, collate new data from dedicated surveys, and provide training in data entry to the project database.

Resources: EHA: 2 scientists (conduct training, advise on site selection), 1 program administrator (assist country partners with data entry); High-engagement countries: At least two scientists from each country; Other country partners: at least one per country. Scientific Advisory Board: all members (provide input on study design, troubleshooting, best practices).

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Moved down [1]: Sera will be frozen and banked for future investigations, particularly to identify potential reservoirs for MERS-related CoVs, and rectal swabs will be prioritized for screening given primary CoV shedding in this specimen type¹³.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

Progress Metrics: Number of trapping and echolocation survey nights completed; Number of specimens collected; Number of species locality and ecological data records entered in database.

Deliverable(s): Initiate bat surveys, specimen collection, and ecological data collection, and compile data in central spatial database.

Subtasks: **1.2.1** Equip country partners with field supplies; **1.2.2** Conduct field-based specimen collection training in high-engagement countries; **1.2.3** Assist countries with study design and implementation plan for standardized surveys and implement bat study transects; **1.2.4** Collect bat specimens for CoV study and species distribution and taxonomic data; **1.2.5** Transport specimens to approved laboratories for storage.

Task 3: Regional bat coronavirus characterization (Y1-OY2).

Description and execution: As laboratory characterization of bat viruses is core to our research aims, collaborating scientists will be trained to conduct field investigations for bat virus discovery, laboratory characterization of bat CoVs, and analysis of data (*analysis of CoV sequence and ecological data are presented in detail in Task 5 as relevant to hypothesis testing and risk modeling*). Testing will be centralized at two regional laboratories: RSS lab (Jordan) and R. Lugar Center (Georgia), with potential to add additional lab partners per Task 1 following consultation with regional laboratory leads and DTRA. Per Task 2, we will use previously validated, non-lethal capture and sampling strategies for viral discovery¹². Cold chain (liquid N₂), viral transport and biosecurity best practices will be standardized and utilized across the project. **Study design and sample size justification:** Sampling plan details are provided in *Supporting Documentation, Attachment 3, section 7*. In summary, we will conduct 0-5 sampling events (unique location and time) per country, per year. A total of 90 bats will be captured and sampled in each event, with a minimum target sample size of 30 individuals per species. Four specimen types will be collected per animal (blood, saliva, feces, and wing tissue), for a total of 360 specimens collected per sampling event. **Feces/rectal specimens will be prioritized for testing each year** as these are most likely to yield CoVs¹³. Sera will be frozen and banked for future investigations, particularly to identify potential reservoirs for MERS-related CoVs. DNA from bat wing tissue from 10% of individuals will be sequenced for cytochrome b (1110 base pairs) to confirm field identification and obtain data for host virus co-phylogenetic analyses. **Species with distributions in two or more countries within a subregion, but that are unique between subregions (see Fig 3) will be targeted to address patterns of geographic CoV diversity per hypothesis 1.** Assuming mean bat-CoV RNA prevalence of 6% in feces¹³, 30 individuals per species per sampling site will give us 95% probability of detecting a positive CoV, and a sample size of 90 specimens per site will yield an average of 5.4 CoV sequences for analyses. Thus, screening an anticipated 1800 bat specimens (e.g. in project year 3) will yield 108 ± 12 positive CoV samples for analysis. However, CoV prevalence in bats may actually be much larger than ~6% depending on species and seasonality. For example, in a survey of bat CoVs in Saudi Arabia we found that 219 (32%) of 675 fecal pellets collected in April 2013 were CoV PCR positive and were successfully sequenced³. Using an analysis of CoV 'species' accumulation curves from our previous work, an overall sample size of just 300 individuals will allow us to characterize 80% of the predicted CoV strain diversity in a given species¹⁴. *Over the course of the project, we will conduct 60 sampling events, sample 5,220 bats, and collect over 20,000 specimens (5,220 of which will be prioritized for CoV screening) – see Attachment 3, section 7* **Laboratory assays:** We will screen fecal samples using standard RNA extraction protocols and degenerate PCR CoV assays to amplify and sequence the RNA-

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

dependent RNA polymerase (*RdRp*) gene^{15,16}. These protocols have been extensively validated by the USAID PREDICT project to amplify a large range of known and novel bat-CoVs. Regional laboratories will be equipped with supplies and will validate PCR assays in Year 1, and synthetic positive controls developed under the USAID PREDICT project will be shared with partner laboratories.

Additional hypotheses (testable given the described sampling approach) will be developed in Year 1 to further understand bat CoV diversity in the region, and possibly additional CoV assays (e.g. CoV serology) will be utilized pending in-kind contributions or additional resources (e.g. from NIH Rocky Mountain, the USAID PREDICT-2 project in overlapping countries, or additional DoD funds). For example, we can test whether and which bat species in Western Asia are reservoirs for MERS-CoV by screening of bat sera samples for MERS-CoV antibodies.

Resources: EHA: 3 scientists (procure equipment, provide training on screening protocols, conduct analysis/interpretation on CoVs with scientific partners); High-engagement countries: 2 research scientists (collect samples, ship to designated laboratories, conduct analysis/interpretation on CoVs); Other country partners: 1 research scientist per country via laboratory research exchange (collect samples, ship to designated laboratories, conduct analysis/interpretation on CoVs); RSS and the Lugar Center 1-2 laboratory scientists.

Progress Metrics: Samples sent to laboratories; samples tested; number of viruses detected.

Deliverable(s): Initiate bat sampling and testing for CoVs.

Subtasks: 1.3.1 Equip country partners with laboratory supplies; 1.3.2 Conduct laboratory-based diagnostic training

Task 4: Compile and disseminate research results and reports to stakeholders (Y1-OY2).

Description and execution: Research results, summary of data collected, and outputs from meetings and workshops will be compiled annually and shared in reports to various stakeholders (country-level, regional, and international). DTRA reporting will be completed annually. At least two network participants will participate in international meetings each year, e.g. the North American Society for Bat Research, the American Society for Hygiene and Tropical Medicine, ASM Biodefense, or International Meeting on Emerging Diseases to disseminate scientific findings. Biobank sample repository information and associated metadata will be maintained in a DTRA-specified format and all samples and data will be available for at least 12 months past the project end date. We will publish 1 peer-reviewed, open access manuscript in Year 1.

Resources: EHA: 3 scientists (synthesize outputs of the network, develop annual report for DTRA and a summary report for stakeholders, provide input on country-level reports), 1 program assistant (to assist EHA tech team in maintaining cloud-based data storage system, assist country POCs with data entry, arrange travel for partners). High-engagement countries: 1 research scientist per country (compile country-level report and preliminary findings); Other country partners: 1 research scientist per country (compile country-level report).

Progress Metrics: Completion of annual reports to DTRA, the wider scientific community and other stakeholders. Completion of country-level reports on time.

Deliverable(s): Communication via reports to DTRA, the wider scientific community, and other stakeholders. Biobank sample repository maintained and updated.

Subtasks: 1.4.1 Submit annual report, including sample repository data, to DTRA; 1.4.2 Analyze and disseminate study findings to local, regional, and global stakeholders; 1.4.3 Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review.

Moved up [2]: We will also sequence a mitochondrial gene (cytochrome b, 1140 base pairs) for a subset of CoV positive bats to obtain data for host-virus co-phylogenetic analyses.

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Year #2

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Y1-OY2).

Description and execution: As specified in Task 1, Year 1. **The Year 2 workshop** will include hands-on echolocation monitoring, non-lethal bat sampling for disease investigations, and specimen and cold chain management. It will include an introduction or refresher course on PPE, biosafety, and principles of One Health research. In the beginning of Year 2, the core competency tool will be rolled out for use in all high-engagement partner countries. Other countries will also be invited to conduct the assessment. We will work with the existing CBEP mechanism to support travel for scientific advancement.

Resources: Same as Task 1, Year 1. *Progress Metrics:* Attendance at workshop; training modules covered; number of trainees and research exchanges; individual core competency tool finalized; number of personnel completing assessment. *Deliverable(s):* Regional capacity building and data sharing workshop; professionals trained and engaged in scientific research projects; and core competency tool implemented. *Subtasks:* **2.1.1** Confirm and identify research partners and diagnostic laboratories; **2.1.2** Develop, pilot and implement core scientific competency assessment; **2.1.3** Host workshop and data-sharing meeting in a high-engagement partner country; **2.1.4** Refine hypotheses for CoV study; **2.1.5** Organize and implement field-to-lab research exchange program; **2.1.6** Develop and maintain website for project; **2.1.7.** Develop and maintain information sharing database.

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Task 2: Continued: Bat specimen and disease ecology field data collection (Y1-OY2).

Description and execution: As specified in Task 2, Year 1.

Resources: Same as Task 2, Year 1. *Progress Metrics:* Same as Task 2, Year 1. *Deliverable(s):* Same as Task 2, Year 1. *Subtasks:* **2.2.1** Equip country partners with field supplies; **2.2.2** Conduct field-based specimen collection training in high-engagement countries; **2.2.3** Assist countries with study design and implementation plan for standardized surveys and implement bat study transects; **2.2.4** Collect bat specimens for CoV study and species distribution and taxonomic data; **2.2.5** Transport specimens to approved laboratories for storage.

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Task 3: Continued: Regional bat coronavirus characterization (Y1-OY2).

Description and execution: As specified in Task 3, Year 1, subtasks 3.3-3.5 will additionally be implemented in Year 2 to OY2.

Resources: Same as Task 3, Year 1. *Progress Metrics:* Samples sent to laboratories; samples tested; number of viruses detected. *Deliverable(s):* Initiate bat sampling and testing for CoVs. *Subtasks:* **2.3.1** Equip country partners with laboratory supplies; **2.3.2** Conduct laboratory-based diagnostic training; **2.3.3** Store and update repository data for bat specimens; **2.3.4** Screen specimens for CoVs; **2.3.5** Confirm and sequence positive specimens.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders (Y1-OY2).

Description and execution: Same as above; see Task 4, Year 1.

Resources: Same as Task 4, Year 1. *Progress Metrics:* Same as Task 4, Year 1. *Deliverable(s):* Same as Task 4, Year 1, except two peer-reviewed publications drafted. *Subtasks:* **2.4.1** Submit annual report, including sample repository data, to DTRA; **2.4.2** Analyze and disseminate study findings to local, regional, and global stakeholders; **2.4.3** Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review

Year #3

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Y1-OY2).

Description and execution: As specified in Task 1, Year 1. **The Year 3 workshop** will include analysis of biodiversity community data; GIS mapping and spatial analysis; and basic phylogenetic tree reconstruction. In Y3, each country will update the core capacity assessment. *Resources:* Same as Task 1, Year 1. *Progress Metrics:* Same as Task 1, Year 1. *Deliverable(s):* Same as Task 1, Year 1. *Subtasks:* **3.1.1** Confirm and identify research partners and diagnostic laboratories; **3.1.2** Develop, pilot and implement core scientific competency assessment; **3.1.3** Host workshop and data-sharing meeting in a high-engagement partner country; **3.1.5** Organize and implement field-to-lab research exchange program; **3.1.6** Develop and maintain website for project; **3.1.7.** Develop and maintain information sharing database.

Task 2: Continued: Bat specimen and disease ecology field data collection (Y1-OY2).

Description and execution: As specified in Task 2, Year 1. *Resources:* Same as Task 2, Year 1. *Progress Metrics:* Same as Task 2, Year 1. *Deliverable(s):* Same as Task 2, Year 1. *Subtasks:* **3.2.1** Equip country partners with field supplies; **3.2.2** Conduct field-based specimen collection training in high-engagement countries; **3.2.3** Assist countries with study design and implementation plan for standardized surveys and implement bat study transects; **3.2.4** Collect bat specimens for CoV study and species distribution and taxonomic data; **3.2.5** Transport specimens to approved laboratories for storage.

Task 3: Continued: Regional bat coronavirus characterization (Y1-OY2).

Description and execution: As specified in Task 3, Year 1. *Resources:* Same as Task 3, Year 1. *Progress Metrics:* Samples sent to laboratories; samples tested; number of viruses detected. *Deliverable(s):* Initiate bat sampling and testing for CoVs. *Subtasks:* **3.3.1** Equip country partners with laboratory supplies; **3.3.2** Conduct laboratory-based diagnostic training; **3.3.3** Store and update repository data for bat specimens; **3.3.4** Screen specimens for CoVs; **3.3.5** Confirm and sequence positive specimens.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders (Y1-OY2). *Description and execution:* As specified in Task 4, Year 1. Additionally in Year 3 through OY2, synthesis reports will be generated annually to disseminate preliminary findings to relevant stakeholders and local governments including risk analyses outputs; and three manuscripts will be drafted for regional or international peer-reviewed journals.

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Resources: Same as Task 4, Year 1. *Progress Metrics:* Same as Task 4, Year 1. *Deliverable(s):* Same as Task 4, Year 1. *Subtasks:* **3.4.1** Submit annual report, including sample repository data, to DTRA; **3.4.2** Analyze and disseminate study findings to local, regional, and global stakeholders; **3.4.3** Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review; **3.4.4.** Prepare/submit peer-reviewed manuscripts

Task 5: Synthesize data and conduct analyses of bat pathogen spillover risk (Y3-OY2).

Description and execution: We will test our three primary hypotheses (plus additional hypotheses as developed) aimed at understanding the risk of CoV viral spillover from bats to humans using a range of analytical approaches. Project data including bat and virus distribution from ecological field surveys, species occurrence and ecological data collated from partners;

novel CoV sequence data; and previously published CoV data and existing spatial data sets (environmental, socio-economic, and ecological disease drivers) from the region will be synthetically analyzed in Y3-OY2. We will employ a combination of disease risk modeling approaches developed and/or currently being used at EHA^{1,7,9,13,14,17,18}. Species capture and presence/absence data from echolocation monitoring at field sites will be used to refine **ecological niche models** for each bat species to test patterns of observed CoV richness/diversity using previously published methods¹. A minimum of 30 well-distributed occurrence data points are needed for each species to accurately model its distribution¹⁹ which will be met combining existing data with our proposed field sampling strategy across the region. We will use Ecological Niche Models (ENMs) under an ensemble²⁰ modeling framework, as conducted previously at EHA¹⁷ to create fine-scale habitat suitability models and improved geographical ranges for each potential CoV reservoir bat species. We will resample bat occurrence points within these refined geographic ranges, combining data with bioclimatic²¹ variables to produce a climatic envelope representing the potential geographic distribution of each species and validate these models with occurrence data obtained from the field and literature. Using a novel spatial tool ('geographic profiling')²² to describe spread from a common source we will identify target areas where high levels of bat CoV diversity and potential ecological drivers for viral spillover combine. We will combine data from field surveys, habitat suitability models of bat species, global gridded data sets for environmental variables and human and livestock density, and localities of CoV-positive bats from 60 sampling events sites to develop high-resolution maps of CoV spillover potential in Western Asia. We will use **spatially-explicit, multivariate linear conditional autoregressive (CAR) models**¹ to correct for autocorrelation in response and explanatory variables and test for correlation between CoV diversity and host species diversity and environmental variables (**to test H₁ and H₂**). Relationship between CoV strain diversity and host species life history trait and demographic information (**H₂**) will additionally be tested using Generalized Additive Models and K-fold validation, following our recent work⁹.

Bat-viral co-phylogenetic analyses¹⁸ will be used to quantify frequency and likelihood of CoV spillover between species (**to test H₃**), and develop predictions of cross-species CoV transmission as it relates to either host relatedness or geography. We will use CoV and host sequence data generated in this project as well as previously published CoV strains from a diverse range of host species to quantify co-evolutionary patterns and host range in bat-CoVs. Phylogenetic relationships will be reconstructed using the RdRp gene for CoVs and the cytb gene for host species. Multiple sequence alignments will be performed using MUSCLE and ClustalW methods implemented in Geneious²³. Phylogenies will be estimated using maximum likelihood and Bayesian inference implemented in RaxML²⁴ and MrBayes²⁵, respectively. Robustness of the trees will be assessed using bootstrap replicates. For co-phylogenetic analyses, we will select programs that are capable of accounting for evolutionary patterns given association of virus species to multiple hosts, as well as the presence of multiple viruses in a single host. To test the null hypothesis that there is no pattern of co-evolution and assess the statistical significance of bat-CoV associations, we will use both global fit and event-based methods and perform permutations to randomized hosts-virus associations and then measure congruence relative to the host tree. Global-fit analysis will be tested using ParaFit²⁶ to quantify the degree of congruence between host and CoV phylogenies, and identify the significant individual associations contributing most to the co-phylogenetic structure. We will additionally use the event-based program Jane²⁷ to determine the most probable co-evolutionary history of the associated host and viruses. Two phylogenies are considered as significantly congruent if the

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

cost of the best solution is lower than the costs expected by chance²⁷. We will use different spatial and taxonomic data partitions to test co-phylogenetic significance at multiple spatial and taxonomic scales across Western Asia (**H₃**). Comparing the patterns of host-CoV co-phylogeny between different regions, we will also be able to test the hypothesis that cross-species transmission of CoVs are more frequent in areas with greater species overlap (related to **H₁**).

Power test and CoV diversity measures: We will use epidemiological analyses to assess statistically significant differences in CoV prevalence and diversity across study sites using a range of hierarchical aggregations of data by site, species, and country. Using our previous data and analysis derived from extensive sampling of one bat species¹⁴, we predict each bat species may harbor on average 14 unique CoV ‘species’. We simulated our sampling plan to estimate our ability (i.e. power test) to distinguish viral communities between species using analysis of similarities (ANOSIM), with Bray-Curtis distance as our similarity measure²⁸. Assuming 20% overlap between hosts in viral species, sampling 450 individuals per species for the most common species in the region, over the course of the project, will provide strong statistical power to distinguish between species on a pairwise basis. Inference is strong ($p < 0.001$) at 10, 20, and 50% overlap, and $p > 0.05$ at 80% viral overlap per species.

Resources: EHA: 3 research scientists (conduct analyses and provide interpretation and synthesis for reporting on findings); High-engagement countries: 2 research scientists per country (collate and clean country-level data sets); Other countries: at least 1 research scientist per country (collate country-level data sets); Scientific Advisory Board: all members (provide guidance on data interpretation and communication of findings to steering committee).

Progress Metrics: Development of regional and country-level analyses and risk models.

Deliverables: Phylogenetic analyses by species groups; number of spatial risk maps generated; synthesized interpretation of findings reported. **Subtasks:** **3.5.1** Clean and refine field and laboratory data from database for analyses; **3.5.2** Conduct viral phylogeny and co-phylogenetic analyses; **3.5.3** Conduct epidemiological analysis of CoV prevalence and diversity; **3.5.4** Refine ecological niche and species distribution analyses; **3.5.5** Develop and refine bat spillover risk assessment model

Option Year 1

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Y1-OY2).

Description and execution: As specified in Task 1, Year 1. **The OY1 workshop** will include a round-table for troubleshooting CoV laboratory diagnostics, hands-on training in co-phylogenetic analysis of viral and host sequence data, and basics in species distribution modeling. We will seek local support and in-country government funds to cost-share in OY1 to begin to offset the costs of holding an annual workshop, with a plan for fully supporting the meeting at the end of the project. Local cost sharing may include covering venue costs via free use of local university or government conference facilities, receptions during workshop, and volunteer and staff time needed to organize and host meetings. We will additionally identify and meet with potential regional sponsors in Western Asia with a history of supporting international conferences.

Resources: Same as Task 1, Year 1 – except no EHA field scientist. **Progress Metrics:** Same as Task 1, Year 1. **Deliverable(s):** Same as Task 1, Year 1. **Subtasks:** **OY1.1.3** Host workshop and data-sharing meeting in a high-engagement partner country; **OY1.1.5** Organize and implement

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

field-to-lab research exchange program; **OY1.1.6:** Develop and maintain website for project;
OY1.1.7. Develop and maintain information sharing database.

Task 2: Continued: Bat specimen and disease ecology data collection (Y1-OY2).

Description and execution: As specified in Task 2, Year 1.

Resources: Same as Task 2, Year 1. *Progress Metrics:* Same as Task 2, Year 1. *Deliverable(s):* Same as Task 2, Year 1. *Subtasks:* **OY1.2.4** Collect bat specimens for CoV study and species distribution and taxonomic data; **OY1.2.5** Transport specimens to approved laboratories for storage.

Task 3: Continued: Regional bat coronavirus characterization (Y1-OY2).

Description and execution: As specified in Task 3, Year 1.

Resources: Same as above; See Task 3, Year 1. *Progress Metrics:* Samples sent to laboratories; samples tested; number of viruses detected. *Deliverable(s):* Continue bat sampling and testing for CoVs. *Subtasks:* **OY1.3.1** Equip country partners with laboratory supplies; **OY1.3.2** Conduct laboratory-based diagnostic training; **OY1.3.3** Store and update repository data for bat specimens; **OY1.3.4** Screen specimens for CoVs; **OY1.3.5** Confirm and sequence positive specimens.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders (Y1-OY2). *Description and execution:* As specified in Task 4, Year 1.

Resources: Same as Task 4, Year 1. *Progress Metrics:* Same as Task 4, Year 1. *Deliverable(s):* Same as Task 4, Year 1. *Subtasks:* **OY1.4.1** Submit annual report, including sample repository data, to DTRA; **OY1.4.2** Analyze and disseminate study findings to local, regional, and global stakeholders; **OY1.4.3** Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review; **OY1.4.4.** Prepare/submit peer-reviewed manuscripts

Task 5: Continued: Synthesize data and conduct analyses of bat pathogen spillover risk (Y3-OY2). *Description and execution:* Same as above; see Task 5, Year 3.

Resources: Same as Task 5, Year 3 - plus part time LHA data analyst statistician. *Progress Metrics:* Development of regional and country-level analyses and risk models. *Deliverables:* Host-virus phylogenetic analyses by species groups; number of spatial risk maps generated; synthesized interpretation of findings reported. *Subtasks:* **OY1.5.1** Clean and refine field and laboratory data from database for analyses; **OY1.5.2** Conduct viral phylogeny and co-phylogenetic analyses; **OY1.5.3** Conduct epidemiological analysis of CoV prevalence and diversity; **OY1.5.4** Refine ecological niche and species distribution analyses; **OY1.5.5** Develop and refine bat spillover risk assessment model

Option Year 2

Task 1: Continued: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Y1-OY2).

Description and execution: As specified in Task 1, OY1. **The OY2 workshop** will additionally include an overview of integrated emerging disease risk modeling; and training on grant and manuscript writing to facilitate research network sustainability. Multi-year research datasets and analyses will be summarized in advance and presented concisely (in written and oral form) for participants to share the information with stakeholders in their respective countries. We will seek local support and in-country government funds to cost-share in OY2.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

Resources: Same as Task 1, Option Year 1. *Progress Metrics:* Same as Task 1, Option Year 1.
Deliverable(s): Same as Task 1, Year 1. *Subtasks:* **OY2.1.3** Host workshop and data-sharing meeting in a high-engagement partner country; **OY2.1.5** Organize and implement field-to-lab research exchange program; **OY2.1.6;** Develop and maintain website for project; **OY2.1.7.** Develop and maintain information sharing database.

Task 2: Continued: Bat specimen and disease ecology data collection (Y1-OY2).

Description and execution: As specified in Task 2, Year 1. Activities will be limited to the first half of OY2 to allow for adequate time for screening and analysis of bat specimens.
Resources: Same as Task 2, Year 1. *Progress Metrics:* Same as Task 2, Year 1. *Deliverable(s):* Same as Task 2, Year 1. *Subtasks:* **OY2.2.4** Collect bat specimens for CoV study and species distribution and taxonomic data; **OY2.2.5** Transport specimens to approved laboratories for storage.

Task 3: Continued: Regional bat coronavirus characterization (Y1-OY2).

Description and execution: Same as above; See Task 3, Year 1.
Resources: Same as above; See Task 3, Year 1. *Progress Metrics:* Samples sent to laboratories; samples tested; number of viruses detected. *Deliverable(s):* Continue testing for CoVs; sequencing completed. *Subtasks:* **OY2.3.3** Store and update repository data for bat specimens; **OY2.3.4** Screen specimens for CoVs; **OY2.3.5** Confirm and sequence positive specimens.

Task 4: Continued: Compile and disseminate research results and reports to stakeholders (Y1-OY2).

Description and execution: As specified in Task 4, Year 1. Additionally in OY2, end-of-project reports will be generated. Two peer-reviewed publications will focus on scientific advancements made through the five years of data collection, sharing, and analysis; and the structure and best practices learned from *WAB-Net* for a One Health model that other regions or disciplines could employ. At least two *WAB-Net* scientists will attend the North American Society for Bat Research and another international conference to share end-of-project findings.
Resources: Same as Task 4, Year 1. *Progress Metrics:* Same as Task 4, Year 1. *Deliverable(s):* Same as Task 4, Year 1. Additionally, end-of-project report is finalized. *Subtasks:* **OY2.4.1** Submit annual report, including sample repository data, to DTRA; **OY2.4.2** Analyze and disseminate study findings to local, regional, and global stakeholders; **OY2.4.3** Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review; **OY2.4.4.** Prepare/submit peer-reviewed manuscripts

Task 5: Continued: Synthesize data and conduct analyses of bat pathogen spillover risk (Y3-OY2).

Description and execution: As specified in Task 5, (OY1). In OY2 a policy brief will additionally be developed for decision makers to summarize primary findings from bat virus spillover risk models.

Resources: Same as Task 5, Year 3. *Progress Metrics:* Development of regional and country-level analyses and risk models. *Deliverables:* Spatial risk maps finalized; synthesized interpretation of findings reported. *Subtasks:* **OY2.5.1** Clean and refine field and laboratory data from database for analyses; **OY2.5.2** Conduct viral phylogeny and co-phylogenetic analyses; **OY2.5.3** Conduct epidemiological analysis of CoV prevalence and diversity; **OY2.5.4** Refine ecological niche and species distribution analyses; **OY2.5.5** Develop and refine bat spillover risk assessment model; **OY2.5.6** Develop final technical report and policy brief from risk assessment

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

I. PERFORMANCE SCHEDULE.

Task	Year 1	Year 2	Year 3	OY 1	OY 2
Task 1: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia					
1.1 Confirm and identify research partners and diagnostic laboratories					
1.2 Develop, pilot and implement core scientific competency assessment					
1.3 Host workshop and data-sharing meeting in a high-engagement partner country					
1.4 Refine hypotheses for CoV study					
1.5 Organize and implement field-to-lab research exchange program					
1.6 Develop and maintain website for project					
1.7 Develop and maintain information sharing database					
Task 2: Bat specimen and disease ecology field data collection					
2.1 Equip country partners with field supplies					
2.2 Conduct field-based specimen collection training in core countries					
2.3 Assist countries with study design and implementation plan for standardized surveys and implement bat study transects					
2.4 Collect bat specimens for CoV study and species distribution and taxonomic data					
2.5 Transport specimens to approved laboratories for storage					
Task 3: Regional bat Coronavirus characterization					
3.1 Equip country partners with laboratory supplies					
3.2 Conduct laboratory-based diagnostic training					
3.3 Store and update repository data for bat specimens					
3.4 Screen specimens for coronaviruses					
3.5 Confirm and sequence positive specimens					
Task 4: Compile and disseminate research results and reports to stakeholders					
4.1 Submit annual report, including sample repository data, to DTRA					
4.2 Analyze and disseminate study findings to local, regional, and global stakeholders					
4.3 Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review					
4.4 Prepare/submit peer-reviewed manuscripts					
Task 5: Synthesize data and conduct analyses of bat pathogen spillover risk					
5.1 Clean and refine field and laboratory data from database for analyses					
5.2 Conduct viral phylogeny and co-phylogenetic analyses					
5.3 Conduct epidemiological analysis of CoV prevalence and diversity					
5.4 Refine ecological niche and species distribution analyses					
5.5 Develop and refine bat spillover risk assessment model					
5.6 Develop final technical report and policy brief from risk assessment					

II. REFERENCES

¹Briely, L. *et al.* Quantifying Global Drivers of Zoonotic Bat Viruses: A Process-Based Perspective. *The American Naturalist* 187, E53-E64, (2016). ²Olival, KJ *et al.* Are Bats Really “Special” as Viral Reservoirs? What We Know and Need to Know. *Bats and Viruses: A New Frontier of Emerging Infectious Diseases*, 281-294. (2015). ³Memish, ZA *et al.* Middle East Respiratory Syndrome Coronavirus in Bats, Saudi Arabia. *Emerging Infectious Diseases* 19, 1819-1823, (2013). ⁴Alagaili, AN *et al.* Middle East respiratory syndrome coronavirus infection in dromedary camels in Saudi Arabia. *MBio* 5, e00884-00814, (2014). ⁵Epstein, J & Olival, KJ. In *Forum on Microbial Threats* (eds Choffnes, ER & A Mack) (The National Academies Press, 2015). ⁶Morse, SS. Factors in the emergence of infectious diseases. *Emerging Infectious Diseases* 1, 7-15, (1995). ⁷Jones, KE *et al.* Global trends in emerging infectious diseases. *Nature* 451, 990-993, (2008). ⁸Wacharapluesadee, S *et al.* Diversity of coronavirus in bats from Eastern Thailand. *Virology Journal* 12, 57, (2015). ⁹Olival, KJ *et al.* Host and viral traits predict zoonotic spillover from mammals. *Nature*. (In Review). ¹⁰Gorresen, PM *et al.* Assessing bat detectability and occupancy with multiple automated echolocation detectors. *Journal Of Mammalogy* 89, 11-17, (2008). ¹¹Weller, TJ & Baldwin, JA. Using echolocation monitoring to model bat occupancy and inform mitigations at wind energy facilities. *Journal of Wildlife Management* 76, 619-631, (2012). ¹²Newman, SH *et al.* Investigating the role of bats in emerging zoonoses: balancing ecology, conservation and public health interests. Vol. 12 (FAO, 2011). ¹³Young, CW & Olival, KJ. Optimizing Viral Discovery in Bats. *PLoS one* 11, e0149237, (2016). ¹⁴Anthony, SJ *et al.* A strategy to estimate unknown viral diversity in mammals. *MBio* 4, e00598-00513, (2013). ¹⁵Quan, P-L *et al.* Identification of a severe acute respiratory syndrome coronavirus-like virus in a leaf-nosed bat in Nigeria. *MBio* 1, e00208-00210, (2010). ¹⁶Watanabe, S *et al.* Bat coronaviruses and experimental infection of bats, the Philippines. *Emerg Infect Dis* 16, 1217-1223, (2010). ¹⁷Daszak, P *et al.* Interdisciplinary approaches to understanding disease emergence: the past, present, and future drivers of Nipah virus emergence. *Proceedings of the National Academy of Sciences* 110, 3681-3688, (2013). ¹⁸Lei, BR & Olival, KJ. Contrasting patterns in mammal-bacteria coevolution: Bartonella and Leptospira in bats and rodents. *PLoS Negl Trop Dis* 8, e2738, (2014). ¹⁹Stoeckwell, DR & Peterson, AT. Effects of sample size on accuracy of species distribution models. *Ecological Modelling* 148, 1-13, (2002). ²⁰Araújo, MB & New, M. Ensemble forecasting of species distributions. *Trends in ecology & evolution* 22, 42-47, (2007). ²¹Hijmans, RJ *et al.* Very high resolution interpolated climate surfaces for global land areas. *International journal of climatology* 25, 1965-1978, (2005). ²²Verity, R *et al.* Spatial targeting of infectious disease control: identifying multiple, unknown sources. *Methods in Ecology and Evolution* 5, 647-655, (2014). ²³Kearse, M *et al.* Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics* 28, 1647-1649, (2012). ²⁴Stamatakis, A. RAxML-VI-HPC: maximum likelihood-based phylogenetic analyses with thousands of taxa and mixed models. *Bioinformatics* 22, 2688-2690, (2006). ²⁵Ronquist, F & Huelsenbeck, JP. MrBayes 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics* 19, 1572-1574, (2003). ²⁶Legendre, P *et al.* A statistical test for host-parasite coevolution. *Systematic Biology* 51, 217-234, (2002). ²⁷Conow, C *et al.* Jacc: a new tool for the cophylogeny reconstruction problem. *Algorithms for Molecular Biology* 5, 1, (2010). ²⁸Clarke, KR. Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology* 18, 117-143, (1993).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: K.J. Olival, EcoHealth Alliance,
HDTRA1-14-24-FRCWMD-BAA CBEP-TA 6 CC WMD

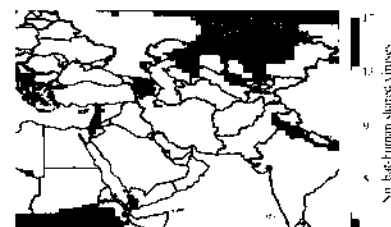
Objective: To characterize the diversity of coronaviruses (CoVs) and test key hypotheses about bat-borne zoonotic virus emergence risk in Western Asia in order to reduce the threat of infectious diseases.

Methods: Multi-country field investigations to collect bat specimens and ecological data; laboratory characterization of bat CoV diversity; establish collaborative research network and data sharing via annual review and planning workshops and research exchanges; and risk modeling to improve understanding of zoonotic disease emergence across Western Asia.

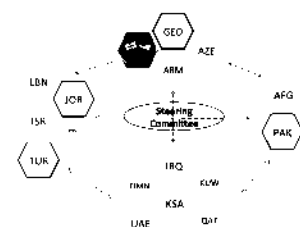
Status of effort: Partnerships established with 3 core laboratories (Georgia, Jordan, US NIH/RML) and field research partners in 12 countries from the region, and Scientific Advisory Board formed.

Personnel Supported: 24 Researchers, 8 University Faculty, 6 Graduate Students, 2 Post-Doctoral Fellows, 6 Scientific Advisors.

Publications & Meetings: >12 peer-reviewed scientific papers and >15 presentations at National and International Science, Medicine, or Policy forums and conferences are expected.



Known bat zoonoses 'hotspots'



High engagement:
Medium engagement:
NA

Research
Network
Structure

Major Goals and Milestones:

- Establish One Health research platform to investigate bat zoonoses – Years 1-3 & Option Years 1-2
- Characterization of CoVs – Years 2-3 & OY1-2
- Increased capacity to research, publish, and share scientific information – Years 1-3 & OY 1-2
- Analysis of bat viral emergence risk Year 3 & OY1-2

Funding Profile: \$782,329 Yr1, \$893,443 Yr 2, \$942,264 Yr 3, \$772,972 OY1, \$590,533 OY2

Contact information PI: Dr. Kevin J. Olival,
212-380-4478 Olival@EcoHealthAlliance.org

Statement of Work

Project Title: Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

Document Date: July 29, 2016

Objective: Our primary objective is to characterize the diversity of coronaviruses (CoVs) and test key hypotheses about bat-borne zoonotic virus emergence risk in Western Asia in order to reduce the threat of infectious diseases. Despite growing recognition of the importance of bat viruses as zoonotic diseases, and the emergence of the Middle East Respiratory Syndrome coronavirus (MERS-CoV), there remains limited scientific knowledge of the distribution and ecology of bats, their pathogen diversity, and potential interfaces for transmission to humans and other species in Western Asia – an area encompassing over 20 countries in the Middle East and Near East. Our project is designed to detect emerging viruses at their source (wildlife populations) through hypothesis-driven research, and to provide a mechanism for improved risk assessment, information sharing and scientific collaboration in an area with fragmented, and often limited, capacity for zoonotic disease investigations. Through partnerships with laboratories within the region and extensive field investigations, we will establish a statistically rigorous research platform to characterize endemic pathogen diversity for coronaviruses, a key viral family with known pandemic potential. Data on pathogen diversity, host distribution, and ecological traits will be curated, exchanged, and used to model zoonotic disease risk and facilitate scientific collaboration in this politically volatile region.

Scope:

The grantee proposes development of a regional zoonotic bat disease research program, including specific hypothesis-driven scientific activities to characterize coronavirus (CoV) diversity and risk of viral spillover to people. Toward advancement of One Health research, the grantee will also establish a network of scientists currently working independently on bat and disease research to more effectively share data aimed at parameterizing risk models and testing regional hypotheses in disease ecology of bat-borne pathogens. Research findings will be disseminated broadly in the scientific community and to relevant government authorities and policy makers in the US and Western Asia. The grantee team shall focus on the following goals and milestones:

1. Conduct disease ecology investigations to more precisely map bat-borne zoonotic disease distribution and spillover risk (Year 1 – Option Year 2).
 - Milestones: Establish study protocols; map existing data; implement field surveys to catalogue regional bat diversity, species inventories, and collect specimens for CoV characterization; collate spatial and ecological data into central database; refine species distribution maps and niche models to refine reservoir host distribution in Western Asia; develop and maintain information sharing database and website.
2. Characterize bat CoV diversity in Western Asia to improve understanding of spillover risk. (Year 1 – Option Year 2).

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

- Milestones: Train personnel and implement field and laboratory studies; collect and transport bat specimens; validate coronavirus assays; screen specimens using PCR; sequence CoV positive specimens; database for viral sequence, host, and spatial data.
3. Improve the One Health scientific capacity for bat and disease ecology research in Western Asia (Year 1 – Option Year 2).
 - Milestones: Establish regional network of scientists; implement hypothesis-driven research projects (per below); field, laboratory and analytical training of in-country scientists; research exchanges from 'field to lab'; annual project planning and data sharing workshop; country capacity assessments; coordinated information sharing platform; and publish and disseminate scientific findings.
 4. Synthesize data and conduct analyses of bat pathogen spillover risk (Year 3 Option Year 2)
 - Milestones: Develop and apply a range of analytical approaches to model spatial patterns of zoonotic virus distribution and risk, host-viral sharing and evolutionary co-divergence, and identify correlates of viral diversity; develop and parameterize a synthetic model of bat spillover risk for region.

This work will support strengthening One Health research capacity in four high-engagement countries with CBEP determination: Jordan, Georgia, Turkey, and Pakistan, and a broader research coordination network including countries geographically adjacent to core countries in Western Asia. The project will engage one to two lead bat scientist identified as points of contact in each country and establish field and laboratory teams with additional local scientists to conduct surveillance activities. The Center For Excellence In Biosafety, Biosecurity And Biotechnology Royal Scientific Society (Amman, Jordan) and the R. Lugar Center for Public Health Research (Tbilisi, Georgia) will serve as regional hubs for laboratory research and training in pathogen detection. Support for laboratory protocols and transfer of technology and information sharing will additionally be provided by NIH's Rocky Mountain Laboratories and the USAID Emerging Pandemic Threats PREDICT project. A Steering Committee will facilitate communication within and between the country regions and with government ministries, and will define and oversee the strategic aims of the network. The Scientific Advisory Board will provide general oversight to animal welfare and biosecurity issues and scientific validity of proposed research activities, maintain collaborations with researchers from other regions, and will serve as lead experts during capacity building activities and workshops. The proposed project period is three years, with two optional years to augment datasets for more robust hypothesis testing and promote further advancement of scientific capacity in the region.

Background:

Bats are hosts to a wide range of viral zoonoses of concern to DoD, CDC, WHO, and OIE due to their pandemic potential, high mortality rates, and lack of treatment options, including Ebola virus, Marburg virus, Nipah virus, SARS-CoV and MERS-CoV. However, despite the risk that viral zoonoses emerging from bats pose worldwide, compared to Southeast Asia, Europe, the Americas, and Africa, virtually nothing is known about viral pathogens in natural bat populations

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

from Western Asia. Bats are an extremely diverse group (1200+ species globally) of ecologically important animals that have been understudied compared to other taxonomic groups.

Zoonotic disease research in the Middle East and Western Asia is highly fragmented and largely undeveloped – with often only one or two experts per country working in isolation within national boundaries and without access to disease experts or laboratories for diagnostics. As bats are mobile and do not respect political borders, there is a critical need to engage and link ecological researchers through meaningful field-based projects to allow for more comprehensive research and surveillance activities in Western Asia. Bat research coordination networks exist in Southeast Asia (Southeast Asian Bat Conservation Research Unit, SEABCRU); in Europe (Eurobats); and in Africa (Bat Conservation Africa), but Western Asia represents a major geographic gap. Western Asia does not currently have the infrastructure in place to support data sharing for regional understanding of zoonotic disease threats, nor wildlife ecology and distribution more generally. Many health authorities in the region are not aware of bat populations or diversity in their countries. Our proposed research project will additionally serve multiple goals and objectives of the CBEP mission, by: 1) engaging partner country scientists in high-quality, hypothesis-driven research; 2) enhancing understanding of endemic viruses to allow differentiation of natural vs. nefarious emergence events in the future; 3) supporting biosurveillance capacity building by enhancing partner capability to detect, diagnose, and report select agents; 4) employing responsible bio-risk management best practices; 5) training partner country researchers to think critically about ethical research and be competitive in soliciting international funding; and 6) promoting a One Health concept.

Key references include (further references can be found in the Project Narrative):

- Memish, ZA, N Mishra, KJ Olival, SF Fagbo, V Kapoor, JH Epstein, R AlHakeem, M Al Asmari, A Islam, A Kapoor, T Briesce, P Daszak, AA Al Rabeeah, and WI Lipkin. 2013. Middle East Respiratory Syndrome Coronavirus in Bats, Saudi Arabia. *Emerging Infectious Diseases* 19: 1819-1823.
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- Newman, SH, HE Field, JH Epstein, and CE de Jong. 2011. Investigating the role of bats in emerging zoonoses: Balancing ecology, conservation and public health interests. Food and Agricultural Organization of the United Nations, Rome.

Tasks/Scientific Goals: (Format: Year #(s).Task #. Subtask#).

Task Y1.1-OY2.1: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia (Years 1-OY2).

The grantee shall assemble a network of scientific research partners from high and medium-engagement countries via email, conference calls, and formal invitations. Data for risk modeling will be collated across a larger regional footprint than our proposed field sampling sites through annual data-sharing workshops and the creation of the Western Asia Bat Research Network (*WAB-Net*) – a collaborative, sustainable network of key wildlife researchers and public health representatives from >12 countries. The process of coordinating and building the network will be ongoing throughout the grant. Participants will be added through networking opportunities,

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

including at poster sessions, workshops, bat and/or wildlife health meetings, and as in-country contacts grow in ministries and academic and research institutions. 2-4 participants will be selected to participate in research exchanges with regional reference laboratories each year to strengthen their scientific capacity and facilitate testing of specimens collected from collaborating partner countries (e.g. Pakistan, Turkey). A simple core competency assessment tool (piloted in Y1, and then implemented Y2-OY2) will be developed to measure individual competency of project participants in the areas of: best practices for wildlife field investigations, safe animal handling, specimen collection and transport, personal protective equipment and biosafety, cold chain management, specimen tracking, and pathogen testing. A workshop and data-sharing meeting will be held annually. The grantee will build a website for communication and customize an existing CBEP funded cloud-based database to host project ecological and viral data and enable testing of hypotheses related to CoV diversity and spatial modeling.

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- Y1.1.1-Y3.1.1** Confirm and identify research partners and diagnostic laboratories.
- Y1.1.2-Y3.1.2** Develop, pilot and implement core scientific competency assessment.
- Y1.1.3-OY2.1.3** Host workshop and data-sharing meeting in a high-engagement partner country.
- Y1.1.4-Y2.1.4** Refine hypotheses for CoV study.
- Y1.1.5-OY2.1.5** Organize and implement field-to-lab research exchange program.
- Y1.1.6-OY2.1.6** Develop and maintain website for project.
- Y1.1.7-OY2.1.7** Develop and maintain information sharing database.

Task Y1.2-OY2.2: Bat specimen and disease ecology field data collection (Years 1-OY2).

The grantee will train for and support field investigations for targeted bat specimen collection using standardized ecological methods for capture, species identification, and characterization of bat communities from geographic gaps identified in the first year of the project. All bats will be non-lethally sampled with strict adherence to US IACUC approved protocols. Improving the quality of bat species distribution and abundance data is essential for understanding the risk of zoonotic disease emergence and testing hypotheses relevant to the diversity and distribution of coronaviruses and other endemic bat pathogens. Longitudinal datasets will be additionally identified among *WAB-Net* scientists, and where possible, trends in population decline or increase will be measured over the duration of the project from field trapping data. Data will be collated and entered into the database with appropriate permission controls for data access, agreed upon by each member. Field survey methods include 5-7 nights of bat trapping and echolocation monitoring at each site (0-5 unique sites per participating country over the course of this project), with a minimum target of 30 bats *per species per site* on each sampling trip, with target 3 *species per site* (total 90 bats per sampling event). We will conduct 58 sampling events (46 in high-engagement countries, and at least 12 in medium-engagement countries) over the course of the project. Bat echolocation call analyses will be used to identify additional taxa (e.g. genera or families) not sampled using trapping and to quantify nightly bat activity using published algorithms. Data will be analyzed using rank abundance and rarefaction curves to compare diversity and abundance in tandem between sites, and we will apply standard statistical comparisons of bat and CoV diversity and abundance among sites (See Task 5). Specimens for the CoV study (rectal swabs/feces, oral swabs, blood, and tissue wing) will be collected during field surveys (see Task 3). Tissue biopsies will be collected for genetic barcoding to confirm field species IDs as needed. Supplies for ecological surveys will be provided to the four high-engagement countries and four or more medium-engagement countries, and a recommended

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

supply list (plus additional supplies as budget allows) will be provided to the remaining partner countries. At each annual workshop we will collate data from previous and dedicated surveys and provide training in data entry to the *WAB-Net* database (see Task 1).

Y1.2.1-Y3.2.1 Equip country partners with supplies for study.

Y1.2.2-OY1.2.2 Conduct field-based training for network scientists.

Y1.2.3-OY1.2.3 Assist countries with study design and implementation plan for standardized surveys and implement bat study transects.

Y1.2.4-OY2.2.4 Collect bat specimens for CoV study and species distribution and taxonomic data.

Y1.2.5-OY2.2.5 Transport specimens to approved local or regional laboratory for storage.

Task Y1.3-OY2.3: Regional bat coronavirus characterization (Years 1-OY2).

The grantee shall develop and maintain a collaborative research investigation to characterize bat-CoVs. Local researchers shall be trained to conduct non-lethal bat virus specimen collection, and refine and test hypotheses relevant to geographic and host specific patterns of CoV diversity in bats. We will capture bats and collect fecal, oral, blood, and tissue specimens. 5220 fecal specimens representing individual bats will be collected and prioritized for testing (with testing of additional samples as resources allow), with 522 tissue specimens banked for species confirmation. Assuming mean RNA prevalence of 6%, this will give us 95% probability of detecting a positive CoV in each species, and with 30 fecal specimens per species, per site, will yield an average of 3 CoV sequences per target species for analyses. Assuming a conservative average prevalence of ~6% across all bat species and locations, screening an anticipated 5220 bat fecal specimens across the project will yield a minimum of 313 ± 36 positive CoV samples for analysis. Cold chain, viral transport and biosecurity best practices will be standardized and utilized across the project. Demographic and ecological data will be collected with specimens and entered into the central database. Testing will be initially conducted at two regional laboratories (RSS and Lugar), with additional potential laboratory capacity for CoV screening pending funding and DTRA approval. We will validate CoV PCR assays in Year 1, and screen fecal samples with follow-up confirmatory sequencing and analysis on positive specimens in subsequent years.

Y1.3.1-OY1.3.1 Equip country partners with laboratory supplies.

Y2.3.2-OY1.3.2 Conduct laboratory-based diagnostic training.

Y2.3.3-OY2.3.3 Store and update repository data for bat specimens.

Y2.3.4-OY2.3.4 Screen specimens for CoVs.

Y2.3.5-OY2.3.5 Confirm and sequence positive specimens.

Task Y1.4-OY2.4: Compile and disseminate research results and reports to stakeholders (Years 1-OY2).

The grantee shall synthesize and report on the project's scientific, regional capacity building achievements, and specific data collected/analyzed to DTRA and various stakeholders (country-level, regional, and international). Biobank sample repository information and associated metadata will be maintained in a DTRA-specified format and all samples and data will be available for at least 12 months past the project end date. Scientific publications will be written and submitted for peer-review and presentation and international conferences.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

Y1.4.1-OY2.4.1 Submit annual report, including sample repository data, to DTRA.

Y1.4.2-OY2.4.2 Analyze and disseminate study findings to local, regional, and global stakeholders.

Y1.4.3-OY2.4.3 Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review.

Y1.4.4-OY2.4.4 Prepare/submit peer-reviewed manuscripts

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Task Y3.5-OY2.5: Synthesize data and conduct analyses of bat pathogen spillover risk (Years 3-OY2).

The grantee will analyze data to test primary hypotheses aimed at understanding the risk of CoV viral spillover from bats to humans using a range of analytical approaches. Project data including bat and virus distribution from ecological field surveys, species occurrence and ecological data collated from partners, novel CoV sequence data, and previously published CoV data and existing spatial (environmental and ecological disease drivers) data sets from the region will be synthetically analyzed. Specific analytical tools used will include ecological niche models, geographic profiling analysis, spatial regressions, bat-virus cophylogeny analyses, and epidemiological analyses and power tests to assess risk of spillover between species and by subregion.

Y3.5.1-OY2.5.1 Clean and refine field and laboratory data from database for analyses.

Y3.5.2-OY2.5.2 Conduct viral phylogeny and co-phylogenetic analyses.

Y3.5.3-OY2.5.3 Conduct epidemiological analysis of CoV prevalence and diversity.

Y3.5.4-OY2.5.4 Refine ecological niche and species distribution analyses.

Y3.5.5-OY2.5.5 Develop and refine bat spillover risk assessment model.

OY2.5.6 Develop final technical report and policy brief from risk assessment.

Performance Schedule

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia
PI: Kevin J. Olival CBEP –Thrust Area 6, CC WMD

Task	Year 1	Year 2	Year 3	OY1	OY2
Task 1: Establish robust scientific research platform to understand zoonotic disease risk in Western Asia					
1.1 Confirm and identify research partners and diagnostic laboratories					
1.2 Develop, pilot and implement core scientific competency assessment					
1.3 Host workshop and data-sharing meeting in a high-engagement partner country					
1.4 Refine hypotheses for CoV study					
1.5 Organize and implement field-to-lab research exchange program					
1.6 Develop and maintain website for project					
1.7 Develop and maintain information sharing database					
Task 2: Bat specimen and disease ecology field data collection					
2.1 Equip country partners with field supplies					
2.2 Conduct field-based specimen collection training in core countries					
2.3 Assist countries with study design and implementation plan for standardized surveys and implement bat study transects					
2.4 Collect bat specimens for CoV study and species distribution and taxonomic data					
2.5 Transport specimens to approved laboratories for storage					
Task 3: Regional bat Coronavirus characterization					
3.1 Equip country partners with laboratory supplies					
3.2 Conduct laboratory-based diagnostic training					
3.3 Store and update repository data for bat specimens					
3.4 Screen specimens for coronaviruses					
3.5 Confirm and sequence positive specimens					
Task 4: Compile and disseminate research results and reports to stakeholders					
4.1 Submit annual report, including sample repository data, to DTRA					
4.2 Analyze and disseminate study findings to local, regional, and global stakeholders					
4.3 Conduct presentations/meetings at times and places specified in the grant schedule, including DTRA Annual Technical Review					
4.4 Prepare/submit peer-reviewed manuscripts					
Task 5: Synthesize data and conduct analyses of bat pathogen spillover risk					
5.1 Clean and refine field and laboratory data from database for analyses					
5.2 Conduct viral phylogeny and co-phylogenetic analyses					
5.3 Conduct epidemiological analysis of CoV prevalence and diversity					
5.4 Refine ecological niche and species distribution analysis					
5.5 Develop and refine bat spillover risk assessment model					
5.6 Develop final technical report and policy brief from risk assessment					

RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		338,876.14
Section B, Other Personnel		632,958.95
Total Number Other Personnel	10	
Total Salary, Wages and Fringe Benefits (A+B)		1,321,835.09
Section C, Equipment		
Section D, Travel		866,211.20
1. Domestic	28,100.00	
2. Foreign	846,111.20	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		1,230,391.40
1. Materials and Supplies	324,500.00	
2. Publication Costs	21,600.00	
3. Consultant Services		
4. ADP/Computer Services	104,000.00	
5. Subawards/Consortium/Contractual Costs	780,291.40	
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		3,118,437.69
Section H, Indirect Costs		863,103.79
Section I, Total Direct and Indirect Costs (G + H)		3,981,541.48
Section J, Fee		

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text" value="1,800.00"/>
2. Foreign Travel Costs	<input type="text" value="136,790.40"/>
Total Travel Cost	<input type="text" value="138,590.40"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

		Funds Requested (\$)
1.	Materials and Supplies	82,500.00
2.	Publication Costs	2,800.00
3.	Consultant Services	
4.	ADP/Computer Services	60,000.00
5.	Subawards/Consortium/Contractual Costs	76,786.00
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.	<input type="text"/>	
9.	<input type="text"/>	
10.	<input type="text"/>	
Total Other Direct Costs		221,686.00

G. Direct Costs

		Funds Requested (\$)
Total Direct Costs (A thru F)		581,190.45

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	35.40	568,190.44	201,139.42
Total Indirect Costs			201,139.42

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

		Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)		782,329.87

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text" value="4,400.00"/>
2. Foreign Travel Costs	<input type="text" value="176,078.40"/>
Total Travel Cost	<input type="text" value="180,478.40"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

		Funds Requested (\$)
1.	Materials and Supplies	83,000.00
2.	Publication Costs	3,600.00
3.	Consultant Services	
4.	ADP/Computer Services	20,000.00
5.	Subawards/Consortium/Contractual Costs	176,993.00
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
Total Other Direct Costs		283,593.00

G. Direct Costs

		Funds Requested (\$)
Total Direct Costs (A thru F)		696,661.14

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	35.40	555,882.14	196,782.28
Total Indirect Costs			196,782.28

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

		Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)		893,443.42

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1224-DTRA_REA_Budget_Justification_Nov			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> Add Attachment <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text" value="6,500.00"/>
2. Foreign Travel Costs	<input type="text" value="195,722.40"/>
Total Travel Cost	<input type="text" value="202,222.40"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

		Funds Requested (\$)
1.	Materials and Supplies	70,000.00
2.	Publication Costs	5,400.00
3.	Consultant Services	
4.	ADP/Computer Services	8,000.00
5.	Subawards/Consortium/Contractual Costs	224,858.00
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
Total Other Direct Costs		308,258.00

G. Direct Costs

		Funds Requested (\$)
Total Direct Costs (A thru F)		754,699.64

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	35.40	529,841.63	187,563.94
Total Indirect Costs			187,563.94

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

		Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)		942,263.58

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1224-DTRA_REA_Budget_Justification_Nov			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> Add Attachment <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text" value="3,600.00"/>
2. Foreign Travel Costs	<input type="text" value="174,875.60"/>
Total Travel Cost	<input type="text" value="178,475.60"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

		Funds Requested (\$)
1.	Materials and Supplies	54,600.00
2.	Publication Costs	5,400.00
3.	Consultant Services	
4.	ADP/Computer Services	8,000.00
5.	Subawards/Consortium/Contractual Costs	225,568.00
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
Total Other Direct Costs		293,568.00

G. Direct Costs

		Funds Requested (\$)
Total Direct Costs (A thru F)		629,854.36

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	35.40	404,286.36	143,117.37
Total Indirect Costs			143,117.37

Cognizant Federal Agency
 (Agency Name, POC Name, and
 POC Phone Number)

I. Total Direct and Indirect Costs

		Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)		772,971.73

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1224-DTRA_REA_Budget_Justification_Nov			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text" value="3,800.00"/>
2. Foreign Travel Costs	<input type="text" value="162,644.40"/>
Total Travel Cost	<input type="text" value="166,444.40"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

		Funds Requested (\$)
1.	Materials and Supplies	34,400.00
2.	Publication Costs	5,400.00
3.	Consultant Services	
4.	ADP/Computer Services	8,000.00
5.	Subawards/Consortium/Contractual Costs	76,086.40
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
Total Other Direct Costs		123,886.40

G. Direct Costs

		Funds Requested (\$)
Total Direct Costs (A thru F)		456,032.10

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	35.40	379,945.70	134,500.78
Total Indirect Costs			134,500.78

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

		Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)		590,532.88

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1224-DTRA_REA_Budget_Justification_Nov			
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RESEARCH & RELATED BUDGET - Cumulative Budget

Totals (\$)

Section A, Senior/Key Person		338,876.14
Section B, Other Personnel		682,958.95
Total Number Other Personnel	10	
Total Salary, Wages and Fringe Benefits (A+B)		1,021,835.09
Section C, Equipment		
Section D, Travel		866,211.20
1. Domestic	20,100.00	
2. Foreign	846,111.20	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		1,230,391.40
1. Materials and Supplies	324,500.00	
2. Publication Costs	21,600.00	
3. Consultant Services		
4. ADP/Computer Services	104,000.00	
5. Subawards/Consortium/Contractual Costs	780,291.40	
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		3,118,437.69
Section H, Indirect Costs		863,103.79
Section I, Total Direct and Indirect Costs (G + H)		3,981,541.48
Section J, Fee		

10 YEAR R&R SUBAWARD BUDGET ATTACHMENT(S) FORM

Instructions: On this form, you will attach the 10 Year R&R Subaward Budget files for your grant application. Complete the subawardee budget(s) in accordance with the 10 Year R&R budget instructions. Please remember that any files you attach must be a PDF document.

[Click here to extract the 10 Year R&R Subaward Budget Attachment](#)

Important: Please attach your subawardee budget file(s) with the file name of the subawardee organization. Each file name must be unique.

1) Please attach Attachment 1	RR_Budget_Jordan.pdf		Delete Attachment	View Attachment
2) Please attach Attachment 2	RR_Budget_Pakistan.pdf		Delete Attachment	View Attachment
3) Please attach Attachment 3	RR_Subaward_Budget_Georgia.pdf		Delete Attachment	View Attachment
4) Please attach Attachment 4	RR_Subaward_Budget_Turkey.pdf		Delete Attachment	View Attachment
5) Please attach Attachment 5		Add Attachment		
6) Please attach Attachment 6		Add Attachment		
7) Please attach Attachment 7		Add Attachment		
8) Please attach Attachment 8		Add Attachment		
9) Please attach Attachment 9		Add Attachment		
10) Please attach Attachment 10		Add Attachment		

RESEARCH & RELATED BUDGET - Budget Period 1

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 1 **Start Date:** **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
	Nisreen		Al Eroud		(b)(6)						
Project Role: <input type="text" value="Key Personnel National Project Coordinator"/>											
	TBD		TBD		24,000.00	1.00			2,400.00	400.00	2,400.00
Project Role: <input type="text" value="Zoologist"/>											
	TBD		TBD		18,000.00	1.00			1,250.00	250.00	1,500.00
Project Role: <input type="text" value="Virologist"/>											

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text"/>	Post Doctoral Associates	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Total Number Other Personnel						Total Other Personnel <input type="text"/>
Total Salary, Wages and Fringe Benefits (A+B)							<input type="text" value="11,550.00"/>

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	1,500.00
Total Travel Cost	1,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	7,450.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	7,450.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	20,500.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Total Indirect Costs			

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	20,500.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	1,500.00
Total Travel Cost	1,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	41,450.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	41,450.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	66,500.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Total Indirect Costs			

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	66,500.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1235 DTRA_WAB Not_Jordan_BudgetJustif			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	4,500.00
Total Travel Cost	4,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	55,680.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	55,680.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	88,500.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Total Indirect Costs			

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	88,500.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1235 DTRA_WAB Not_Jordan_BudgetJustif			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	4,500.00
Total Travel Cost	4,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	54,860.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	54,860.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	89,210.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Total Indirect Costs			

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	89,210.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1235 DTRA_WAB Not_Jordan_BudgetJustif			
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RESEARCH & RELATED BUDGET - Budget Period 5

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 5 Start Date: **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
	Nisreen		Al Hroub		(b)(6)						

Project Role:

	TBD		TBD		23,000.00	2.00			3,200.00	640.00	3,840.00
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Project Role:

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text"/>	Post Doctoral Associates	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Total Number Other Personnel **Total Other Personnel**

Total Salary, Wages and Fringe Benefits (A+B)

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>
Additional Equipment: <input type="text"/>	<input type="text"/>
<input type="text"/> Add Attachment <input type="text"/>	<input type="text"/>
Total funds requested for all equipment listed in the attached file	<input type="text"/>
Total Equipment	<input type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input type="text"/>
2. Foreign Travel Costs	<input type="text"/>
Total Travel Cost	<input type="text"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input type="text"/>
2. Stipends	<input type="text"/>
3. Travel	<input type="text"/>
4. Subsistence	<input type="text"/>
5. Other <input type="text"/>	<input type="text"/>
<input type="text"/> Number of Participants/Trainees	<input type="text"/>
Total Participant/Trainee Support Costs	<input type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	23,760.00
2. Publication Costs	<input type="text"/>
3. Consultant Services	<input type="text"/>
4. ADP/Computer Services	<input type="text"/>
5. Subawards/Consortium/Contractual Costs	<input type="text"/>
6. Equipment or Facility Rental/User Fees	<input type="text"/>
7. Alterations and Renovations	<input type="text"/>
8. <input type="text"/>	<input type="text"/>
9. <input type="text"/>	<input type="text"/>
10. <input type="text"/>	<input type="text"/>
Total Other Direct Costs	23,760.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	39,000.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Total Indirect Costs			

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	39,000.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1235 DTRA_WAB Not_Jordan_BudgetJustif			
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RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		108,510.00
Section B, Other Personnel		
Total Number Other Personnel		
Total Salary, Wages and Fringe Benefits (A+B)		108,510.00
Section C, Equipment		
Section D, Travel		12,000.00
1. Domestic		
2. Foreign	12,000.00	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		183,200.00
1. Materials and Supplies	183,200.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		303,710.00
Section H, Indirect Costs		
Section I, Total Direct and Indirect Costs (G + H)		303,710.00
Section J, Fee		

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	2,250.00
Total Travel Cost	2,250.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	3,000.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	3,000.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 13,700.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

13,700.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1236-DTRA_WAB-Net_Pakistan_Budget_Justif

Delete Attachment

View Attachment

RESEARCH & RELATED BUDGET - Budget Period 2

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 2 **Start Date:** **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
Dr.	Shahzad		Ali		(b)(6)						

Project Role:

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**
Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text" value="1"/>	Post Doctoral Associates	<input type="text" value="12.00"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="2,400.00"/>	<input type="text" value="0.00"/>	<input type="text" value="2,400.00"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text" value="1"/>	Total Number Other Personnel						<input type="text" value="2,400.00"/>
Total Salary, Wages and Fringe Benefits (A+B)							<input type="text" value="(b)(6)"/>

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>

Additional Equipment:

Total funds requested for all equipment listed in the attached file
Total Equipment

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	6,750.00
Total Travel Cost	6,750.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	5,100.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	5,100.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 15,250.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

15,250.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1236-DTRA_WAB-Net_Pakistan_Budget_Justif

RESEARCH & RELATED BUDGET - Budget Period 3

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 3 **Start Date:** **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
Dr.	Shahzad		Ali		(b)(6)						
Project Role: <input type="text" value="PD/PI"/>											

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**

Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text" value="1"/>	Post Doctoral Associates	<input type="text" value="12.00"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="2,400.00"/>	<input type="text" value="0.00"/>	<input type="text" value="2,400.00"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text" value="1"/>	Total Number Other Personnel					Total Other Personnel	<input type="text" value="2,400.00"/>
						Total Salary, Wages and Fringe Benefits (A+B)	<input type="text" value="(b)(6)"/>

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>

Additional Equipment:

Total funds requested for all equipment listed in the attached file
Total Equipment

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	11,250.00
Total Travel Cost	11,250.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	2,600.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	2,600.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 17,250.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

17,250.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1236-DTRA_WAB-Net_Pakistan_Budget_Justif

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	11,250.00
Total Travel Cost	11,250.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	2,600.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	2,600.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 17,250.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

17,250.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1236-DTRA_WAB-Net_Pakistan_Budget_Justif

RESEARCH & RELATED BUDGET - Budget Period 5

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 5 **Start Date:** **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
	N/A		N/A						0.00	0.00	0.00

Project Role:

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**
Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text"/>	Post Doctoral Associates	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Total Number Other Personnel						Total Other Personnel <input type="text"/>
							Total Salary, Wages and Fringe Benefits (A+B) <input type="text" value="0.00"/>

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>

Additional Equipment:

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	
Total Travel Cost	

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	

G. Direct Costs**Funds Requested (\$)****Total Direct Costs (A thru F)** **H. Indirect Costs**

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
 (Agency Name, POC Name, and
 POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

0.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1236-DTRA_WAB-Net_Pakistan_Budget_Justif

RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		3,250.00
Section B, Other Personnel		8,400.00
Total Number Other Personnel	4	
Total Salary, Wages and Fringe Benefits (A+B)		11,650.00
Section C, Equipment		7,000.00
Section D, Travel		31,500.00
1. Domestic		
2. Foreign	31,500.00	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		13,300.00
1. Materials and Supplies	13,300.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		63,450.00
Section H, Indirect Costs		
Section I, Total Direct and Indirect Costs (G + H)		63,450.00
Section J, Fee		

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	1,500.00
Total Travel Cost	1,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	10,000.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	11,000.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	20,900.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	4.00	20,900.00	836.00
Total Indirect Costs			836.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	21,736.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	4,500.00
Total Travel Cost	4,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	42,550.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	42,550.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	75,450.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	4.00	75,450.00	3,018.00
Total Indirect Costs			3,018.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	78,468.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1237 DTRA_WAB Net_Georgia_Budget_Just			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	4,500.00
Total Travel Cost	4,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	53,188.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	53,188.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	95,488.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	4.00	95,488.00	3,820.00
Total Indirect Costs			3,820.00

Cognizant Federal Agency
 (Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	99,308.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1237 DTRA_WAB Net_Georgia_Budget_Just			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	4,500.00
Total Travel Cost	4,500.00

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	53,188.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	53,188.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	95,488.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	4.00	95,488.00	3,820.00
Total Indirect Costs			3,820.00

Cognizant Federal Agency
 (Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	99,308.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1237 DTRA_WAB Net_Georgia_Budget_Just			
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C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>
Additional Equipment: <input style="width: 200px;" type="text"/>	<input style="width: 100px;" type="text"/>
<input type="button" value="Add Attachment"/>	<input style="width: 100px;" type="text"/>
Total funds requested for all equipment listed in the attached file	<input style="width: 100%;" type="text"/>
Total Equipment	<input style="width: 100%;" type="text"/>

D. Travel

	Funds Requested (\$)
1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	<input style="width: 100%;" type="text"/>
2. Foreign Travel Costs	<input style="width: 100%;" type="text"/>
Total Travel Cost	<input style="width: 100%;" type="text"/>

E. Participant/Trainee Support Costs

	Funds Requested (\$)
1. Tuition/Fees/Health Insurance	<input style="width: 100%;" type="text"/>
2. Stipends	<input style="width: 100%;" type="text"/>
3. Travel	<input style="width: 100%;" type="text"/>
4. Subsistence	<input style="width: 100%;" type="text"/>
5. Other <input style="width: 300px;" type="text"/>	<input style="width: 100%;" type="text"/>
<input style="width: 50px;" type="text"/> Number of Participants/Trainees	Total Participant/Trainee Support Costs
	<input style="width: 100%;" type="text"/>

F. Other Direct Costs

	Funds Requested (\$)
1. Materials and Supplies	14,060.00
2. Publication Costs	<input style="width: 100%;" type="text"/>
3. Consultant Services	<input style="width: 100%;" type="text"/>
4. ADP/Computer Services	<input style="width: 100%;" type="text"/>
5. Subawards/Consortium/Contractual Costs	<input style="width: 100%;" type="text"/>
6. Equipment or Facility Rental/User Fees	<input style="width: 100%;" type="text"/>
7. Alterations and Renovations	<input style="width: 100%;" type="text"/>
8. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
9. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
10. <input style="width: 450px;" type="text"/>	<input style="width: 100%;" type="text"/>
Total Other Direct Costs	14,060.00

G. Direct Costs

	Funds Requested (\$)
Total Direct Costs (A thru F)	35,660.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	4.00	35,660.00	1,426.40
Total Indirect Costs			1,426.40

Cognizant Federal Agency
 (Agency Name, POC Name, and POC Phone Number)

I. Total Direct and Indirect Costs

	Funds Requested (\$)
Total Direct and Indirect Institutional Costs (G + H)	37,086.40

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1237 DTRA_WAB Net_Georgia_Budget_Just			
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RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		68,800.00
Section B, Other Personnel		65,200.00
Total Number Other Personnel	47	
Total Salary, Wages and Fringe Benefits (A+B)		134,000.00
Section C, Equipment		
Section D, Travel		15,000.00
1. Domestic		
2. Foreign	15,000.00	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		173,986.00
1. Materials and Supplies	173,986.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		322,986.00
Section H, Indirect Costs		12,920.40
Section I, Total Direct and Indirect Costs (G + H)		335,906.40
Section J, Fee		

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	1,000.00
Total Travel Cost	1,000.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	7,000.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	7,000.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 19,500.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	10.00	13,500.00	1,350.00
Total Indirect Costs			1,350.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

20,850.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1238-DTRA_WAB-Net_Turkey_budget_justifj

Delete Attachment

View Attachment

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	3,000.00
Total Travel Cost	3,000.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	4,000.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	4,000.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 15,250.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	10.00	15,250.00	1,525.00
Total Indirect Costs			1,525.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

16,775.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1238-DTRA_WAB-Net_Turkey_budget_justif

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	5,000.00
Total Travel Cost	5,000.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	2,000.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	2,000.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 18,000.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	10.00	18,000.00	1,800.00
Total Indirect Costs			1,800.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

19,800.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1238-DTRA_WAB-Net_Turkey_budget_justif

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	5,000.00
Total Travel Cost	5,000.00

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	2,000.00
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	2,000.00

G. Direct Costs**Funds Requested (\$)**

Total Direct Costs (A thru F) 18,000.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
Institutional Overhead	10.00	18,000.00	1,800.00
Total Indirect Costs			1,800.00

Cognizant Federal Agency
(Agency Name, POC Name, and
POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

19,800.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1238-DTRA_WAB-Net_Turkey_budget_justif

RESEARCH & RELATED BUDGET - Budget Period 5

OMB Number: 4040-0001
Expiration Date: 6/30/2016

ORGANIZATIONAL DUNS:

Enter name of Organization:

Budget Type: Project Subaward/Consortium

Budget Period: 5 Start Date: **End Date:**

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary (\$)	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
						Cal.	Acad.	Sum.			
	N/A		N/A						0.00	0.00	0.00

Project Role:

Additional Senior Key Persons: **Total Funds requested for all Senior Key Persons in the attached file**
Total Senior/Key Person

B. Other Personnel

Number of Personnel	Project Role	Months			Requested Salary (\$)	Fringe Benefits (\$)	Funds Requested (\$)
		Cal.	Acad.	Sum.			
<input type="text"/>	Post Doctoral Associates	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Graduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Undergraduate Students	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Secretarial/Clerical	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	Total Number Other Personnel						Total Other Personnel <input type="text"/>
							Total Salary, Wages and Fringe Benefits (A+B) <input type="text" value="0.00"/>

C. Equipment Description

List items and dollar amount for each item exceeding \$5,000

Equipment item	Funds Requested (\$)
<input type="text"/>	<input type="text"/>

Additional Equipment:
Total funds requested for all equipment listed in the attached file
Total Equipment

D. Travel**Funds Requested (\$)**

1. Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	
2. Foreign Travel Costs	
Total Travel Cost	

E. Participant/Trainee Support Costs**Funds Requested (\$)**

1. Tuition/Fees/Health Insurance	
2. Stipends	
3. Travel	
4. Subsistence	
5. Other <input type="text"/>	
<input type="text"/> Number of Participants/Trainees	
Total Participant/Trainee Support Costs	

F. Other Direct Costs**Funds Requested (\$)**

1. Materials and Supplies	
2. Publication Costs	
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. <input type="text"/>	
9. <input type="text"/>	
10. <input type="text"/>	
Total Other Direct Costs	

G. Direct Costs**Funds Requested (\$)****Total Direct Costs (A thru F)** **H. Indirect Costs**

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total Indirect Costs			<input type="text"/>

Cognizant Federal Agency
 (Agency Name, POC Name, and
 POC Phone Number)

I. Total Direct and Indirect Costs

Funds Requested (\$)

Total Direct and Indirect Institutional Costs (G + H)

0.00

J. Fee

Funds Requested (\$)

K. Budget Justification

(Only attach one file.)

1238-DTRA_WAB-Net_Turkey_budget_justif

RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals (\$)
Section A, Senior/Key Person		29,250.00
Section B, Other Personnel		6,500.00
Total Number Other Personnel	8	
Total Salary, Wages and Fringe Benefits (A+B)		35,750.00
Section C, Equipment		6,000.00
Section D, Travel		14,000.00
1. Domestic		
2. Foreign	14,000.00	
Section E, Participant/Trainee Support Costs		
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		15,000.00
1. Materials and Supplies	15,000.00	
2. Publication Costs		
3. Consultant Services		
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		70,750.00
Section H, Indirect Costs		6,475.00
Section I, Total Direct and Indirect Costs (G + H)		77,225.00
Section J, Fee		

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

EcoHealth Alliance (EHA): Y1

PI Salary. PI Olival, PhD will commit 3 months p.a. (Y1-OY2) to oversee the primary research project and support the extended Western Asia Bat Research Network's (WAB-Net) success (\$30,000 requested in Year 1). In Year 1, PI Olival will coordinate and liaise with the research participants to design and launch the project, lead the organization of the annual workshop and provide training opportunities, lead development of the capacity assessment and work with local partners on its piloting, guide and monitor progress with network participants on field projects, identify needs for equipment allocation and track progress with delivery, identify additional laboratories for participation and secure approval, and annual reports. He will ensure proper permits/IACUC equivalents are submitted and accepted in partner countries, as well maintain a U.S.-based IACUC. He will work with Co-PI Karesh, DVM to identify additional network participants. Salary is requested for Co-PI Karesh for 0.5 month p.a. (Y1-OY2) (\$10,000, in Year 1); he will provide additional time in-kind as a technical advisor as needed for the success of the project. Co-PI Karesh will provide presentations and lead training at the annual workshop, advise on hypothesis-driven research design, and provide informal peer-review of posters and scientific publications as they are prepared. Dr. Karesh will also provide links as needed to external relevant organizations including WHO, IUCN and OIE.

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Other Personnel. Key Personnel (KP) Epstein, DVM, MPH, will commit 0.5 month p.a. (Y1-OY2) to the project (\$6,041.67, requested in Year 1). KP Epstein will be founding member of the project's Scientific Advisory Board and brings 15 years of experience in bat veterinary medicine and disease ecology. He will serve as a key advisor for disease ecology investigations, in particular in developing and refining protocols for sampling, epidemiological study design, and telemetry methods. Dr. Epstein is a representative on the IUCN Bat Specialist Group and will ensure that the WAB-Net is aligned with IUCN in its goals and conservation aims. A program assistant will commit 12 months p.a. to the project (Y1-OY2) to assist with daily logistics and program support for the network's maintenance and advancement (\$42,000 is requested in Year 1). The program assistant will aid PI Olival with communication among the collaborators, travel and venue arrangements for the annual workshop and scientific meetings, drafting content (e.g. updating the events page) for the network's website, drafting and formatting components of the capacity assessment, processing contracts and reimbursements, ordering of supplies, and other duties related to the project as needed. A field scientist/veterinarian will commit 12 months p.a. to the project (Y1-OY2) to train in-country personnel, assist with specimen collection in the field with local partners, and standardization of sampling protocols (\$20,000 is requested in Year 1).

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Fringe Benefits. Fringe benefits are calculated as 31.3% of base salary for PIs, KPs, and the other personnel (program assistant and field scientist).

Travel.

International Travel

Annual Workshop: An annual workshop (Y1-OY2) is planned to coordinate and share data for core research activities to characterize coronavirus diversity and risk, provide regional networking, training, and refinement of research hypotheses, development of protocols and study

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

designs, and sharing of research findings. A 5-day meeting is planned (3 days of training, and 2 days of data training/analysis). In Year 1 the meeting location is tentatively planned for Amman, Jordan (the finalized meeting location will be dependent on specific training priorities and alignment with scientific capacity building opportunities; costs provided for all five years reflect estimates from Amman, Jordan and are used as estimates for planning purposes although it is intended to rotate host countries in the region annually). Network participants (2-3 per country) will be invited for 5 nights. The Steering Committee (plus the field scientist) will stay for 7 days (to allow for one day pre- and one day post-workshop coordination). Travel costs are estimated at an average of \$680 for regional network participants (20 travelers) and \$950 for Scientific Advisory board members (8 travelers) (traveling from the U.S. and U.K.) plus \$200 per person in ground transport. Flights will not be needed for the participants from Jordan. Lodging is estimated at \$147 per night, \$41.40 nightly hotel taxes and fees, and \$100 per diem/food. An estimated per participant cost is \$2,322 for regional members and \$3,169 for the Steering Committee participants. \$15,000 has been budgeted for venue rental, \$5,000 for field or laboratory visit(s), and \$5,000 for poster printing costs (20 posters anticipated). (\$90,000) is requested in Year 1 for the annual meeting).

Field Scientist Travel: Funds are budgeted for travel for field scientist in-country visits. This will allow the field scientist to train in-country personnel and to provide expertise and standardization of sampling methods across sites. The field scientist's needs and length of stay will vary per country. Travel funds are budgeted for \$2,500 per trip (\$1,200 airfare, \$800 ground transportation, \$500 accommodation, \$500 food). Four country visits are planned for Y1; these will be to high engagement countries Georgia, Jordan, Turkey, and Pakistan (\$10,000 requested in Year 1).

Subject Matter Expert Travel: Funds are budgeted for travel for subject matter experts (SMEs) to provide capacity building support to the network and additional training expertise as needed during the annual workshop. SME needs will be determined based on the capacity building assessment, the specific goals of the workshops, and the specific research questions. SMEs may be from the Scientific Advisory Board or external experts. Travel funds are budgeted for eight SMEs p.a. (Y1-OY2) at an estimated \$2,500 per trip (\$1,200 airfare, \$300 ground transportation, \$500 accommodation, \$500 food) (\$20,000 requested in Year 1).

Research Exchange Travel: Funds are budgeted for extended stays in regional hub laboratories or external reference laboratories for hands-on training on diagnostic techniques, or to fund visits by invited experts to provide capacity building guidance to laboratory staff. Funding is requested for three network individuals for two weeks each, budgeted at ~\$3,333 each, estimated as \$1,100 per flight, \$300 for ground transportation, \$700 for per diem (\$50/day), \$1,200 lodging, and \$33 in visa fees (\$10,000 requested in Year 1).

Local travel in Non-High Engagement Network Countries: No funds are budgeted for local transit or field work in non-high engagement network countries in Year 1. Local travel for sampling events in high-engagement countries is included in subaward budgets and budget justifications.

U.S. Domestic Travel

Funds are budgeted for attendance at the DTRA Annual Review meeting. In Year 1 we are budgeting \$1,800 for PI Olival to attend the DTRA Annual Technical Review (\$550 airfare – \$130/night hotel x 5d + \$100/day food x 5d + \$100 for transit) (\$1,800 requested in Year 1).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Other Direct Costs.

Materials and Supplies

We will strive to organize bulk purchasing discounts where possible to maximize access to supplies for field work, and materials and supplies that can be purchased locally are included in subaward budgets to the four high-engagement countries.

A total of \$80,000 is requested for supplies in Year 1. This includes supplies for safe collection of specimens from bats and personal protective equipment (PPE) in the four high-engagement countries including: 450 tyvek suits, 600 N95 masks, 8 Powered Air Purifying Respirators (PAPRs), 32 replacement filters for PAPRs, 4000 nitrile gloves of various sizes, and 16 face shields for a **PPE subtotal of \$16,500**. Additionally, supplies for ecological surveys and bat capture which are difficult to purchase outside of the US will be procured, and include: 50 mist nets, 8 harp traps, 12 mist net collapsible poles, 800 cloth bat bags, 16 Pescola spring scales, 8 calipers, 8 SM3 echolocation recording devices with microphones, software for echolocation call analysis for 4 countries, and 8 GPS units for a **field equipment subtotal of \$40,000**. Additional supplies for collection, storage, and transport of specimens from bats include: 4000 cryovials, 8 pipettes, filtered pipette tips, 4 field centrifuges, 4 liquid nitrogen dry shippers, 8 cool boxes, 1000 swabs, 500 needles and syringes, cotton balls, disinfectants, and lysis buffer for specimen storage for a **specimen collection subtotal of \$17,000**. To accommodate proper specimen cold-chain during shipping of specimens from non-regional lab country field sites (Turkey and Pakistan) to regional partner labs, \$3,000 per shipment is requested (\$6,000 requested). Lastly, laptop computers for the EHA program assistant and field scientist for project coordination at \$1,500 each (\$3,000 requested). Total amount for Year 1 supplies is **\$82,500**.

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ADP/Computing Services

A database and website will be developed (Year 1) and maintained (Years 2-OY2) to promote regional information sharing. The database (**\$40,000** requested in Year 1 for development and hosting), which will collect and store specimen and ecological data from the field, and laboratory and test result data, will be integrated into EcoHealth Alliance's One Health database platform built on top of an existing database for our CBEP Rift Valley Fever project in South Africa currently supported by DTRA. Consultancy meetings and calls with data scientists from the SEABCRU project and other global bat partners will be held in Year 1 to ensure that the WAB-Net database is built to be compatible with other regional bat network datasets. Funds are requested to develop the *WAB-Net* specific database platform through user interviews about data collection needs and preferences, coding, development, and testing of the GUI for users, program databases and custom APIs for linking databases. Fees for establishing data hosting services on the Amazon Cloud Services are included for the database completion. The website (**\$20,000** requested in Year 1) will be developed to provide a space for sharing of information on regional and international scientific events and information to promote wider regional engagement in the network and One Health capacity building. The website will also provide a forum for discussion and hosting/posting of webinars and/or other training resources. Total amount for Year 1 Computer Services is **\$60,000**.

Publication Costs. We have budgeted funds for one open-access peer-reviewed publication to be produced in Year 1 (\$1,800 is requested in Year 1).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Subawards. Four subawards are planned for Year 1 (\$20,500 to the Royal Scientific Society in Jordan, \$21,750 to the R. Lugar Center in Georgia, \$21,500 to the Bogazici University in Turkey, \$13,000 to the University of Veterinary & Animal Sciences, Lahore-Pakistan in Pakistan). These subawards will support field specimen collection, laboratory preparation for the Coronavirus study to validate coronavirus assays and begin preliminary testing of specimens, and genetic barcoding of bat species. The laboratories are both highly performing and have strong interest in strengthening their capacity for bat disease ecology research. Their budgets have been determined to be fair and reasonable based on comparable costs of laboratories in the region. Details provided in the subaward budget justifications.

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Indirect Costs We are requesting the federally-agreed indirect cost of 35.4% on all direct costs. We have applied this IC rate to only the first \$25,000 of the subcontracts valued over \$25,000 p.a. not including equipment purchased for \$5,000. Total EcoHealth Alliance budgeted indirect costs for Y1: \$20,139.75.

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EcoHealth Alliance (EHA): Y2

PI Salary. All salaries are increased by 5% p.a. due to the high cost of living increases in New York City. PI Olival, PhD will commit 3 months in Y2 to oversee the research project and support the network's success (\$31,500 is requested). In Year 2, PI Olival will coordinate and liaise with the research participants, lead the organization of the annual workshop and provide training opportunities, interpret capacity assessment results and identify training priorities with network partners, guide and monitor progress with network participants on field and laboratory projects, identify needs for equipment allocation and track progress with delivery, identify additional laboratories for participation and secure approval, provide guidance on initial data analysis and interpretation, and coordinate annual reports. He will ensure proper permits/IACUC equivalents are submitted and accepted in partner countries, as well maintain a U.S.-based IACUC. He will work with Co-PI Karesh, DVM to identify additional network participants and maintain a strong collaborative research platform. Salary is requested for Co-PI Karesh for 0.5 month in Y2 (\$11,200 is requested); he will provide additional time in-kind as a technical advisor as needed for the success of the project. Co-PI Karesh will provide presentations and lead training at the annual workshop, advise on hypothesis-driven research design, and provide informal peer-review of posters and scientific publications as they are prepared. Dr. Karesh will also provide links as needed to external relevant organizations including WHO, IUCN and OIE.

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Other Personnel. Key Personnel (KP) Epstein, DVM, MPH, will commit 0.5 month in Y2 to the project (\$6,333.75 is requested). KP Epstein will continue to strengthen the Scientific Advisory Board's involvement for the project's success, as well as provide a link to the IUCB Bat Specialist Group and One Health Alliance of South Asia participants and Ministry of Health contacts in Pakistan. He will serve as a key advisor for disease ecology investigations, in particular in developing and refining protocols for sampling, epidemiological study design, and telemetry methods. A program assistant will commit 12 months in Y2 to assist with daily logistics and program support for the network's maintenance and advancement (\$4,000 is requested). The program assistant will aid PI Olival with communication among the collaborators, travel arrangements for the annual workshop and scientific meetings, drafting

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

content (e.g. updating the events page) for the network's website, drafting and formatting components of the capacity assessment, processing contracts and reimbursements, ordering of supplies, and other duties related to the project as needed. A field scientist/veterinarian will commit 1.2 months in Y2 to train in-country personnel, to assist with specimen collection in the field with local partners, and standardization of sampling protocols (\$84,000 is requested).

Fringe Benefits. Fringe benefits are calculated as 31.3% of base salary for PIs, KPs, and the other personnel (program assistant and field scientist).

Travel.

International Travel

Annual Workshop: An annual workshop is planned in Y2 to provide regional networking, training, and investigation of research questions and sharing of research findings, including data on bat species distributions and preliminary findings from CoV screening. A 5-day meeting is planned (3 days of training, and 2 days of data training/analysis). In Year 2 the meeting location is tentatively planned for Tbilisi, Georgia (finalized meeting location will be dependent on specific training priorities and alignment with scientific capacity building opportunities). Network participants (2-3 per country) will be invited for 5 nights. The Steering Committee (plus the field scientist) will stay for 7 days (to allow for one day pre- and one day post-workshop coordination). Travel costs are estimated at an average of \$680 for regional network participants (74 travelers) and \$950 for Steering Committee members (8 travelers, traveling from the U.S. and U.K.) plus \$200 per person in ground transport. Flights will not be needed for the participants from Georgia. Hotel is estimated at \$147 per night, \$41.40 nightly hotel taxes and fees, and \$100 per diem/meals. An estimated per participant cost is \$2,322 for regional members and \$3,169 for the Steering Committee participants. \$15,000 has been budgeted for venue rental, \$5,000 for field or laboratory visit(s), and \$5,000 for poster printing costs (20 posters anticipated). The cost in Y2 is raised slightly to accommodate additional participants (32, total) as the network grows (\$106,078.40 is requested in Year 2 for the annual meeting).

Field Scientist Travel: Funds are budgeted for travel for field scientist in-country visits. These will allow the field scientist to train in-country personnel and provide expertise and standardization of sampling methods across sites. The field scientist's needs and length of stay will vary per country. Travel funds are budgeted for \$2,500 per trip (\$1,200 airfare, \$500 ground transportation, \$500 accommodation, \$500 food). Four country visits are planned for Y2; these will be to medium engagement countries, prospectively Armenia, Azerbaijan, Iraq, and Saudi Arabia (\$10,000 requested in Year 2).

Subject Matter Expert Travel: Funds are budgeted for travel for subject matter experts (SMEs) to provide capacity building support to the network. SME needs will be determined based on the capacity building assessment, the specific goals of the workshops, and the specific research questions. SMEs may be from the Steering Committee or external experts. Travel funds are budgeted for eight SMEs at an estimated \$2,500 per trip (\$1,200 airfare, \$300 ground transportation, \$500 accommodation, \$500 food) (\$20,000 requested in Year 2).

Research Exchange Travel: Funds are budgeted for extended stays in regional hub laboratories or external reference laboratories for hands-on training on diagnostic techniques, or to fund visits by invited experts to provide capacity building guidance to laboratory staff. Funding is requested for six network individuals for two weeks each, budgeted at ~\$3,333 each, estimated as \$1,100

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

per flight, \$300 for ground transportation, \$700 for per diem (\$50/day), \$1,200 lodging, and \$33 in visa fees (\$20,000 requested in Year 2).

Local travel in Non-High Engagement Network Countries; Funds are budgeted in Y2 for local transit for field work in four non-high engagement, network countries approved to participate in specimen sampling, \$5000 is budgeted per medium-engagement country, to include accommodation (\$500), per diem food allocations (\$300), and in-country transport (\$350) per person for three in-country field personnel on one sampling trip. This will catalyze field research activities, and intends to provide flexibility based on the specific hypotheses generated by the network (\$30,000 is budgeted in Year 2). Local travel for sampling events in high-engagement countries is included in subaward budgets and budget justifications.

U.S. Domestic Travel

In Year 2 we are budgeting \$1,800 for PI Olival to attend the DTRA Annual Technical Review meeting in Northern Virginia (\$550 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for ground transit). Key Personnel Al-Hmoud will also be invited to attend to learn more about the grant review process and present her research under the network's support, with \$2,600 budgeted for her attendance (\$1,350 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for transit) (\$4,400 requested in Year 2).

Other Direct Costs.

Materials and Supplies

We will strive to organize bulk purchasing discounts where possible to maximize access to supplies for field work.

A total of \$65,000 is requested for supplies in Year 2. This includes supplies needed to maintain research in the 4 high engagement countries, and for CoV and bat survey research projects and limited specimen collection in an additional four medium-engagement countries from the region. Supplies for safe collection of specimens from bats and personal protective equipment (PPE) include: 600 tyvek suits, 700 N95 masks, 2 Powered Air Purifying Respirators (PAPRs), 8 replacement filters for PAPRs, 4000 nitrile gloves of various sizes, and 16 face shields for a **PPE subtotal of \$10,700**. Supplies for ecological surveys and bat capture include: 50 additional mist nets, 5 harp traps, 12 mist net collapsible poles, 800 cloth bat bags, 16 Pescola spring scales, 8 calipers, 8 lanterns, 8 scopes, 4 SM3 echolocation recording devices with microphones, software for echolocation call analysis for 4 countries, and 8 GPS units for a **field equipment subtotal of \$29,700**. Supplies for collection, storage, and transport of specimens from bats include: 12000 cryovials, 8 pipettes, filtered pipette tips, 2 field centrifuges, 4 liquid nitrogen dry shippers, 8 cool boxes, 2000 swabs, 1000 needles and syringes, cotton balls, disinfectants, and lysis buffer for specimen storage for a **specimen collection subtotal of \$24,600**. To accommodate proper specimen cold-chain during shipping of specimens from non-regional lab country field sites (Turkey, Pakistan, plus four medium engagement countries) to partner labs, \$3,000 per shipment (\$18,000 is requested). Total amount for Year 2 supplies is \$83,000.

ADP/Computing Services

The database and website will be maintained in Y2 to promote regional information sharing. User experience testing will be conducted. The annual meeting will provide an opportunity for further training on the database and generating additional ideas for content on the website. The

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

database GUI and user interface will be refined. Any problems identified with the database will be corrected by EcoHealth Alliance programmers that will dedicate necessary time during Year 2 to fix outstanding issues. Data hosting and services on the Amazon Cloud services will be maintained (\$15,000 is requested for improving the database and testing interoperability with other regional bat and disease databases and hosting the database and \$5,000 for the website maintenance in Year 2). Total amount for Year 2 computer services is \$20,000.

Publication Costs. We have budgeted funds for two open-access peer-reviewed publications to be produced in Year 2 (\$3,000 is requested in Year 2).

Subawards. Four subawards are planned for Year 2 (\$60,500) to the Royal Scientific Society in Jordan, \$18,100 to the R. Lugar Center in Georgia, \$16,700 to Bogazici University in Turkey, and \$15,250 to the University of Veterinary & Animal Sciences, Lahore Pakistan in Pakistan). The subawards for RSS and R. Lugar Center will support specimen collection by laboratory members, diagnostic screening for the Coronavirus study, and genetic barcoding analysis of bat specimens. The laboratories are both highly performing and have strong interest in strengthening their capacity for bat disease ecology and Coronavirus research. Their budgets have been determined to be fair and reasonable based on comparable costs of laboratories in the region. The subawards for Bogazici University and UVAS, Lahore will support fieldwork efforts and proper specimen storage. Details provided in the subaward budget justifications.

Indirect Costs. We are requesting the federally-agreed indirect cost of 35.4% on all direct costs. We have applied this IC rate to the remaining first \$25,000 of the four subawards, not including equipment purchased for \$5,000. EcoHealth Alliance budgeted indirect costs for Y2: \$196,782.25.

EcoHealth Alliance (EHA): Y3

PI Salary. All salaries are increased by 5% p.a. due to the exceptionally high cost of living increases in New York City. PI Olival, PhD will commit 3 months in Y3 to oversee the research project and support the network's success (\$53,075 is requested). In Year 3, PI Olival will coordinate and liaise with research participants, lead the organization of the annual workshop and provide training opportunities, interpret capacity assessment results and identify training priorities with network partners, guide and monitor progress with network participants on field and laboratory projects, identify needs for equipment allocation and track progress with delivery and finalize annual reports. He will ensure proper permits/IACUC equivalents are submitted and accepted in partner countries, as well maintain a U.S.-based IACUC. He will work with Co-PI Karesh, DVM to identify additional network participants and maintain a strong collaborative research platform. Salary is requested for Co-PI Karesh for 0.5 month in Y3 (\$11,600 is requested); he will provide additional time in-kind as a technical advisor as needed for the success of the project. Co-PI Karesh will provide presentations and lead training at the annual workshop, advise on hypothesis-driven research design, and provide informal peer-review of posters and scientific publications as they are prepared. Dr. Karesh will also provide links as needed to external relevant organizations including WHO, IUCN and OIE, and advise on findings in the context of global health security.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Other Personnel. Key Personnel (KP) Epstein, DVM, MPH, will commit 0.5 month in Y3 to the project (\$5,000 is requested). KP Epstein will continue to strengthen the Scientific Advisory Board's involvement for WAB-Net's success, as well as provide a link to the IUCB Bat Specialist Group. He will serve as a key advisor for disease ecology investigations, in particular in developing and refining protocols for sampling, epidemiological study design, and telemetry methods. A program assistant will commit 12 months in Y3 to assist with daily logistics and program support for the network's maintenance and advancement (\$46,505 is requested). The program assistant will aid PI Olival with communication among the collaborators, travel arrangements for the annual workshop and scientific meetings, drafting content (e.g. updating the events page) for the network's website, tracking capacity assessments, processing contracts and reimbursements, ordering of supplies, and other duties related to the project as needed. A field scientist/veterinarian will commit 12 months in Y3 to assist with field trips and sampling protocols (\$85,200 is requested).

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Fringe Benefits. Fringe benefits are calculated as 31.3% of base salary for PIs, KPs, and the other personnel (program assistant and field scientist).

Travel.

International Travel

Annual Workshop: An annual workshop is planned in Y3 to provide regional networking, training, and investigation of research questions and sharing of research findings, including the coronavirus study and next steps to refine surveillance strategy and ecological risk assessment based on bat distribution data. A 5-day meeting is planned (3 days of training, and 2 days of data training/analysis). In Year 3 the meeting location is tentatively planned for Istanbul, Turkey (finalized meeting location will be dependent on specific training priorities and alignment with scientific capacity building opportunities). Network participants (2-3 per country) will be invited for 5 nights. The Steering Committee will stay for 7 days (to allow for one day pre- and one day post-workshop coordination). Travel costs are estimated at an average of \$680 for regional network participants (20 travelers) and \$950 for Steering Committee members (8 travelers, traveling from the U.S. and U.K.) plus \$200 per person in ground transport. Flights will not be needed for the participants from Turkey. Hotel is estimated at \$180 per night, \$41.40 nightly hotel taxes and fees, and \$100 per diem rates. An estimated per participant cost is \$2,322 for regional members and \$3,169 for the Steering Committee participants. \$15,000 has been budgeted for venue rental, \$5,000 for field or laboratory visit(s), and \$5,000 for poster printing costs (20 posters anticipated). The costs are raised slightly in Y3 to accommodate more participants (31 total) as the network grows (\$15,122.00 is requested in Year 3 for the annual meeting).

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Field Scientist Travel: Funds are budgeted for travel for field scientist in-country visits. This will allow the field scientist to train in-country personnel and provide expertise and standardization of sampling methods across sites. The field scientist's needs and length of stay will vary per country. Travel funds are budgeted for \$2,500 per trip (\$1,200 airfare, \$800 ground transportation, \$500 accommodation, \$500 food). Eight country visits are planned for Y3, these will be to the four high engagement countries, as well as four medium-engagement countries (\$20,000 requested in Year 3).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Subject Matter Expert Travel: Funds are budgeted for travel for subject matter experts (SMEs) to provide capacity building support to the network. SME needs will be determined based on the capacity building assessment, the specific goals of the workshops, and the specific research questions. SMEs may be from the Steering Committee or external experts. Travel funds are budgeted for eight SMEs at an estimated \$2,500 per trip (\$1,200 airfare, \$300 ground transportation, \$500 accommodation, \$500 food) (**\$20,000 requested in Year 3**).

Research Exchange Travel: Funds are budgeted for extended stays in regional hub laboratories or external reference laboratories for hands-on training on diagnostic techniques, or to fund visits by invited experts to provide capacity building guidance to laboratory staff. Funding is requested for five network individuals for two weeks each, budgeted at ~\$3,333 each, estimated as \$1,100 per flight, \$300 for ground transportation, \$700 for per diem (\$50/day), \$1,200 lodging, and \$33 in visa fees, plus two one-week exchanges, estimated at \$1,668 (**\$20,000 requested in Year 3**).

Local travel in non-High Engagement Network Countries: Funds are budgeted in Y2 for local transit for field work in four non-high engagement network countries approved to participate in specimen sampling. \$7000 is budgeted per medium-engagement country, to include accommodation (\$500), per diem/food allocations (\$300), and in-country transport (\$350) per person on three in-country field personnel on one sampling trip. This will catalyze field research activities, and intends to provide flexibility based on the specific hypotheses generated by the network (\$20,000 is budgeted in Year 3).

U.S. Domestic Travel

In Year 3 we are budgeting \$1,800 for PI Olival to attend the DTRA Annual Technical Review meeting in Northern Virginia (\$550 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for ground transit). Key Personnel Urushadze and Sidamonidze will also be invited to attend to learn more about the grant review process and present their research under the network's support, with \$2,350 each budgeted for their attendance (\$1,100 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for transit) (**\$6,500 requested in Year 3**).

Other Direct Costs.

Materials and Supplies

We will strive to organize bulk purchasing discounts where possible to maximize access to supplies for field work, and materials and supplies that can be purchased locally are included in subaward budgets to the four high-engagement countries.

A total of \$52,000 is requested for supplies in Year 3. This includes supplies needed to maintain research in the 4 high engagement countries and 4 additional medium engagement countries from the region. Supplies for safe collection of specimens from bats and personal protective equipment (PPE) include: 900 tyvek suits, 900 N95 masks, and 5000 nitrile gloves of various sizes for a **PPE subtotal of \$10,000**. Supplies for ecological surveys and bat capture include: 40 additional mist nets, 4 harp traps, 6 mist net collapsible poles, 400 cloth bat bags, 8 calipers, 8 lanterns, 8 scopes, 6 additional licenses for software for echolocation call analysis, and 8 additional GPS unit for a **field equipment subtotal of \$22,000**. Supplies for collection, storage, and transport of specimens from bats include: 12000 cryovials, 8 pipettes, filtered pipette tips, 4 field centrifuges, 4 liquid nitrogen dry shippers, 10 cool boxes, 1000 swabs, 500 needles and syringes, cotton balls, disinfectants, and lysis buffer for specimen storage for a **specimen collection subtotal of \$20,000**. To accommodate proper specimen cold-chain during shipping of specimens from non-regional lab country field sites to partner labs (Turkey, Pakistan, plus four

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

medium engagement countries, \$3,000 per shipment (\$18,000 is requested). Total amount for Year 3 supplies is \$70,000.

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ADP/Computing Services

The database and website will be maintained in Y3 to promote regional information sharing. Data hosting and services on the Amazon Cloud services will be maintained (\$5,000 is requested for the database and \$3,000 for the website maintenance in Year 3).

Publication Costs. We have budgeted funds for three open-access peer-reviewed publications (two international and one local national) to be produced in Year 3 (\$5,000 is requested in Year 3).

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Subawards. Four subawards are planned for Year 3 (\$88,500 to the Royal Scientific Society in Jordan, \$99,308 to the R. Lugar Center in Georgia, \$19,800 to Bogazici University in Turkey, and \$17,250 to the University of Veterinary & Animal Sciences, Lahore-Pakistan in Pakistan). The subawards to RSS and the R. Lugar Center will support specimen collection by laboratory members and diagnostic screening for the Coronavirus study. The laboratories are both highly performing and have strong interest in strengthening their capacity for bat disease ecology and Coronavirus research. Their budgets have been determined to be fair and reasonable based on comparable costs of laboratories in the region. The subawards to Bogazici University and UVAS, Lahore will support fieldwork efforts and proper specimen storage. Details provided in the subaward budget justifications.

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Indirect Costs. We are requesting the federally-agreed indirect cost of 35.4% on all direct costs. This IC was not applied to the subawards after exceeding \$25000. Total EcoHealth Alliance budgeted indirect costs for Y3: \$187,563.91.

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EcoHealth Alliance (EHA): OY1

PI Salary. All salaries are increased by 5% p.a. due to the exceptionally high cost of living increases in New York City. PI Olival, PhD will commit 3 months in OY1 to oversee the project and support the network's success (\$34,778.75 is requested). In OY1, PI Olival will coordinate and liaise with the network participants, lead the organization of the annual workshop and provide training opportunities, interpret capacity assessment results and identify training priorities with network partners, guide and monitor progress with network participants on field and laboratory projects, identify needs for equipment allocation and track progress with delivery, advise on prioritization and next steps of analyses and interpretation of results, and coordinate annual reports. He will ensure proper permits/IACUC equivalents are submitted and accepted in partner countries, as well maintain a U.S.-based IACUC. He will work with Co-PI Karesh, DVM to identify additional network participants and maintain a strong collaborative research platform. Salary is requested for Co-PI Karesh for 0.5 month in OY1 (\$10,348.00 is requested); he will provide additional time in-kind as a technical advisor as needed for the success of the project. Co-PI Karesh will provide presentations and lead training at the annual workshop, advise on hypothesis-driven research design, and provide informal peer-review of posters and scientific publications as they are prepared. Dr. Karesh will also provide links as needed to external relevant organizations including WHO, IUCN and OIE.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Other Personnel. Key Personnel (KP) Epstein, DVM, MPH, will commit 0.5 month in OY1 to the project (\$6,993.98 is requested). KP Epstein will continue to strengthen the Scientific Advisory Board's involvement for WAB-Net's success, as well as provide a link to the IUCB Bat Specialist Group. He will serve as a key advisor for disease ecology investigations, in particular in developing and refining protocols for sampling, epidemiological study design, and telemetry methods. A program assistant will commit 12 months in OY1 to assist with daily logistics and program support for the network's maintenance and advancement (\$18,020 is requested). The program assistant will aid PI Olival with communication among the collaborators, travel arrangements for the annual workshop and scientific meetings, drafting content (e.g. updating the events page) for the network's website, drafting and formatting components of the capacity assessment, processing contracts and reimbursements, ordering of supplies, and other duties related to the project as needed. A master's level data analyst/statistician will commit 3 months will implement mathematical models and statistical validation of all analyses (\$17,200 is requested).

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Fringe Benefits. Fringe benefits are calculated as 31.3% of base salary for PIs, KPs, and the other personnel (program assistant and field scientist).

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Travel.

International Travel

Annual Workshop: An annual workshop is planned in OY1 to provide regional networking, training, and investigation of research questions and sharing of research findings. A 5-day meeting is planned (3 days of training, and 2 days of data training/analysis). The finalized meeting location will be dependent on specific training priorities and alignment with scientific capacity building opportunities. Costs estimated using average travel to high-engagement countries in the region based on Years 1-3. Network participants (2-3 per country) will be invited for 5 nights. The Steering Committee will stay for 7 days (to allow for one day pre- and one day post-workshop coordination). Travel costs are estimated at an average of \$680 for regional network participants (77 travelers) and \$950 for Steering Committee members (7 travelers, traveling from the U.S. and U.K.) plus \$200 per person in ground transport. Flights will not be needed for the participants from Georgia. Hotel is estimated at \$180 per night, \$41.40 nightly hotel taxes and fees, and \$100 per diem rates. An estimated per participant cost is \$2,322 for regional members and \$3,169 for the Steering Committee participants. \$15,000 has been budgeted for venue rental, \$5,000 for field or laboratory visit(s), and \$5,000 for poster printing costs (20 posters anticipated). The costs are raised slightly in OY1 to accommodate additional network participants (34, total) as the network grows (\$114,875.00 is requested in Year OY1 for the annual meeting).

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Subject Matter Expert Travel: Funds are budgeted for travel for subject matter experts (SMEs) to provide capacity building support to the network. SME needs will be determined based on the capacity building assessment, the specific goals of the workshops, and the specific research questions. SMEs may be from the Steering Committee or external experts. Travel funds are budgeted for eight SMEs at an estimated \$2,500 per trip (\$1,200 airfare, \$300 ground transportation, \$500 accommodation, \$500 food) (\$20,000 requested in OY1).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Research Exchange Travel: Funds are budgeted for extended stays in regional hub laboratories or external reference laboratories for hands-on training on diagnostic techniques, or to fund visits by invited experts to provide capacity building guidance to laboratory staff. Funding is requested for five network individuals for two weeks each, budgeted at ~\$3,333 each, estimated as \$1,100 per flight, \$300 for ground transportation, \$700 for per diem (\$50/day), \$1,200 lodging, and \$33 in visa fees, plus two one-week exchanges, estimated at \$1,668 (**\$20,000** requested in OY1).

Local travel in Non-High Engagement Network Countries: Funds are budgeted in OY1 for local transit for field work in four non-high engagement network countries approved to participate in specimen sampling. \$5,000 is budgeted per medium engagement country, to include accommodation (\$500), per diem food allocations (\$300), and in-country transport (\$350) per person for three in-country field personnel, or one sampling trip. This will catalyze field research activities, and intends to provide flexibility based on the specific hypotheses generated by the network (\$20,000 is budgeted in OY1).

U.S. Domestic Travel

In OY1 we are budgeting \$1,800 each for PI Olival and the Program Assistant to attend the DTRA Annual Technical Review meeting in Northern Virginia (\$550 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for ground transit) (\$3,600 requested in OY1).

Other Direct Costs.

Materials and Supplies

We will strive to organize bulk purchasing discounts where possible to maximize access to supplies for field work, and materials and supplies that can be purchased locally are included in subaward budgets to the four high-engagement countries.

A total of \$54,600 is requested for supplies in Option Year 1. This includes supplies needed to maintain research in the four high-engagement countries and additional medium engagement countries from the region. Supplies for safe collection of specimens from bats and personal protective equipment (PPE) include: 600 tyvek suits, 800 N95 masks, 22 replacement PAPR filters for maintenance, and 4000 nitrile gloves of various sizes for a **PPE subtotal of \$11,500**. Supplies for ecological surveys and bat capture needed to replace equipment include: 50 additional mist nets, 6 mist net collapsible poles, and 400 cloth bat bags for a **field equipment subtotal of \$5,500**. Supplies for collection, storage, and transport of specimens from bats include: 12000 cryovials, filtered pipette tips, 2000 swabs, 1000 needles and syringes, cotton balls, disinfectants, and lysis buffer for specimen storage for a **specimen collection subtotal of \$18,000**. One computer for EHA data analysis; statistician for analyses and risk modeling at \$1,600. To accommodate proper specimen cold-chain during shipping of specimens from non-regional lab country field sites (Turkey, Pakistan, plus four medium engagement countries) to partner labs, \$3,000 per shipment (**\$18,000 is requested**). Total amount for Option Year 1 supplies is \$54,600.

ADP/Computing Services

The database and website will be maintained in OY1 to promote regional information sharing. Data hosting and services on the Amazon Cloud services will be maintained (\$5,000 is requested for the database and \$3,000 for the website maintenance in OY1).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Publication Costs. We have budgeted funds for three (two international and one national/regional) open-access peer-reviewed publications to be produced in Option Year 1 (\$2,100 is requested in OY1).

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Subawards. Four subawards are planned for OY1 (\$89,210 to the Royal Scientific Society in Jordan, and \$99,308 to the R. Lugar Center in Georgia, \$19,800 to Bogazici University in Turkey, and \$17,250 to the University of Veterinary & Animal Sciences, Lahore in Pakistan). These subawards will support specimen collection by laboratory members and diagnostic screening for the Coronavirus study. The laboratories are both highly performing and have strong interest in strengthening their capacity for bat disease ecology and Coronavirus research. Their budgets have been determined to be fair and reasonable based on comparable costs of laboratories in the region. Details provided in the subaward budget justifications.

Indirect Costs. We are requesting the federally-agreed indirect cost of 35.4% on all direct costs. The IC rate is not applied to subawards for OY1. Total EcoHealth Alliance budgeted indirect costs for OY1: \$143,117.37.

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EcoHealth Alliance (EHA): OY2

PI Salary. All salaries are increased by 5% p.a. due to the exceptionally high cost of living increases in New York City. PI Olival, PhD will commit 3 months in OY2 to oversee the project and support the network's success (\$36,465.79 is requested). In OY2, PI Olival will coordinate and liaise with the network participants, lead the organization of the annual workshop and provide training opportunities, interpret capacity assessment results and identify training priorities with network partners, guide and monitor progress with network participants on field and laboratory projects, identify needs for equipment allocation and track progress with delivery, identify additional laboratories for participation and secure approval, and annual reports. He will ensure proper permits/IACUC equivalents are submitted and accepted in partner countries, as well maintain a U.S.-based IACUC. He will work with Co-PI Karesh, DVM to identify additional network participants and maintain a strong collaborative research platform. Salary is requested for Co-PI Karesh for 0.5 month in OY2 (\$12,965.40 is requested); he will provide additional time in-kind as a technical advisor as needed for the success of the project. Co-PI Karesh will provide presentations and lead training at the annual workshop, advise on hypothesis-driven research design, and provide informal peer-review of posters and scientific publications as they are prepared. Dr. Karesh will also provide links as needed to external relevant organizations including WHO, IUCN and OIE.

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Other Personnel. Key Personnel (KP) Epstein, DVM, MPH, will commit 0.5 month in OY2 to the project (\$7,313.68 is requested). KP Epstein will continue to strengthen the Scientific Advisory Board's involvement for WAB-Net's success, as well as provide a link to the IUCB Bat Specialist Group. He will serve as a key advisor for disease ecology investigations, in particular in developing and refining protocols for sampling, epidemiological study design, and telemetry methods. A program assistant will commit 12 months in OY2 to assist with daily logistics and program support for the network's maintenance and advancement (\$1,051.26 is requested). The program assistant will aid PI Olival with communication among the

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

collaborators, travel arrangements for the annual workshop and scientific meetings, drafting content (e.g. updating the events page) for the network's website, drafting and formatting components of the capacity assessment, processing contracts and reimbursements, ordering of supplies, and other duties related to the project as needed. A master's level data analyst statistician will commit 1.5 months will implement mathematical models and statistical validation of all analyses (\$18,375 is requested).

Fringe Benefits. Fringe benefits are calculated as 31.3% of base salary for PIs, KPs, and the other personnel (program assistant and field scientist).

Travel.

International Travel

Annual Workshop: An annual workshop is planned in OY2 to provide regional networking, training, and investigation of research questions and sharing of research findings, including viral risk analyses. Special focus of the workshop will be on sustainment of the research network and interpretation of risk analysis results. The OY2 meeting will also provide a final evaluation and direction for future capacity building, as well as generation of participant-led hypothesis generation for future scientific research and a workshop on grant writing and identifying future funding sources for network members. A 5-day meeting is planned (3 days of training, and 2 days of data training/analysis). In OY2 the meeting location is tentatively planned for Tbilisi, Georgia (finalized meeting location will be dependent on specific training priorities and alignment with scientific capacity building opportunities). Network participants (2-3 per country) will be invited for 5 nights. The Steering Committee will stay for 7 days (to allow for one day pre- and one day post-workshop coordination). Travel costs are estimated at an average of \$680 for regional network participants (2 travelers) and \$950 for Steering Committee members (3 travelers, traveling from the U.S. and U.K.) plus \$200 per person in ground transport. Flights will not be needed for the participants from Georgia. Hotel is estimated at \$180 per night, \$41.40 nightly hotel taxes and fees, and \$100 per diem/meals. An estimated per participant cost is \$2,322 for regional members and \$3,169 for the Steering Committee participants. \$15,000 has been budgeted for venue rental, \$5,000 for field or laboratory visit(s), and \$5,000 for poster printing costs (20 posters anticipated). The costs are raised slightly in OY2 to accommodate additional participants (35 total) as the network grows (\$118,044.40 is requested in OY2 for the annual meeting).

Subject Matter Expert Travel: Funds are budgeted for travel for subject matter experts (SMEs) to provide capacity building support to the network. SME needs will be determined based on the capacity building assessment, the specific goals of the workshops, and the specific research questions. SMEs may be from the Steering Committee or external experts. Travel funds are budgeted for eight SMEs at an estimated \$2,500 per trip (\$1,200 airfare, \$300 ground transportation, \$500 accommodation, \$500 food) (\$20,000 requested in OY2).

Research Exchange Travel: Funds are budgeted for extended stays in regional hub laboratories or external reference laboratories for hands-on training on diagnostic techniques, or to fund visits by invited experts to provide capacity building guidance to laboratory staff. Funding is requested for seven network individuals for two weeks each, budgeted at ~\$3,333 each, estimated as \$1,100 per flight, \$300 for ground transportation, \$700 for per diem (\$50/day), \$1,200 lodging, and \$33 in visa fees, plus a one-week exchange, estimated at \$1,668 (\$25,000 requested in OY2).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Local travel in Non-High Engagement Network Countries: No funds are budgeted for local transit or field work in non-high engagement network countries in Year 1.

Project Management Meeting: Funds are budgeted for Key Personnel at Regional Labs to visit IHA headquarters and discuss the future of the project. Estimated as \$1400 per flight, \$500 for ground transportation, \$500 per diem (5-10 day), \$1000 for accommodation for KP from Georgia, 2 Participants from Jordan (\$6900 total requested).

U.S. Domestic Travel

In OY2 we are budgeting \$3,800 for PI Olival and the program assistant to attend the DTRA Annual Technical Review meeting in Northern Virginia (\$650 airfare + \$130/night hotel x 5d + \$100/day food x 5d + \$100 for ground transit) (\$3,800 requested in OY2).

Other Direct Costs.

Materials and Supplies

We will strive to organize bulk purchasing discounts where possible to maximize access to supplies for field work, and materials and supplies that can be purchased locally are included in subaward budgets to the four high-engagement countries.

A total of \$28,100 is requested for supplies in Option Year 2. This includes a limited number of supplies needed to complete research on characterizing coronaviruses and ecological risk factors for bat zoonoses emergence in four high-engagement countries and additional limited engagement countries from the region. Supplies for safe collection of specimens from bats and personal protective equipment (PPE) include: 200 tyvek suits, 400 N95 masks, and 1000 nitrile gloves of various sizes for a **PPE subtotal of \$3,100**. No supplies for ecological surveys and bat capture are requested in OY2. Supplies for collection, storage, and transport of specimens from bats include: 2000 cryovials, filtered pipette tips, 1000 swabs, cotton balls, disinfectants, and lysis buffer for specimen storage for a **specimen collection subtotal of \$5,600**. To accommodate proper specimen cold-chain during shipping of any outstanding specimens from field sites to partner labs, \$3,000 per shipment (\$6,000 is requested). For the final year, a total of \$19,700 is requested for capacity building in partner countries to ensure continued network support and success. Two labs will receive 50% contribution for a new PCR machine (\$7,700). Each of the four high-engagement countries will receive \$3000 for field manuals, protocols, and a laptop for continued database use. Total amount for Option Year 2, supplies is **\$34,400**.

ADP/Computing Services

The database and website will be maintained in OY2 to promote regional information sharing. Data hosting and services on the Amazon Cloud services will be maintained (\$5,000 is requested for the database and \$3,000 for the website maintenance in OY2).

Publication Costs. We have budgeted funds for three open-access (two international and one national/regional) peer-reviewed publication to be produced in Option Year 2 (\$5,400 is requested in OY2).

Subawards. Two subawards are planned for Option Year 2 (\$39,000 to the Royal Scientific Society in Jordan, and \$27,080.00 to the R. Lugar Center in Georgia). These subawards will support follow-up diagnostic screening or analyses for the Coronavirus study as needed, in particular to complete testing and viral characterization from bat specimens that were not tested

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

in previous years. The laboratories are both highly performing and have strong interest in strengthening their capacity for bat disease ecology and Coronavirus research. Their budgets have been determined to be fair and reasonable based on comparable costs of laboratories in the region. Details provided in the subaward budget justifications.

Indirect Costs. We are requesting the federally-agreed indirect cost of 35.4% on all direct costs. The IC rate is not applied to subawards. For OY2, Total EcoHealth Alliance budgeted indirect costs for OY2: \$134,500.

Budget Allocation

In addition to the subawards, the EHA central budget will heavily support the four high engagement countries and additional network countries. Based on the central budget's allocation to subawards, capacity building (including annual workshop, subject matter experts trainings, and research exchanges), and in-country field support (including field scientist visits, materials, and local travel) we conservatively estimate that 33% of this project supports the four high-engagement countries and 14% other medium-engagement country partners. This is a cumulative total of at least 17% of project funds going to partner countries in the region.

Matching Funds over the course of the project

We conservatively estimate matching funds over the course of the five year project at \$267,774.50. Calculation is based on annual salary of \$90,000 for four US and UK members of the Scientific Advisory Board who each contribute 3 weeks p.a. of unpaid contribution to the project (subtotal \$20,800 p.a.); 6 international members of the Steering Committee assuming an annual salary of \$45,000 for 3 weeks p.a. of unpaid contribution (subtotal \$15,600 p.a.). In total \$182,000 of matching funds in salary contribution from the Scientific Advisory Board and the Steering Committee. As detailed in the subaward justifications, matched support from RSS, Lugar Center, University of Veterinary & Animal Sciences, Lahore, and Bogazici University for unpaid salary contributions, lab facilities, and equipment use totals \$67,507.50 over five years and \$16,222 from the USAID PREDICT project in Jordan supplemented sampling events in Years 1 and 2.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Bogazici University Y1

Collaborator Salary: Bogazici University will provide field capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Turkey. Dr. Ibrahim Rasit Bilgin, project key personnel, will commit 1 month in Y1 (\$4,500 requested) to manage the field investigations and specimen collection in Turkey. Salary for two field technicians is calculated at \$500 each for 1 month (\$1,000 requested).

Materials and Supplies: In Year 1, \$3000 is requested to purchase local field equipment including mistnets, wing punches, alcohol, swabs, and cryovials.

Equipment: In Year 1, \$6,000 is requested for a compact -80C freezer for bat specimen storage and \$1,000 for a benchtop autoclave for sterilizing equipment.

Travel: One in-country field sampling event of five nights is planned in Y1. Trips are budgeted at \$1,000/trip to account for the cost of vehicle rental and fuel (\$300), accommodation (\$400), and meals (\$300) for three field personnel.

Indirect Costs: Bogazici University has an institutional overhead rate of 10%. \$1,550 is requested in Y1. Equipment costs in Year 1 >\$5000 have been subtracted from the IC calculation for this subaward.

Total Costs: \$20,850 is requested in Year 1.

Matched Funds: \$700 is calculated as a total of in-kind contribution for the year based on use of existing laboratory and field equipment.

Bogazici University Y2

Collaborator Salary: Bogazici University will provide field capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Turkey. Dr. Ibrahim Rasit Bilgin, project key personnel, will commit 1.5 month in Y2 (\$6,750 requested) to manage the field investigations and specimen collection in Turkey. Salary for two field technicians is calculated at \$750 each for 1.5 months (\$1,500 requested).

Materials and Supplies: In Year 2, \$4,000 is requested to purchase local field equipment including mistnets, wing punches, alcohol, swabs, reagents for viral transport, and cryovials.

Travel: Three in-country field sampling event of five nights are planned in Y1. Trips are budgeted at \$1,000/trip to account for the cost of vehicle rental and fuel (\$300), accommodation (\$400), and meals (\$300) for three field personnel. (\$3,000 requested).

Indirect Costs: Bogazici University has an institutional overhead rate of 10%. \$1,525 is requested in Y2.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Total Costs: \$16,775 is requested in Year 2.

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Matched Funds: \$2,000 is calculated as a total of in-kind contribution for the year based on use of existing laboratory and field equipment.

Bogazici University Y3

Collaborator Salary. Bogazici University will provide field capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Turkey. Dr. Ibrahim Rasit Bilgin will commit 2 months in Y3 (\$9,000 requested). Salary for two field technicians is calculated at \$1000 each for 2 months (\$2,000 requested).

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Materials and Supplies. In Year 3, \$2,000 is requested to purchase additional local field equipment needed for bat capture, and supplies including wing punches, alcohol, swabs, reagents for viral transport, and cryovials. Fieldwork will focus on bat specimen collection from 5 field sites in Year 3.

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Travel. Five in country field sampling event of five nights are planned in Y3. Trips are budgeted at \$1,000/trip to account for the cost of vehicle rental and fuel (\$300), accommodation (\$400), and meals (\$300) for three field personnel (\$5000 requested).

Indirect Costs. Bogazici University has an institutional overhead rate of 10%. \$1,800 is requested in Y3.

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Total Costs: \$19,800 is requested in Year 3.

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Matched Funds: \$3,000 is calculated as a total of in-kind contribution for the year based on use of existing laboratory and field equipment.

Bogazici University OY1

Collaborator Salary. Bogazici University will provide field capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Turkey. Dr. Ibrahim Rasit Bilgin will commit 2 months in OY1 (\$9,000 requested). Salary for two field technicians is calculated at \$1000 each for 2 months (\$2,000 requested).

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Materials and Supplies. In OY1, \$2000 is requested to purchase additional local field equipment needed for bat capture, and supplies including wing punches, alcohol, swabs, reagents for viral transport, and cryovials. Fieldwork will focus on bat specimen collection from 5 field sites in OY1.

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Travel. Five in country field sampling event of five nights are planned in Y1. Trips are budgeted at \$1,000/trip to account for the cost of vehicle rental and fuel (\$300), accommodation (\$400), and meals (\$300) for three field personnel (\$5000 requested).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Indirect Costs. Bogazici University has an institutional overhead rate of 10%. \$1,800 is requested in Y3.

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Total Costs: \$19,800 is requested in Option Year 1.

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Matched Funds: \$5,000 is calculated as a total of in-kind contribution for the year based on use of existing laboratory and field equipment.

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Bogazici University OY2

Bogazici University will not receive a subaward in Option Year 2.

Fair and Reasonable Subaward Determination: Bogazici University is a highly performing research university, and has strong interest in strengthening personnel and institutional capacity for bat disease ecology research. The budget has been determined to be fair and reasonable based on comparable costs of laboratories in the region.

R. Lugar Center for Public Health Research, National Center for Disease Control & Public Health: Y1

Collaborator Salary: The R. Lugar Center will provide laboratory capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Georgia, building on their participation in a recent bat sampling training and bat virology studies. Key Personnel (KP) Urushadze, Virologist, and KP Sidamonidze, Molecular Biologist, will provide coordination of project activities through the R. Lugar Center as well as serve as a point of contact in Georgia for participation in the network (Y1-OY2). They will oversee the laboratory's field and Coronavirus screening activities. KP Urushadze and KP Sidamonidze will each commit 20% time during 12 months in Y1 (\$3,600 each, for a total of \$7,200 requested). KP Urushadze and Sidamonidze will coordinate efforts to collect bat specimens and lead coronavirus screening activities. Administrative support for R. Lugar center is requested at \$1,200 for 20% time during a 6 month period. Total salary requested: \$8,400.

Fringe benefits: The R. Lugar Center does not assign fringe benefits in addition to salary.

Travel: Funds are budgeted for one in-country field sampling event in Y1. To cover costs of five samplings nights, \$1,500 is requested. This includes vehicle rental and fuel (\$300), accommodation (\$700), and meals (\$500) for an estimated three field personnel.

Materials and Supplies: In Year 1, supply acquisition will emphasize training needs, protocol optimization, and preliminary specimen testing (intended for collection of a limited number of samples). Field supplies will be purchased to support institutional infrastructure for bat disease ecology studies and begin testing of bat specimens for Coronavirus study. Field supplies are based on sampling 90 bats in Y1. Supplies include Pipette Tips, Aerosol Barrier, Sterile Rack of 96, 0.5-10-ul (6 packs of 960) estimated at \$130, Pipette Tips, Aerosol Barrier, Sterile Rack of 96, 2-20-ul (6 packs of 960) for \$130, 2ml microtubes with attached caps (1x1000) for PCR applications for \$85, Pipette Tips, Aerosol Barrier, Sterile Rack of 96, 300ul (6 packs of 960) estimated at \$130, Pipette Tips, Aerosol Barrier, Sterile Rack of 96, 1000ul (6 pack of 800) estimated at \$130. Eppendorf 1.5mL tubes (1x1000) are estimated at \$50. Reagents will be purchased, reverse and forward primers (10 of each), One step RT-PCR kits, and other PCR reagents needed. Sequencing cost are estimated for 10% of specimens positive. Reagent and sequencing costs are estimated based on Daigger, Sigma-Aldrich, Quiagen and IDT price listings and testing of 180 fecal specimens (from Georgia and Turkey Y1 field sampling), and 18 tissue specimens (10% for DNA barcoding) (\$11,000 requested in Y1).

Indirect Costs: The R. Lugar Center has an institutional overhead rate of 4%. \$836 is requested in Y1.

Total Costs: \$21,736 is requested in Year 1.

Matched Funds: \$1,500 calculated as a total of in-kind contribution for the year based on proportion of shared time using pre-existing laboratory equipment, including freezer space and PCR machines.

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R.G. Lugar Center for Public Health Research, National Center for Disease Control & Public Health: Y2

Collaborator Salary: The R. Lugar Center will provide laboratory capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Georgia. KP Urushadze and KP Sidamonidze will each commit 35% time during 12 months in Y2 to provide Virology and Molecular Biology expertise, respectively, for the Coronavirus study (\$7,200 each, for a total of \$14,400 requested). KP Urushadze and Sidamonidze will lead the banking of bat samples for future studies. Additional collaborators through the R. Lugar Center have been identified for participation as follows: (b)(6) Zoologists, will each provide 25% time over 6 months (\$1,800 each, for a total of \$3,600 requested); 4 laboratory staff (b)(6) will each commit 20% time over 2 months for bat sampling (\$800 each, for \$3,200 total requested).

(b)(6) Molecular Biologist (b)(6) (b)(6) Virologist/molecular biologist, will each commit 25% time over 6 months for laboratory support (\$1,500 each, for a total of \$6,000 requested). Administrative support \$1,200 20% time during 6 months. Total salary requested: \$28,400

Travel: Funds are budgeted for three in-country field sampling events in Y2, to cover costs of 15 samplings nights (5 nights per sampling event). This includes vehicle rental and fuel (\$500), accommodation (\$700), and meals (\$500) for an estimated three field personnel each (a total of \$1,500 is requested).

Materials and Supplies: Supplies, reagents, and bat sampling supplies will be purchased in Y2 for the Coronavirus study. Bat sampling supplies will be purchased, including disposable syringes, blue pads, hand nets, forceps, sterile scissors, and protective biosafety field gear (field boots, helmets) (estimated at \$4,360). Field supplies are based on sampling 270 bats in Y2. Laboratory consumables and reagents will be purchased from the subaward budget. These include: pipette tips, microtubes, swabs, transfer pipettes, Eppendorf tubes, and laboratory coats will be purchased \$2,830 estimated for general laboratory supplies; please see Y1 for detailed supply costs). Reagent and prep kit costs for RNA extraction, PCR, sequencing, and next-generation sequencing have been priced as follows: QIAamp Viral RNA Mini Kits One step RT-PCR kits NEB E7370L NEBNext Ultra DNA Library Prep Kit 192 rxns MiSeq Reagent Kit v2 2x150 (300-cycles) 2 Bioanalyzer DNA High Sensitivity kits for OP-7™ Polymer for 3730/3730xl DNA Analyzers 1 ea x 7 ml plus forward and reverse primers Hi-Di formamide MicroAmp® Optical 96-Well Reaction Plates, Optically Clear Heat Seals for PCR and Aluminum PCR sealing Film, ExoSAP-IT, DNTP's, Qiaamp gel extraction kit. Laboratory supplies are based on testing 120 fecal specimen, and 12 tissue specimens (100% for DNA barcoding). In total, \$42,550 is requested in Y2 for sampling/laboratory supplies.

Indirect Costs: The R. Lugar Center has an institutional overhead rate of 4%. \$3,018 is requested in Y2.

Total Costs: \$78,468 is requested in Year 2.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Matched Funds: \$5,000 calculated as a total of in-kind contribution for the year based on proportion of shared time using pre-existing laboratory equipment, including freezer space and PCR machines.

R.G. Lugar Center for Public Health Research, National Center for Disease Control & Public Health: Y3

Collaborator Salary: The R. Lugar Center will provide laboratory capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Georgia. KP Urushadze and KP Sidamonidze will each commit 35% time during 12 months in Y3 to provide Virology and Molecular Biology expertise, respectively, for the Coronavirus study (\$8,200 each, for a total of \$16,400 requested). KP Urushadze and Sidamonidze will lead the banking of bat samples for future studies. Additional collaborators through the R. Lugar Center have been identified for participation as follows: (b)(6) Zoologists, will each provide 25% time over 6 months (\$2,100 each, for a total of \$4,200 requested); 5 laboratory staff (b)(6) will each commit 20% time over 2 months for bat sampling (\$800 each, for \$4000 total requested); (b)(6) Virologist, (b)(6) Molecular Biologist will each commit 25% time over 6 months for laboratory support (\$1500 each, for a total of \$9000 requested). Administrative support at \$1,200 20% time during 6 months. Epidemiologists: (b)(6) \$1,500 20% time during 6 months for total of \$3,000. Total salary requested: \$37,600.

Travel: Funds are budgeted for three in-country field sampling events in Y3. To cover costs of 18 samplings nights (6 nights per sampling event), this includes vehicle rental and fuel (\$300), accommodation (\$900), and meals (\$900) for an estimated three field personnel each trip (\$1,500 is requested).

Materials and Supplies: Supplies, reagents, and bat sampling supplies will be purchased in Y3 for the Coronavirus study (replacing the supplies used up the previous year's work). Bat sampling supplies will be purchased, including disposable syringes, blue pads, hand nets, forceps, sterile scissors, and protective biosafety field gear (field boots, helmets) (estimated at \$4,625). Field supplies are based on sampling 270 bats in Y3. Laboratory consumables and reagents will be purchased from the subaward budget. These include: pipette tips, microtubes, swabs, transfer pipettes, Eppendorf tubes, and laboratory coats will be purchased (\$2,630 estimated for general laboratory supplies; please see Y1 for detailed supply costs). Reagent and prep kit costs for RNA extraction, PCR, sequencing, and next-generation sequencing have been priced as follows: 3 QIAamp Viral RNA Mini Kits), 3 One step RT-PCR kit NEB E7370L NEBNext Ultra DNA Library Prep Kit 288 rxns), MiSeq Reagent Kit v2 4x150 (300-cycles)), 2 Bioanalyzer DNA High Sensitivity kits, OP-7™ Polymer for 3730/3730xl DNA Analyzers 1ea x 14 ml (\$1000), plus forward and reverse primers, Hi-Di formadide, MicroAmp® Optical 96-Well Reaction Plates, Optically Clear Heat Seals for PCR, and Aluminum PCR sealing Film (total of \$21,045 for reagent/sequencing costs). Laboratory supplies are based on testing 900

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

feet, specimen, and 90 tissue specimens (10% of for DNA barcoding). In total, \$53,188 is requested in Y3 for sampling/laboratory supplies.

Indirect Costs: The R. Lugar Center has an institutional overhead rate of 4%. \$3,820 is requested in Y3.

Total Costs: \$99,308 is requested in Year 3.

Matched Funds: \$5,000 calculated as a total of in-kind contribution for the year based on proportion of shared time using pre-existing laboratory equipment, including freezer space and PCR machines.

R.G. Lugar Center for Public Health Research, National Center for Disease Control & Public Health: OY1

Collaborator Salary: The R. Lugar Center will provide laboratory capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Georgia. KP Urushadze and KP Sidamonidze will each commit 35% time during 12 months in OY1 to provide Virology and Molecular Biology expertise, respectively, for the Coronavirus study (\$8,400, each, for a total of \$16,400 requested). KP Urushadze and Sidamonidze will lead the banking of bat samples for future studies. Additional collaborators through the R. Lugar Center have been identified for participation as follows (b)(6) Zoologists, will each provide 25% time over 6 months (\$2,100 each, for a total of \$4,200 requested); 5 laboratory staff (b)(6) (b)(6) will each commit 20% time over 2 months for bat sampling (\$800 each, for \$4000 total requested). (b)(6) (b)(6) Virologist, (b)(6) Molecular Biologist, (b)(6) (b)(6) Molecular Biologist will each commit 25% time over 6 months for laboratory support (\$1500 each, for a total of \$9000 requested). Administrative support at \$1,200 20% time during 6 months. Epidemiologists: (b)(6) \$1,500 20% time during 6 months for total of \$3,000. Total salary requested: \$37,800.

Travel: Funds are budgeted for three in-country field sampling events in OY1. To cover costs of 15 sampling nights (5 nights per sampling event). This includes vehicle rental and fuel (\$3,000), accommodation (\$700), and meals (\$500) for an estimated three field personnel each trip (\$4,500 is requested).

Materials and Supplies: Supplies, reagents, and bat sampling supplies will be purchased in OY1 for the Coronavirus study (replacing the supplies used up the previous year's work). Bat sampling supplies will be purchased, including disposable syringes, blue pads, hand nets, forceps, sterile scissors, and protective biosafety field gear (field boots, helmets) (estimated at \$4,625). Field supplies are based on sampling 270 bats in Y3. Laboratory consumables and reagents will be purchased from the subaward budget. These include: pipette tips, microtubes, swabs, transfer pipettes, Eppendorf tubes, and laboratory coats will be purchased (\$2,630 estimated for general laboratory supplies; please see Y1 for detailed supply costs). Reagent and

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

prep kit costs for RNA extraction, PCR, sequencing, and next-generation sequencing have been priced as follows: 3 QIAamp Viral RNA Mini Kits), 3 One step RT-PCR kit NEB E7370L NEBNext Ultra DNA Library Prep Kit 288 rxns), MiSeq Reagent Kit v2 4x150 (300-cycles)), 2 Bioanalyzer DNA High Sensitivity kits, OP-7™ Polymer for 3730/3730xl DNA Analyzers 1 ea x 14 ml (\$1000), plus forward and reverse primers, Hi-Di formamide, MicroAmp® Optical 96-Well Reaction Plates, Optically Clear Heat Seals for PCR, and Aluminum PCR sealing Film (total of \$21,045 for reagent/sequencing costs). Laboratory supplies are based on testing 9000 fecal, specimen, and 90 tissue specimens (10% for DNA banking). In total, \$53,188 is requested in OY1 for sampling/laboratory supplies.

Indirect Costs. The R. Lugar Center has an institutional overhead rate of 4%. \$3,820 is requested in OY1.

Total Costs: \$99,308 is requested in Option Year 1.

Matched Funds: \$5,000 calculated as a total of in-kind contribution for the year based on proportion of shared time using pre-existing laboratory equipment, including freezer space and PCR machines.

R.G. Lugar Center for Public Health Research, National Center for Disease Control & Public Health: OY2

Collaborator Salary: The R. Lugar Center will provide laboratory capacity as a regional center of excellence and a participant base for bat disease ecology capacity building in Georgia, building on their participation in recent bat sampling training and bat virology studies. KP Urushadze and KP Sidamonidze will each commit 25% time during 12 months in OY2 to provide Virology and Molecular Biology expertise, respectively, for the Coronavirus study and bat migration and pathogen spread analyses (\$7,200 each, for a total of \$14,400 requested). KP Urushadze and Sidamonidze will lead the banking of bat samples for future studies.

Collaborators (b)(6) Molecular Biologist, and (b)(6) Virologist, (b)(6) Molecular Biologists will each commit 25% time over 6 months for laboratory support in OY2 (\$1,500 each, for a total of \$6,000 requested). Administrative support at \$1,200 20% time during 6 months. Total salary requested: \$21,600.

Materials and Supplies: Laboratory supplies and reagents will be purchased in OY2 for final coronavirus screening. The increased supply costs are justified to test as many remaining archived specimens as possible at the end of the project, anticipating that accumulated specimens from neighboring countries will be transferred to the Lugar lab and available for screening. Pipette tips, microtubes, and Eppendorf tubes will be purchased (\$1,440 estimated for general laboratory supplies; please see Y1 for detailed supply costs). Reagent and prep kit costs for RNA extraction, PCR, sequencing, and next-generation sequencing have been priced as follows: 4 QIAamp Viral RNA Mini Kit 4 One step RT-PCR kit NEB E7370L NEBNext Ultra DNA Library Prep Kit 288 rxns (\$6,675), MiSeq Reagent Kit v2 6x150 (300-cycles)), 4 Bioanalyzer DNA High Sensitivity kits for OP-7™ Polymer for 3730/3730xl DNA Analyzers 1 ea x 28 ml

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

plus forward and reverse primers (\$600), Hi-Di formadide MicroAmp® Optical 96-Well Reaction Plates Optically Clear Heat Seals for PCR and Aluminum PCR sealing Film (total of \$12,560 for reagent/sequencing costs). In total, \$14,060 is requested in OY2 for laboratory supplies.

Indirect Costs. The R. Lugar Center has an institutional overhead rate of 4%. \$1,406.40 is requested in OY2.

Total Costs: \$17,086.40 is requested in OY2.

Matched Funds: \$5,000 calculated as a total of in-kind contribution for OY2 based on proportion of shared time using pre-existing laboratory equipment, including freezer space and PCR machines.

Fair and Reasonable Subaward Determination: The R. Lugar Center is a highly performing laboratory, and has strong interest in strengthening personnel and institutional capacity for bat disease ecology research in Georgia and the region. The budget has been determined to be fair and reasonable based on comparable costs of laboratories in the region.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

University of Veterinary & Animal Sciences, Lahore-Pakistan Y1

Collaborator Salary: Department of Wildlife and Ecology, University of Veterinary & Animal Sciences, Lahore-Pakistan will provide field capacity as a regional center of excellence and a participant base for bat research activities and specimen collection in Pakistan. Dr. Shahzad Ali, Assistant Professor in Department of Wildlife and Ecology, key personnel on the project, will commit 4 months in Y1 to coordinate and lead field investigations in Pakistan. Key personnel salary requested \$250. Six month salary of \$1200 is requested for post-doc to assist full-time with fieldwork and project activities. Total salary requested: \$1450.

Materials and Supplies: In Year 1, \$3000 is requested to purchase local field supplies needed for bat capture, specimen collection and storage, and transport.

Equipment: In Year 1, \$7000 is requested for a -80C freezer for bat specimen storage to be housed at the University of Veterinary & Animal Sciences, Lahore-Pakistan.

Travel: One in-country field sampling event of five nights is planned in Y1. Trips are budgeted at \$2250 (trip to account for the cost of vehicle rental and fuel and local air travel as necessary) (\$1050), local accommodation (\$600), and meals (\$600) during fieldwork for three field personnel. (\$2250 requested).

Indirect Costs: No indirect costs are requested. University of Veterinary & Animal Sciences, Lahore-Pakistan will provide in-kind support of \$1370 to cover institutional overhead costs (10%).

Total Costs: \$13,700 is requested in Year 1.

Matched Funds: \$7,000 calculated as a total of in-kind contribution for the year. In-kind contributions calculated as 10% indirect costs contributed to subaward amount, and use of university facilities and existing lab and field equipment.

University of Veterinary & Animal Sciences, Lahore-Pakistan Y2

Collaborator Salary: Department of Wildlife and Ecology, University of Veterinary & Animal Sciences, Lahore-Pakistan will provide field capacity as a regional center of excellence and a participant base for bat research activities and specimen collection in Pakistan. Dr. Shahzad Ali, Assistant Professor in Department of Wildlife and Ecology, key personnel on the project, will commit 4 months in Y2 to coordinate and lead field investigations in Pakistan. Key personnel salary requested \$1000. Annual salary of \$2400 is requested for post-doc to assist full-time with fieldwork and project activities. Total salary requested: \$3400

Materials and Supplies: In Year 2, \$5100 is requested to purchase local field supplies needed for bat capture, specimen collection and storage, and transport.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Travel: Three in-country field sampling events of five nights each are planned in Y2. Trips are budgeted at \$2250/trip to account for the cost of vehicle rental and fuel and local air travel as necessary (\$1050), local accommodation (\$600), and meals (\$600) during fieldwork for three field personnel. \$6750 requested.

Indirect Costs: No indirect costs are requested. University of Veterinary & Animal Sciences, Lahore-Pakistan will provide in-kind support of \$1,525 to cover institutional overhead costs (10%).

Total Costs: \$15,250 is requested in Year 2.

Matched Funds: \$3,000 calculated as a total of in-kind contribution for the year. In-kind contributions calculated as 10% indirect costs contributed to subaward amount, and use of university facilities, and existing lab and field equipment.

University of Veterinary & Animal Sciences, Lahore-Pakistan Y3

Collaborator Salary: University of Veterinary & Animal Sciences, Lahore-Pakistan will provide field capacity as a regional center of excellence and a participant base for bat research activities and specimen collection in Pakistan. Dr. Shahzad Ali will commit 4 months in Y3. Key personnel salary requested \$1000. Annual salary of \$2400 is requested for post-doc to assist full-time with fieldwork and project activities. Total salary requested: \$3400.

Materials and Supplies: In Year 3, \$2600 is requested to local purchase additional field supplies needed for bat capture, specimen collection and storage, and transport.

Travel: Five in-country field sampling events of five nights each are planned in Y2. Trips are budgeted at \$2250/trip to account for the cost of vehicle rental and fuel and local air travel as necessary (\$1050), local accommodation (\$600), and meals (\$600) during fieldwork for three field personnel. \$11,250 requested.

Indirect Costs: No indirect costs are requested. University of Veterinary & Animal Sciences, Lahore-Pakistan will provide in-kind support of \$1,725 to cover institutional overhead costs (10%).

Total Costs: \$17,250 is requested in Year 3.

Matched Funds: \$3,000 calculated as a total of in-kind contribution for the year. In-kind contributions calculated as 10% indirect costs contributed to subaward amount, and use of university facilities, and existing lab and field equipment.

University of Veterinary & Animal Sciences, Lahore-Pakistan OY1

Collaborator Salary: University of Veterinary & Animal Sciences, Lahore-Pakistan will provide field capacity as a regional center of excellence and a participant base for bat research

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

activities and specimen collection in Pakistan. Dr. Shahzad Ali will commit 4 months in OY1. Key personnel salary requested \$1000. Annual salary of \$2400 is requested for post-doc to assist full-time with fieldwork and project activities. Total salary requested: \$3400

Materials and Supplies: In OY1, \$2600 is requested to purchase additional local field supplies needed for bat capture, specimen collection and storage, and transport.

Travel: Five in-country field sampling event of five nights each are planned in Y2. Trips are budgeted at \$2250/trip to account for the cost of vehicle rental and fuel and local air travel as necessary (\$1050), local accommodation (\$600), and meals (\$600) during fieldwork for three field personnel (\$11,250 requested).

Indirect Costs: No indirect costs are requested. University of Veterinary & Animal Sciences, Lahore-Pakistan will provide in-kind support of \$1,725 to cover institutional overhead costs (10%).

Total Costs: \$17,250 is requested in OY1.

Matched Funds: \$7,000 calculated as a total of in-kind contribution for the year. In-kind contributions calculated as 10% indirect costs contributed to subaward amount, and use of university facilities, and existing lab and field equipment.

University of Veterinary & Animal Sciences, Lahore-Pakistan OY2

University of Veterinary & Animal Sciences, Lahore-Pakistan will not receive a subaward in OY2. International travel to OY2 workshop is covered in EcoHealth Alliance central budget.

Fair and Reasonable Subaward Determination: University of Veterinary & Animal Sciences, Lahore-Pakistan is a both highly prestigious institute and has strong interest in strengthening personnel and institutional capacity for bat disease ecology research. The budget has been determined to be fair and reasonable based on comparable costs of laboratories in the region.

Deleted: Five in-country field sampling event of five nights each are planned in Y2. Trips are budgeted at \$1500/trip to account for the cost of vehicle rental and fuel (\$700), local accommodation (\$400), and meals (\$400) during fieldwork for two field personnel (\$7500 requested).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Royal Scientific Society of Jordan (RSS) Y1

Collaborator Salary: RSS will provide laboratory capacity as a regional Center for Excellence and a participant base for bat disease ecology capacity building in Jordan, building on their participation in recent bat sampling training. Key Personnel (KP) Al-Hmoud will provide coordination of project activities through RSS as well as serve as a point of contact in Jordan for participation in the network (Y1-OY2). Through this role KP Al-Hmoud will oversee management of the partnership, field surveys, data processing, dissemination of the results, and financial management. KP Al-Hmoud will commit 1.5 months in Y1 (\$6,375 requested), plus .25 months additional time (\$1,000 as matched funds). A Zoologist will provide expertise on bat species in the country (Y1-OY2), committing 1 month in Y1 (\$2,000 requested). An RSS Virologist will provide support for the Coronavirus study, committing 1 month in Y1 (\$1,250 requested; \$250 as matched funds per month). KP Al-Hmoud and the Virologist will lead the banking of bat samples for future studies. Total salary requested: \$9,625.

Fringe benefits: RSS calculates fringe benefits as 30% of base salary committed to the project for the collaborators. RSS will contribute 10% of fringe costs as matched support in Y1 (\$1,200). 20% of salary committed is requested for fringe benefits in Y1 (\$1,925 requested).

Materials and Supplies: In Year 1, supply acquisition will emphasize training needs and protocol optimization, and testing of specimens collected from one field site. Field supplies will be purchased to support institutional infrastructure for bat disease ecology studies, based on sampling of 90 bats. Reagents will be used to validate assays, test initial specimens collected from Jordan and Pakistan during Y1 sampling, based on testing of 180 fecal specimens, and 18 tissue specimens (10%) for DNA sequencing. Field Kits will be purchased (Mist Net 4m; Mist Net 6m; Mist Net 9m; Mist Net 12m (Total 12), poles, gloves, and other trapping supplies [total cost = \$600]), Sterile sampling equipment, collection materials, sample tubes, pipette tips, plasticware, consumables are together estimated at \$850. Molecular biology supplies (PCR reagents, enzymes, DNA extraction kits, gel purification kits, electrophoresis supplies (agarose, ladders, stains) and sequencing reagents and costs are estimated at \$600. Total supplies requested: \$7,450.

Travel: Funds are budgeted for one in-country field sampling event in Y1. To cover costs of five sampling nights, \$1500 is requested. This includes per person costs of vehicle rental and fuel (\$100), accommodation (\$200), and meals (\$200) for an estimated three field personnel.

Indirect Costs: RSS will provide in-kind support of \$1,500 to cover institutional overhead costs.

Total Costs: \$20,500 is requested in Year 1.

Matched Funds: \$1,200 calculated as a total of in-kind contribution for the year (RSS salary contribution: \$2,700; Office expenses, using lab facilities and equipment: \$1,500). The Jordanian USAID PREDICT project will provide in-kind contribution of sampling and testing of 200 bats during Y1, data from which will be included in this projects regional analysis of CoV diversity

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

and risk. In-kind values are calculated for \$1,111 in field costs, \$10,000 in supplies, and \$2,000 in transport costs for a total of \$13,111.

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Royal Scientific Society of Jordan (RSS) Y2

Collaborator Salary: RSS will provide laboratory capacity as a regional Center for Excellence and a participant base for bat disease ecology capacity building in Jordan, building on their participation in recent bat sampling training. KP Al-Hmoud will commit 3 months in Y2 (\$13,125 requested). A Zoologist will provide expertise on bat species in the country and participate in field expeditions, committing 1 month in Y2 (\$2,500 requested). An RSS Virologist will provide support for the Coronavirus study, committing 3 month in Y2 (\$4,000 requested). KP Al-Hmoud and the Virologist will lead the testing of specimens. Total salary requested: \$19,625

Fringe benefits: RSS calculates fringe benefits as 30% of base salary committed to the project for the collaborators. 20% of salary committed is requested for fringe benefits in Y2 (\$3,925 requested). RSS will contribute 10% of fringe costs as matched support in Y2 (\$1,962,50).

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Materials and Supplies: In Year 2, supply acquisition will emphasize the Coronavirus studies. Based on sampling 90 bats in Y2. Additional Field Kits will be purchased (Mist Net 4m; Mist Net 6m; Mist Net 9m; Mist Net 12m, poles, gloves, and other trapping supplies [total cost = \$1500]), Sterile sampling equipment, collection materials, sample tubes, pipette tips, plasticware, consumables are together estimated at \$3,000. Molecular biology supplies (PCR reagents, enzymes, DNA extraction kits, gel purification kits, electrophoresis supplies (agarose, ladders, stains) and sequencing reagents and costs are estimated at \$28,000, based on testing of 510 fecal specimens (from Jordan and the region) and 54 tissue specimens (10% of for DNA barcoding). General laboratory supplies (Glassware, vials, bottles, gloves, filters (filter cartridges for purified water [\$1000 per year]), chemical reagents and buffers) are estimated at \$5,000. In total \$41,450 is requested for supplies in Y2.

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Indirect Costs: RSS will provide in-kind support of \$3,000 to cover institutional overhead costs.

Total Costs: \$66,500 is requested in Year 2.

Matched Funds: \$6,925, calculated as a total of in-kind contribution for the year. RSS in-kind salary contribution: \$3,925, and office expenses, using lab facilities and equipment: \$3,000. The Jordan USAID PREDICT project will provide in-kind contribution of sampling and testing of 200 bats during Y2, data from which will be included in this projects regional analysis of CoV diversity and risk. In-kind values are calculated for \$1,111 in field costs, \$10,000 in supplies, and \$2,000 transport costs for a total of \$13,111.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Royal Scientific Society of Jordan (RSS) Y3

Collaborator Salary: RSS will provide laboratory capacity as a regional Center for Excellence and a participant base for bat disease ecology capacity building in Jordan, building on their participation in recent bat sampling training. KP Al-Hmoud will commit 3 months in Y3 (\$13,500 requested). A Zoologist will provide expertise on bat species in the country and participate in field expeditions, committing 1 month in Y3 (\$3,000 requested). An RSS Virologist will provide support for the Coronavirus study, committing 5 months in Y3 (\$7,100 requested). KP Al-Hmoud and the Virologist will lead the testing of specimens. Total salary requested: \$23,600

Fringe benefits: RSS calculates fringe benefits as 30% of base salary committed to the project for the collaborators. 20% of salary committed is requested for fringe benefits in Y3 (\$4,720 requested). RSS will contribute 10% of fringe costs as matched support in Y3 (\$2,360).

Materials and Supplies: In Year 3, supply acquisition will emphasize the Coronavirus studies (with intended full-scale sample collection of 200 bats). Replacement field sampling supplies will be purchased: mist nets and associated trapping supplies (\$2,500). Sterile sampling equipment, collection materials, sample tubes, pipette tips, plasticware, consumables are together estimated at \$12,000. Molecular biology supplies (PCR reagents, enzymes, DNA extraction kits, gel purification kits, electrophoresis supplies (agarose, ladders, stains) and sequencing reagents and costs are estimated at \$36,180, based on testing of 900 fecal specimens (from Jordan and the region) and 90 tissue specimens (10% of for DNA sequencing). General laboratory supplies (Glassware, vials, bottles, gloves, filters (filter cartridges for purified water [\$1000 per year]), chemical reagents and buffers) are estimated at \$5,000. In total \$55,680 is requested in Y3.

Travel: Funds are budgeted for three in-country field sampling events in Y3. To cover costs of five stamping nights each event, \$1,500 is requested. This includes vehicle rental and fuel (\$100), accommodation (\$200), and meals (\$200) for an estimated three field personnel (\$4,000 total requested).

Indirect Costs: RSS will provide in-kind support of \$4,000 to cover institutional overhead costs.

Total Costs: \$88,500 is requested in Year 3.

Matched Funds: \$6,360 calculated as a total of in-kind contribution for the year. RSS salary contribution: \$2,360; Office expenses, using lab facilities and equipment: \$4,000.

Royal Scientific Society of Jordan (RSS) OY1

Collaborator Salary: RSS will provide laboratory capacity as a regional Center for Excellence and a participant base for bat disease ecology capacity building in Jordan, building on their participation in recent bat sampling training. KP Al-Hmoud will commit 3 months in OY1 (\$13,875 requested). A Zoologist will provide expertise on bat species in the country and

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

participate in field expeditions, committing 1 month in OY1 (\$3,500 requested). An RSS Virologist will provide support for the Coronavirus study, committing 5 months in OY1 (\$7,500 requested). KP Al-Hmoud and the Virologist will lead the testing of specimens. Total salary requested: \$24,875.

Fringe benefits: RSS calculates fringe benefits as 30% of base salary committed to the project for the collaborators. 20% of salary committed is requested for fringe benefits in OY1 (\$4,975 requested). RSS will contribute 10% of fringe costs as matched support in OY1 (\$2,487.50).

Materials and Supplies: In OY1, supply acquisition will emphasize the Coronavirus studies (with intended full-scale sample collection of 270 bats). Replacement field sampling supplies will be purchased: mist nets and associated trapping supplies (\$1,150), Sterile sampling equipment, collection materials, sample tubes, pipette tips, plasticware, consumables are together estimated at \$12,000. Molecular biology supplies (PCR reagents, enzymes, DNA extraction kits, gel purification kits, electrophoresis supplies (agarose, ladders, stains) and sequencing reagents and costs are estimated at \$36,180, based on testing of 900 fecal specimens (from Jordan and the region) and 90 tissue specimens (10% of) for DNA barcoding. **General laboratory supplies** (Glassware, vials, bottles, gloves, filters (filter cartridges for purified water [\$1000 per year]), chemical reagents and buffers) are estimated at \$5,530. In total \$54,860 is requested in Y3.

Travel: Funds are budgeted for three in-country field sampling events in OY1. To cover costs of five samplings nights each event, \$1500 is requested. This includes vehicle rental and fuel (\$100), accommodation (\$200), and meals (\$200) for an estimated three field personnel (\$4500 total requested).

Indirect Costs: RSS will provide in-kind support of \$4,000 to cover institutional overhead costs.

Total Costs: \$89,210 is requested in OY1.

Matched Funds: \$6,487.50 calculated as a total of in-kind contribution for the year. RSS salary contribution: \$2,487.50; Office expenses, using lab facilities and equipment: \$4,000.

Royal Scientific Society of Jordan (RSS) OY2

Collaborator Salary: RSS will provide laboratory capacity as a regional Center for Excellence and a participant base for bat disease ecology capacity building in Jordan, building on their participation in recent bat sampling training. KP Al-Hmoud will commit 2 months in OY2 (\$9,500 requested). An RSS Virologist will provide support for follow-up analyses/interpretation for the Coronavirus study, committing 2 months in OY2 (\$3,200 requested). KP Al-Hmoud and the Virologist will lead testing of specimens. Total salary requested in OY2: \$12,700.

Fringe benefits: RSS calculates fringe benefits as 30% of base salary committed to the project for the collaborators. 20% of salary committed is requested for fringe benefits in OY2 (\$2,540 requested). RSS will contribute 10% of fringe costs as matched support in OY2 (\$1,270).

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Materials and Supplies: In OY2, supply acquisition will be focused on coronavirus screening. The increased supply costs are justified to test as many remaining archived specimens as possible at the end of the project, anticipating that additional accumulated specimens from neighboring countries will be transferred to the RSS lab and available for screening also in this final year. Sterile sample tubes, pipette tips, plasticware, consumables are together estimated at \$4,260. Molecular biology supplies (PCR reagents, enzymes, DNA extraction kits, gel purification kits, electrophoresis supplies (agarose, ladders, stains)) are estimated at \$12,000. General laboratory supplies (Glassware, vials, bottles, gloves, filters (filter cartridges for purified water [\$1000 per year]), chemical reagents and buffers) are estimated at \$3,000. Sequencing fees for phylogenetic analysis of coronaviruses (\$20) per positive sample are estimated at \$4,500 (in total \$23,760 is requested in OY2).

Indirect Costs: RSS will provide in-kind support of \$2,000 to cover institutional overhead costs.

Total Costs: \$39,000 is requested in OY2.

Matched Funds: \$3,200, calculated as a total of in-kind contribution for the year. RSS salary contribution: \$1,000; Office expenses, using lab facilities and equipment: \$2,000

Fair and Reasonable Subaward Determination: RSS is a highly performing laboratory, and has strong interest in strengthening personnel and institutional capacity for bat disease ecology research. The budget has been determined to be fair and reasonable based on comparable costs of laboratories in the region.

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**APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)**

3. DATE RECEIVED BY STATE	State Application Identifier

1. TYPE OF SUBMISSION

Pre-application Application Changed/Corrected Application

4. a. Federal Identifier	FRBAA09 01 0879
b. Agency Routing Identifier	GRANT11843741
c. Previous Grants.gov Tracking ID	GRANT12223880

2. DATE SUBMITTED	Applicant Identifier
08/01/2016	EcoHealth Alliance

5. APPLICANT INFORMATION

Organizational DUNS: 077090066

Legal Name: EcoHealth Alliance

Department: _____ Division: _____

Street1: 460 West 34th Street, 17th Floor

Street2: _____

City: New York County / Parish: _____

State: NY: New York Province: _____

Country: USA: UNITED STATES ZIP / Postal Code: 10001-2320

Person to be contacted on matters involving this application

Prefix: Miss First Name: Catherine Middle Name: _____

Last Name: Machalaba Suffix: _____

Position/Title: Program Coordinator

Street1: 460 West 34th Street, 17th Floor

Street2: _____

City: New York County / Parish: _____

State: NY: New York Province: _____

Country: USA: UNITED STATES ZIP / Postal Code: 10001 2320

Phone Number: 212-360-4472 Fax Number: _____

Email: machalaba@ecohealthalliance.org

6. EMPLOYER IDENTIFICATION (EIN) or (TIN): 311726494

7. TYPE OF APPLICANT: M: Nonprofit with 501C3 IRS Status (Other than Institution of Higher Education)

Other (Specify): _____

Small Business Organization Type Women Owned Socially and Economically Disadvantaged

8. TYPE OF APPLICATION:

New Resubmission A. Increase Award B. Decrease Award C. Increase Duration D. Decrease Duration

Renewal Continuation Revision E. Other (specify): Response to DTRA comments

Is this application being submitted to other agencies? Yes No What other Agencies? _____

9. NAME OF FEDERAL AGENCY:

Defense Threat Reduction Agency

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: 12.351

TITLE: Basic Scientific Research: Combating Weapons of Mass Destruction

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

12. PROPOSED PROJECT:

Start Date	Ending Date
03/01/2017	02/28/2022

13. CONGRESSIONAL DISTRICT OF APPLICANT

10

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: First Name: Middle Name:
 Last Name: Suffix:
 Position/Title:
 Organization Name:
 Department: Division:
 Street1:
 Street2:
 City: County / Parish:
 State: Province:
 Country: ZIP / Postal Code:
 Phone Number: Fax Number:
 Email:

<p>15. ESTIMATED PROJECT FUNDING</p> <p>a. Total Federal Funds Requested <input type="text" value="3,981,541.45"/></p> <p>b. Total Non-Federal Funds <input type="text" value="267,724.50"/></p> <p>c. Total Federal & Non-Federal Funds <input type="text" value="4,249,265.95"/></p> <p>d. Estimated Program Income <input type="text" value="0.00"/></p>	<p>16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?</p> <p>a. YES <input type="checkbox"/> THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON: DATE: <input type="text"/></p> <p>b. NO <input checked="" type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372; OR <input type="checkbox"/> PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW</p>
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17. By signing this application, I certify (1) to the statements contained in the list of certifications* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances * and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

I agree

**The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.*

18. SFLLL (Disclosure of Lobbying Activities) or other Explanatory Documentation

19. Authorized Representative

Prefix: First Name: Middle Name:
 Last Name: Suffix:
 Position/Title:
 Organization:
 Department: Division:
 Street1:
 Street2:
 City: County / Parish:
 State: Province:
 Country: ZIP / Postal Code:
 Phone Number: Fax Number:
 Email:

<p>Signature of Authorized Representative</p> <p><input type="text" value="Aleksai Chmura"/></p>	<p>Date Signed</p> <p><input type="text" value="11/14/2016"/></p>
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20. Pre-application

21. Cover Letter Attachment

RESEARCH & RELATED Other Project Information

OMB Number: 4040-0001
Expiration Date: 10/31/2019

1. Are Human Subjects Involved? Yes No

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations? Yes No

If yes, check appropriate exemption number. 1 2 3 4 5 6

If no, is the IRB review Pending? Yes No

IRB Approval Date:

Human Subject Assurance Number:

2. Are Vertebrate Animals Used? Yes No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? Yes No

IACUC Approval Date:

Animal Welfare Assurance Number:

3. Is proprietary/privileged information included in the application? Yes No

4.a. Does this Project Have an Actual or Potential Impact - positive or negative - on the environment? Yes No

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an environmental assessment (EA) or environmental impact statement (EIS) been performed? Yes No

4.d. If yes, please explain:

5. Is the research performance site designated, or eligible to be designated, as a historic place? Yes No

5.a. If yes, please explain:

6. Does this project involve activities outside of the United States or partnerships with international collaborators? Yes No

6.a. If yes, identify countries:

6.b. Optional Explanation:

7. Project Summary/Abstract

8. Project Narrative

9. Bibliography & References Cited

10. Facilities & Other Resources

11. Equipment

12. Other Attachments

RESEARCH & RELATED Senior/Key Person Profile

PROFILE - Project Director/Principal Investigator

Prefix: <input type="text" value="Dr."/>	* First Name: <input type="text" value="Kevin"/>	Middle Name: <input type="text" value="James"/>
* Last Name: <input type="text" value="Olival"/>	Suffix: <input type="text"/>	
Position/Title: <input type="text" value="Associate Vice President for Research"/>	Department: <input type="text"/>	
Organization Name: <input type="text" value="EcoHealth Alliance"/>	Division: <input type="text"/>	
* Street1: <input type="text" value="460 West 34th Street, 17th Floor"/>		
Street2: <input type="text"/>		
* City: <input type="text" value="New York"/>	County: <input type="text"/>	
* State: <input type="text" value="NY: New York"/>	Province: <input type="text"/>	
* Country: <input type="text" value="USA: UNITED STATES"/>	* Zip / Postal Code: <input type="text" value="10001-2520"/>	
* Phone Number: <input type="text" value="212 390 4478"/>	Fax Number: <input type="text"/>	
* E-Mail: <input type="text" value="olival@ecohealthalliance.org"/>		
Credential, e.g., agency login: <input type="text"/>		
* Project Role: <input type="text" value="PD/PT"/>	Other Project Role Category: <input type="text"/>	
* Attach Biographical Sketch	<input type="text" value="1239-Olival_WAB-Net_Biosketch"/>	<input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>
Attach Current & Pending Support	<input type="text" value="1240-Olival_C&P_July2016.pdf"/>	<input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>

PROFILE - Senior/Key Person 1

Prefix: <input type="text" value="Dr."/>	* First Name: <input type="text" value="William"/>	Middle Name: <input type="text"/>
* Last Name: <input type="text" value="Karesh"/>	Suffix: <input type="text"/>	
Position/Title: <input type="text"/>	Department: <input type="text"/>	
Organization Name: <input type="text" value="EcoHealth Alliance"/>	Division: <input type="text"/>	
* Street1: <input type="text" value="Executive Vice President, Health and Policy"/>		
Street2: <input type="text"/>		
* City: <input type="text" value="New York"/>	County: <input type="text"/>	
* State: <input type="text" value="NY: New York"/>	Province: <input type="text"/>	
* Country: <input type="text" value="USA: UNITED STATES"/>	* Zip / Postal Code: <input type="text" value="10001 2320"/>	
* Phone Number: <input type="text" value="212-380-4463"/>	Fax Number: <input type="text"/>	
* E-Mail: <input type="text" value="karesh@ecohealthalliance.org"/>		
Credential, e.g., agency login: <input type="text"/>		
* Project Role: <input type="text" value="Co-PD/PT"/>	Other Project Role Category: <input type="text"/>	
* Attach Biographical Sketch	<input type="text" value="1241-Karesh_WAB-Net_Biosketch"/>	<input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>
Attach Current & Pending Support	<input type="text" value="1242-Karesh_C&P_July2016.pdf"/>	<input type="button" value="Delete Attachment"/> <input type="button" value="View Attachment"/>

ADDITIONAL SENIOR/KEY PERSON PROFILE(S)

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Additional Biographical Sketch(es) (Senior/Key Person)

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Additional Current and Pending Support(s)

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OMB Number: 4040-0001
Expiration Date: 10/31/2019

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Kevin J. Olival

EcoHealth Alliance, 460 W. 34th St., 17th Floor, New York, NY 10001
olival@ecohealthalliance.org

Professional Preparation

Columbia University, New York, NY	MA	2003
Columbia University, New York, NY	PhD	2008
American Museum of Nat. History, New York, NY	Post-doc	2008-2009
NIH Fogarty US Global Health Fellow, New York, NY	Post-doc	2009-2010

Appointments

Associate Vice President for Research, EcoHealth Alliance	2015 - present
Modeling and Analytics Coordinator, PREDICT-2 Project, USAID	2015 - present
EHA Lead MERS-CoV animal reservoir investigations with MoH in Saudi Arabia	2013 - present
Stakeholder Committee Rep, White Nose Syndrome National Response	2013 - present
Steering Committee, Southeast Asian Bat Conservation Research Unit	2011 - present
Lead Field Researcher, FAO-EHA investigation of Ebola Reston, Philippines	2010 - present
Senior Research Scientist, EcoHealth Alliance	2010 - present
Visiting Research Scientist, American Museum of Nat. History, Mammalogy	2009 - present
Adjunct Research Faculty, Earth Institute, Columbia University	2009 - present

Publications (of ca 60)

- Young, C.C.W. & Olival, K.J. (2016) Optimizing Viral Discovery in Bats. **PloS one** 11(2): e0149237.
- Brierley, L., Vonhof, M.J., Olival, K.J., Daszak, P. & Jones, K.E. (2016) Quantifying Global Drivers of Zoonotic Bat Viruses: A Process-Based Perspective. **The American Naturalist** 187(2): E53-64.
- Wacharapluesadee, S., Duengkae, P., Rodparn, A., Kaewpom, T., Maneeorn, P., Kanchanasaka, B., Yinsakmongkon, S., Sittidetboripat, N., Chareesaen, C., Khlangsap, N., Pidthong, A., Leadprathom, K., Ghai, S., Epstein, J.H., Daszak P, Olival, K.J., Blair, P., Callahan, M.V. & Hemachudha, T. (2015) Diversity of Coronavirus in Bats from Eastern Thailand. **Virology Journal** 12(1):57.
- Gay, N., Olival, K.J., Bumrungsri, S., Siriaronrat, B., Bourgarel, M. & Morand, S. (2014) Parasite and viral species richness of Southeast Asian bats: Fragmentation of area distribution matters. **International Journal for Parasitology: Parasites and Wildlife** 3(2): 161-170.
- Olival, K.J., Islam, A., Yu, M., Anthony, S.J., Epsteinm J.H., Khan, S.A., Khan, S.U., Cramer, G., Wang, L.F., Lipkin, W.I., Luby, S.P. & Daszak, P. (2013) Ebolavirus Antibodies in Fruit Bats, Bangladesh. **Emerging Infectious Diseases** 19(2): 270-273.
- Anthony, S.J., Epstein, J.H., Murray, K.A., Navarrete-Macias, I., Zambrana-Torrel, C.M., Solovyov, A., Ojeda-Flores, R., Arrigo, N.C., Islam A., Ali Khan S., Hosseini P., Bogich T.L., Olival K.J., Sanchez-Leon, M.D., Karesh, W.B., Goldstein, T., Luby, S.P., Morse, S.S., Mazet, J.A., Daszak P. & Lipkin W.I. (2013) A strategy to estimate unknown viral diversity in mammals. **Mbio** 4(5): e00598-13.
- Memish, Z.A., Mishra, N., Olival, K.J., Fagbo, S.F., Kapoor, V., Epstein, J.H., AlHakeem, R., Durosinioun A., Asmari, M.A., Islam, A., Kapoor, A., Briese, T., Daszak, P., Rabeeah, A.A.A., Lipkin W.I. (2013) Middle East Respiratory Syndrome Coronavirus in Bats, Saudi Arabia. **Emerging Infectious Diseases** 19(11): 1819-1823.
- Olival, K.J. (2012) Correlates and evolutionary consequences of population genetic structure in bats. in G. F. Gunnell and N. Simmons, editors. *Evolutionary History of Bats: Fossils, Molecules, and Morphology*. Cambridge University Press, Cambridge. pp. 267-316.
- Rahman, S.A., Hassan, S.S., Olival, K.J., Mohamed, M., Chang, L-Y, Hassan, L., Saad, N.M., Shohaimi, S.A., Mamat, ZC, Naim MS, Epstein JH, Suri AS, Field HE, Daszak P and HERG. (2010) Characterization of Nipah virus from Naturally Infected *Pteropus vampyrus* Bats, Malaysia. **Emerging Infectious Diseases** 16(12): 1990-93.
- Turmelle, A., & Olival, K.J. (2009). Correlates of viral richness in bats (Order Chiroptera). **EcoHealth** 6(4): 522-39.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Current Research Support- PI Olival

USAID AID-OAA-A-14-00102

Mazet (PI) 10/01/14 - 09/30/19

Emerging Pandemic Threats PREDICT-2

Coordinate all modeling and analytic activities across the project focused on developing new tools to forecast emerging zoonotic diseases. Oversee all field surveillance and laboratory research in Thailand, Indonesia, and South Sudan (new in PREDICT-2), working closely with country coordinators to implement projects

Role: Modeling and Analytics Coordinator; Surveillance Manager: Thailand, Indonesia, South Sudan

National Institute of Health (NIH)/NIAID 1R01AI110964 Daszak (PI) 06/01/14 – 05/31/19

Understanding the Risk of Bat Coronavirus Emergence

Conduct surveillance for bat coronaviruses in Southern China in bats and humans to understand potential routes of viral spillover. Develop and implement analytical approach to integrate host and coronavirus genetic data to predict viral sharing among wildlife and with humans.

Role: co-PI

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Shahzad Ali

Dept. of Wildlife and Ecology, University of Veterinary & Animal Sciences, Lahore-Pakistan

E-mail: shahzad.ali@uvas.edu.pk

Research interests: Wildlife Epidemiology, Zoonotic Diseases, Microbial Diversity, Genomics

Professional Preparation

Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan	M.Sc	2005
Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan	M.Phil	2008
Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan	PhD	2014

Appointments

Assistant Professor, University of Veterinary & Animal Sciences, Lahore-Pakistan	Sept 2014-Present
Scholar, Duke One Health Training Program, Duke University, Durham, NC, USA	May-Jun 2016
Biosafety Trainer, American Society for Microbiology	2014-Present
IRSIP Scholar, Friedrich Loeffler Institute, Jena, Germany	2012

Publications (of ca 30)

- Ali, S., Akhter, S., Neubauer, H., Scherag, A., Kesselmeier, M., Khan, I., Azam, A., Qadeer, S. & Ali, Q. (2016) Brucellosis in Pregnant Women from Pakistan: An Observational Study. **BMC Infectious Diseases** (Accepted).
- Ali, S., Akhter, S., Muhammad, A., Khan, I., Khan, W.A., Iqbal, M.N., Umar, S., Ahmed, H. & Ali, Q. (2016) Identification, Characterization and Antibiotic Sensitivity of *Aeromonas hydrophila*, a Causative Agent of Epizootic Ulcerative Syndrome in Wild and Farmed Fish from Pothwar, Pakistan. **Pakistan Journal of Zoology** 48(3): 899-901.
- Umar, S., Rehman, A., Asif, S., Usman, M., Atif, M., Ali, S., Munir, M.T., Ali, A., Shahzad, M. & Shah, M.A.A. (2016) Variation In Viral Shedding Patterns Between Domestic And Wild Terrestrial Birds Infected Experimentally With Reassortant Avian Influenza Virus (H9N2). **Avian Biology Research** (Accepted).
- Mustafa, I., Ahmed, H., Lodhi, M.A., Khan, A.R.S.S., Haider, W., Bostan, N., Asif, S., Khan, M.R., Qayyum, M, Ali, S., Ali, M.I. & Afzal, M.S. (2015). Newcastle disease as an emerging disease in peacocks of Tharparker, Pakistan. **The Journal of Infection in Developing Countries** 9(8): 914-916.
- Ali, S., Akhter, S., Neubauer, H., Melzer, F., Khan, I., Ali, Q. & Irfan, M. (2014) Serological, cultural and molecular evidence of *Brucella* infection in small ruminants in Pakistan. **The Journal of Infection in Developing Countries** 9(5):470-475.
- Ali, S., Ali, Q., Melzer, F., Khan, I., Akhter, S., Neubauer, H., & Jamal, S.M. (2014) Isolation and Identification of Bovine Brucella Isolates from Pakistan by Biochemical Tests and PCR. **Tropical Animal Health Production** 46:73-78.
- Ali, S., Khan, I., Ali, Q., Khan, S.U., Mizra, Z.S., & Akhter, S. (2014). Isolation and characterization of *Aeromonas sobria* in *Catla catla* (Thailand) affected with hemorrhagic septicemia. **Bull. Eur. Ass. Fish Pathol.** 34(2): 35.
- Ali, S., Ali, Q., Abatih, E.N., Ullah, N., Muhammad, A. & Shamim Akhter, S. (2013) Seroprevalence of *Brucella abortus* among Dairy Cattle and Buffaloes in Pothohar Plateau, Pakistan. **Pakistan Journal of Zoology** 45(4): 1041-1046
- Ali, S., Ali, G., Neubauer, H., Melzer, F., Elschner, M., Khan, I., Ullah, N., Irfan, M. & Akhter, S. (2013) Seroprevalence and factors associated with brucellosis as a professional hazard in Pakistan. **Foodborne Pathogens and Disease** 10(6): 500-505.
- Khan, I., Wieler, L.H., Melzer, F., Elschner, M.C., Muhammad, G., Ali, S., Sprague, L.D., Neubauer, H. & Saqib, M. (2013) Glanders in Animals: A Review on Epidemiology, Clinical Presentation, Diagnosis and Countermeasures. **Transboundary and Emerging Diseases** 60(3): 204-221.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Nisreen AL-Hmoud

Royal Scientific Society, P.O.Box 1438, Amman 1194, The Hashemite Kingdom of Jordan

E-mail: nisreen.hmoud@rss.jo

Professional Preparation

University of Abertay, Scotland	Microbiology	PhD	2002
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Appointments

Project Director-Centre for Excellence in Biosafety, Biosecurity and Biotechnology at Royal Scientific Society			2013 - present
Lecturer at the Health and Community Development Program/Jordan			2013 - present
Head of department and coordinator for the master program of Environmental Technology & Management, Princess Sumaya University for Technology (PSUT)			
President of the Biosafety & Biosecurity International Consortium (BBIC) Steering Committee			2010 - 2012
Lead Bio-safety Group, Royal Scientific Society of Jordan			2009
Assistant Professor, Princess Sumaya University for Technology (PSUT)			2008 - present
Visiting Lecturer of Medical Microbiology at the Department of Biology, Faculty of Science, University of Jordan			2006
Researcher, Royal Scientific Society of Jordan			2003 - present

Publications

Al-Hmoud N, Ibrahim MA, Al-Rousan H, Alseyah A. (2012) The Prevalence of Aflatoxinogenic *Aspergillus parasiticus* in Jordan. **Int J Microbiol.** 675361. doi: 10.1155/2012/675361.

Al-Hmoud N, Al-Husseini N, Ibrahim-Alobaide MA, Kubler E, Farfoura M, Alobydi H, Al-Rousan H. (2014) Unconventional P-35S sequence identified in genetically modified maize. **GM Crops Food.** 5(1):58-64. doi: 10.4161/gmcr.27542.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Ibrahim Rasit Bilgin

Boğaziçi University

email: rasis.bilgin@boun.edu.tr

Professional Preparation

Boğaziçi University, Turkey	Civil Engineering	B.S.	1998
Boğaziçi University, Turkey	Environ Science	M.Sc.	2000
Columbia University, NY	Conservation Bio	M.A.	2002
Columbia University, NY	Ecol and Evol Bio	PhD	2006

Appointments

Associate Professor of Biology, Boğaziçi University, Turkey.	2012-present
Boğaziçi University Committee on Environment and Ethics Member	2011-present

Publications (out of 30)

- Puechmaille, S.J., Allegrini, B., Benda, P., Gürün, K., Šrámek, J., Ibañez, C., Juste, J. & Bilgin, R. (2014) A new species from the *Miniopterus schreibersii* species complex (Chiroptera: Miniopteridae) from the Maghreb region, North Africa. **Zootaxa** 3794: 108–124.
- Çoraman, E., Furman, A., Karataş, A., and Bilgin, R. 2013. Phylogeographic analysis of Anatolian bats highlights the importance of the region for preserving the Chiropteran mitochondrial genetic diversity in the Western Palaearctic. **Conservation Genetics** 14:1205–1216.
- Abolafya, M., Onmuş, O., Şekercioğlu, Ç. and Bilgin, R. (2013) Environmental Distribution Modeling Of Common Resident And Migratory Passerine Birds From Turkey in a Climate Change Perspective. **Plos One**. 8(7): e68037. doi:10.1371/journal.pone.0068037.
- Furman, A., Çoraman, E., Nagy, Z., Postawa, T., Bilgin, R., Gajewska, M. and Bogdanowicz, W. (2013) Phylogeography of the large *Myotis* bats (Chiroptera: Vespertilionidae) in Europe, Asia Minor, and Transcaucasia. **Biological Journal of the Linnean Society**, 108: 189-209.
- Bilgin, R., Maracı, Ö., Gürün, K., Furman, A., Hulva, P., Çoraman, E., Lučan, R. K., Bartonička, T. and Horáček, I. (2012) Syntopic occurrence in Turkey supports separate species status for *Miniopterus schreibersii schreibersii* and *M. schreibersii pallidus* (Mammalia: Chiroptera). **Acta Chiropterologica**, 14: 279-289.
- Bilgin, R., Keşişoğlu, A. and Rebelo, H. (2012) Distribution Patterns of Bats in Eastern Mediterranean Region in a Climate Change Perspective. **Acta Chiropterologica**, 14: 425-437.
- Bilgin R, Coraman E, Karatas A & Morales JC. (2009) Phlyogeography of the greater horseshoe bat, *Rhinolophus ferrumequinum* (Chiroptera: Rhinolophidae), in southeastern Europe and Anatolia, with specific focus on whether the Sea of Marmara is a barrier to gene flow. **Acta Chiropterologica** 11:53-60.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Paul Bates

Harrison Institute, Bowerwood House, 15 St Botolph's Road, Sevenoaks, Kent, TN13 3AQ, UK

E-mail: [\[redacted\]](mailto:(b)(6)@harrison-institute.org) web: www.harrison-institute.org

Professional Preparation

Keble College, Oxford University, UK	BA	1982
Keble College, Oxford University, UK	MA (Geography)	1985
Royal Holloway College, University of London	PhD (Zoology),	1987

Appointments

Harrison Institute	1994 - present
Honorary Research Fellow, School of Biological Sciences, Bristol University, UK	present
Honorary Research Fellow, Faculty of Science, Prince of Songkla University, Hat Yai, Thailand	present

Publications (full list at http://harrison-institute.org/publications/2005_present.html)

- Co-author, 'The Mammals of Arabia' (1992)
- Co-author, 'Bats of the Indian Subcontinent' (1997)

Relevant Work

- Described, with colleagues, one new genus of bat and 13 species of bats and rodents
- Founded the Afro-Asian taxonomic network (including Arabia): http://www.harrison-institute.org/afro_asian/.
- Worked on small mammal projects on East and southern Africa bats
- Helped launch 'Bat Conservation Africa' in Navaisha, Kenya in 2013
- Regularly contributed to SEABCRU (Southeast Asian Bat Conservation Research Unit)
- Supervised postgraduate students (MSc and PhD) from Bhutan, Cambodia, India, Lao PDR, Myanmar, Sri Lanka, Thailand, UK, and Zambia.
- PI in a series of projects in Southeast Asia since 1999, including:
 - Darwin Initiative projects:
 - 2010-2013: Enhancing taxonomic capacity to underpin tropical biodiversity conservation (SE Asia - Thailand; Cambodia; and Lao PDR). http://harrison-institute.org/research/CRM_R3_Darwin_taxonomic%20network.html
 - 2005-2008: Taxonomic initiative for Southeast Asian bat studies (Vietnam, Thailand, Cambodia and Lao PDR) http://www.harrison-institute.org/research/PRM_R8_SEAsian_taxonomic_initiative.html
 - 2002-2005: Biodiversity assessment of limestone karst dependent bats in Myanmar http://www.harrison-institute.org/research/PRM_R9_Bats_of_Myanmar_karst.html
 - CEPF projects:
 - 2014-2015. Developing policies for sustainable tourism in the Upper Ayeyarwady River Corridor, Myanmar (website under construction) http://www.harrison-institute.org/research/CRM_R3_CEPF_Sustainable_tourism_Myanmar.html
 - 2009-2011: Increasing in-country capacity and regional co-operation to promote bat conservation in Cambodia. http://www.harrison-institute.org/research/CRM_R5_Bat_conservation_Cambodia.html

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Jonathan H Epstein

EcoHealth Alliance, 460 W. 34th St. New York, NY 10001

E-mail: epstein@ecohealthalliance.org

Professional Preparation

Brandeis University, MA	Biology	B.A.	1996
Tufts University, MA	Epidemiology	M.P.H.	2002
Tufts University, MA	Veterinary Medicine	D.V.M	2002
Columbia University, NY	Research Fellowship	Molecular Virology	2006-11

Appointments

Science Advisor, Center for Global Health and the Environment, Harvard Univ.	2014-present
Exec. Board (Treasurer): International Assoc. Ecology and Health	2013-present
Adjunct professor: Mt. Sinai School of Medicine	2008-present
Health Advisor, IUCN Bat Specialist Group	2006-present
Adjunct professor: Columbia University, NY	2003-present
Adjunct professor: Tufts University Med & Vet schools, MA	2003-present
Associate Vice President for Conservation Medicine, EcoHealth Alliance	2003-present

Publications (out of 60)

- Mandl Judith N, Ahmed R, Barreiro Luis B, Daszak P, Epstein Jonathan H, Virgin Herbert W, et al. Reservoir Host Immune Responses to Emerging Zoonotic Viruses. **Cell**. 160(1):20-35. 10.1016/j.cell.2014.12.003
- Ge X-Y, Li J-L, Yang X-L, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang Y-J, Luo C-M, Tan B, Wang N, Zhu Y, Crameri G, Zhang S-Y, Wang L-F, Daszak P, Shi Z-L. (2013). First isolation and characterization of bat SARS-like Coronaviruses that use the ACE2 receptor. **Nature** doi:10.1038/nature12711
- Memish ZA, Mishra N, Olival KJ, Fagbo SF, Kapoor V, Epstein JH, et al. Middle East respiratory syndrome coronavirus in bats, Saudi Arabia. **Emerg Infect Dis**. 2013 Nov [date cited]. <http://dx.doi.org/10.3201/eid1911.131172> DOI:10.3201/eid1911.131172
- Peter Daszak, Carlos Zambrana-Torrel, Tiffany L Bogich, Miguel Fernandez, Jonathan H. Epstein, Kris A. Murray, and Healy Hamilton. Interdisciplinary approaches to understanding disease emergence: The past, present and future drivers of Nipah virus emergence. 2012. **PNAS** doi:10.1073/pnas.1201243109
- Epstein JH*, Quan P-L, Briese T, Street C, Jabado O, et al. (2010) Identification of GBV-D, a Novel GB-like Flavivirus from Old World Frugivorous Bats (*Pteropus giganteus*) in Bangladesh. **PLoS Pathogens** 6(7): e1000972. doi:10.1371/journal.ppat.1000972
- Epstein J.H.*, Olival KJ, Pulliam JRC, Smith C, Westrum J, Hughes T, et al. *Pteropus vampyrus*, a hunted migratory species with a multinational home-range and a need for regional management. **Journal of Applied Ecology**. 2009 Oct;46(5):991-1002.
- Li, W., Shi, Z., Yu, M., Ren, W., Smith, C.S., Epstein, J.H., Wang, H., Crameri, G., Hu, Z., Zhang, H., Jianhong, Z., McEachern, J., Field, H.E., Daszak, P., Zhang, S., Eaton, B.T. & Wang, L.-F. (2005). Bats are natural reservoirs of SARS-like coronaviruses. **Science**, 2005 310:676-679.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP – Thrust Area 6, CC WMD

Tigga Kingston

Associate Professor, Dept. Biological Sciences, Texas Tech University, Lubbock, TX 79409

E-mail: tigga.kingston@ttu.edu, Lab Website: www.kingstonlab.org

Research interest: bat diversity, ecology and conservation in the Old World tropics

Professional Preparation

Royal Holloway University of London, UK, Zoology, BSc (Hons)	1993
Boston University, USA, Ecology, Behavior and Evolution Program, PhD	2001
Boston University, USA, Department of Geography, postdoctoral	2001 - 2006

Appointments

Co-Chair, Bat Specialist Group – Old World	2015 -
Lubee Bat Conservancy Scientific Advisory Board	2012 -
Associate Professor, Dept. of Biological Sciences, Texas Tech University	2012 -
Bat Conservation International Scientific Advisory Committee	2010 -
Research Associate, Museum of Texas Tech University	2007 -
Assistant Professor, Dept. of Biological Sciences, Texas Tech University	2006 - 2012

Publications (see researchgate.net for full list)

Voigt, C.C & Kingston, T (eds.) (In press 2015). *Bats of the Anthropocene: conservation of bats in a changing world*. Springer International Publishing AG.

Kingston, T., Waldien, D., Aguirre, L.F, Armstrong, K., & P. A. Racey. Networking Networks for Global Bat Conservation. In: *Bats of the Anthropocene* (eds. CC Voigt, T. Kingston). Springer International, in press

Kingston, T. (2013). Response of bat diversity to forest disturbance in Southeast Asia – insights from long-term research in Malaysia. In: *Bat evolution, ecology, and conservation* (eds RA Adams, SC Pedersen). Springer Science Press. Pp 169-185

Rossiter, S. J., Zubaid, A., Adura, A., Struebig, M. J., Kunz, T. H., Gopal, S., Eric J. Petit, E. J. & T. Kingston (2012). Social organisation and gene flow: insights from co-distributed bat populations. **Special Issue of Molecular Ecology on Social Structure**. DOI: 10.1111/j.1365-294X.2011.05391.x

Kingston, T. (2010). Research priorities for bat conservation in Southeast Asia: a consensus approach. **Biodiversity and Conservation**, 19: 471-484.

Three activities most closely related to the proposed project

(1) 2007—present. Founder and director of the South East Asian Bat Conservation Research Unit an organizational framework for SE Asian bat researchers to network and coordinate conservation research activities. In 2011, the SEABCRU received five years of funding from NSF to collate regional data and train researchers in standardized protocols www.seabcru.org

(2) IUCN: I am the Old World Co-Chair of the IUCN's Bat Specialist Group (BSG). The BSG is one of a number of specialist groups formed within the Species Survival Commission (SSC) of IUCN. We are a collaborative multidisciplinary network of bat biologists and conservationists providing support and promoting bat conservation activities throughout the world. I am responsible for coordinating activities and governing the network of specialists in the Old World (covering > 800 bat species) (2015 --).

(3) Co-organizer of the 1st, 2nd and 3rd International South East Asian Bat Conferences held in Thailand (2007), Indonesia (2011) and Sarawak (2015) respectively.

Mentoring: 1 PhD graduated, 6 PhDs in progress, countries of origin: Malaysia, Taiwan, Nigeria, US. Student research in Malaysia, Indonesia, Philippines, Nigeria, South Africa. PI's research in Malaysia, Myanmar, Indonesia, Kenya, Nigeria.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Vincent J. Munster

National Institute of Allergy and Infectious Diseases, Hamilton, Montana, United States

E-mail: munstervj@niaid.nih.gov

Professional Preparation

Utrecht University	Molecular Microbiology	MSc	1999-2001
Erasmus University	Molecular Virology	PhD.	2002-2006
Erasmus Medical Center	Postdoctoral	Influenza Transmission	2006-2009
Rocky Mountain Laboratories	Postdoctoral	Virus Ecology	2009-2012

Appointments

Chief, Virus Ecology Unit, Virology Laboratory, NIAID	2009-present
Team lead of WHO-CDC/NIH diagnostic laboratory during the Ebola outbreak, Monrovia, Liberia	2014-present
Organizer of the fifth ESWI Influenza Conference in Riga, Latvia.	2014
ASV, Emerging Viruses III: Respiratory, moderator. Ft. Collins, Colorado, USA.	2014
Guest editor for mBio	2014
Editor for PLoS One	2013-present
Board member of the European Scientific Working group on Influenza	2011-present
NIH/NIAID Laboratory of Virology, Hamilton, Montana. IRTA fellowship	2009
Reviewer for journals including: Lancet Infectious Diseases, Nature, Nature Medicine, PNAS and Science.	2005-present

Publications (out of 70, >5400 citations, H-factor:32)

E. de Wit, H Feldmann and V.J. Munster. Tackling Ebola: new insights and therapies. **Genome Medicine**, 2011 January *Genome Medicine*, 3:5.

A. Kühn, M. Hoffmann, A. Müller, V.J. Munster, K. Gnirss, M. Kiene, T. S. Tsegaye, G. Behrens, G. Herrler, H. Feldmann, C. Drosten, and S. Pöhlmann. Comparative analysis of Ebola virus glycoprotein interactions with human and bat cells. 2011 October **Journal of Infectious Diseases**.

Judson S, Prescott J, Munster VJ. Understanding Ebola virus transmission. 2015, **Viruses**.

J. Prescott, T. Bushmaker, R. Fischer, K. Miazgowiec, S. Judson, and V.J. Munster. Postmortem Stability of Ebola Virus. 2015, **Emerging Infectious Diseases**

Hoenen T, Safronetz D, Groseth A, Wollenberg KR, Koita OA, Diarra B, Fall IS, Haidara FC, Diallo F, Sanogo M, Sarro YS, Kone A, Togo AC, Traore A, Kodio M, Dosseh A, Rosenke K, de Wit E, Feldmann F, Ebihara H, Munster VJ, Zoon KC, Feldmann H, Sow S. Mutation rate and genotype variation of Ebola virus from Mali case sequences. 2015, **Science**.

V.J. Munster, A. Wallensten, C. Baas, G.F. Rimmelzwaan, M. Schutten, B. Olsen, A.D.M.E. Osterhaus and R.A.M. Fouchier. Mallards and highly pathogenic avian influenza ancestral viruses, northern Europe. October 2005. **Emerging Infectious Diseases**.

D. van Riel, V.J. Munster, E. de Wit, G.F. Rimmelzwaan, R.A.M. Fouchier, A.D.M.E. Osterhaus and T. Kuiken. H5N1 Virus Attachment to Lower Respiratory Tract. April 2006. **Science**.

B. Olsen, V.J. Munster, A. Wallensten, J. Waldenstrom, A.D.M.E. Osterhaus and R.A.M. Fouchier. Global patterns of influenza A virus in wild birds. April 2006. **Science**.

V.J. Munster, E. de Wit, D. van Riel, W.E.P. Beyer, G.F. Rimmelzwaan, A.D.M.E. Osterhaus, T. Kuiken and R.A.M. Fouchier. The molecular basis of pathogenicity of the Dutch highly pathogenic H7N7 human influenza A viruses. July 2007. **Journal of Infectious Diseases**.

V. J. Munster, C. Baas, P. Lexmond, J. Waldenström, A. Wallensten, G. F. Rimmelzwaan, W. E. P. Beyer, M. Schutten, B. Olsen, A. D.M.E. Osterhaus and R. A.M. Fouchier. Spatial, temporal and species variation in prevalence of influenza A viruses in wild migratory birds. May 2007. **PLoS Pathogens**.

Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Paul Adrian Racey

University of Exeter, Northcote House, Exeter EX4 4QJ, UK

E-mail: p.racey@abdn.ac.uk

Professional Preparation

University of London, UK

PhD 1972

University of Aberdeen, Scotland

DSc 1983

Appointments

Regius Professor of Natural History (Emeritus), University of Aberdeen 2009 - present

Honorary Visiting Professor, University of Exeter in Cornwall 2007 - 2019

Vice Chairman of Council and member, Executive Committee, Fauna and Flora International

Joint Chairman, Bat Specialist Group, IUCN Species Survival Commission

Member of Grants Committee, The Mammals Trust, UK

Vice President & Science and Conservation Advisor, Bat Conservation Trust

Member of Scientific Advisory Board and Steering Committee, The Lubee Bat Conservancy, Florida (Fruit bat biology and conservation)

Publications (of ca 300)

Racey, P.A. (in press) The uniqueness of bats. **Bats and Viruses** Eds Linfa Wang & C. Cowled Wiley, New York

Furey, N. and Racey, P. A. (in press) Conservation Ecology of Cave Bats. In Kingston, T & Voigt, C C (Eds) **Bats in the Anthropocene - conservation of bats in a changing world**, Springer, New York.

Aziz, S. A., Olival, K J, Bumrungsri, S., Richards, G.C. and Racey, P. A. (in press) The conflict between fruit bats and fruit growers: species, legislation and mitigation. In Kingston, T & Voigt, C C (Eds) **Bats in the Anthropocene - conservation of bats in a changing world**. Springer- New York.

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Barlow, K.E., Briggs, P.A., Haysom, K.A., Hutson, A.M., Lechiara, N.L., Racey, P.A., Walsh A.L. & Langton, S.D. (2015) Citizen science reveals trends in bat populations: the National Bat Monitoring Programme in Great Britain. **Biological Conservation** 182: 14-26.

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Understanding the Risk of Bat-Borne Zoonotic Disease Emergence in Western Asia

PI: Kevin J. Olival

CBEP Thrust Area 6, CC WMD

Ketevan Sidamonidze

R. Lugar Center, National Center of Disease Control and Public Health, Tbilisi, Georgia

E-mail: (b)(6)

Professional Preparation

Tbilisi Medical Academy	Medicine	M.D.	1995 - 2002
Tbilisi Stat Medical University	Residency		2003 - 2005
Fogarty Fellowship, Albany, NY	Postdoctoral		2008 - 2009

Appointments

Researcher, Genomic Laboratory, Virology and Molecular Biology Division of R. Lugar Center / National Center for Disease Control and Public Health (NCDC&PH) 2011 - present

Main Specialist, Molecular Epidemiology Laboratory, NCDC&PH 2009 - 2011

Chief Specialist, Department of Malaria and other parasitological, NCDC&PH 2007 - 2008

Probationer, Molecular Epidemiology Laboratory, NCDC&PH 2006 - 2007

Probationer, Department of Malaria and other parasitological diseases, NCDC&PH 2005 - 2006

Publications

Gu SH, Lim BK, Kadjo B, Arai S, Kim JA, Nicolas V, Lalis A, Denys C, Cook JA, Dominguez SR, Holmes KV, Urushadze L, Sidamonidze K, Putkaradze D, Kuzmin IV, Kosoy MY, Song JW, Yanagihara R. (2014) Molecular phylogeny of hantaviruses harbored by insectivorous bats in Côte d'Ivoire and Vietnam. **Viruses**; 6(5):1897-910.

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